VELAMMAL COLLEGE OF ENGINEERING & TECHNOLOGY, MADURAI - 625009

(Autonomous)

REGULATIONS – 2021

B. E. CIVIL ENGINEERING

LIST OF COURSE OUTCOMES

Course Code/Course Name	Course Outcomes
21EN101 PROFESSIONAL ENGLISH - I	CO1: Listen and comprehend complex academic texts. CO2: Read and Infer the denotative and connotative meanings of technical texts. CO3: Write definitions, descriptions, narrations and essays on various topics. CO4: Speak fluently and accurately in formal and informal communicative contexts. CO5: Apply their opinions effectively in both oral and written medium of communication.
21MA101 MATRICES AND CALCULUS	CO1: Use the matrix algebra methods for solving engineering problems. CO2: Apply differential calculus tools in solving various application problems. CO3: Make use of differential calculus ideas on several variable functions. CO4: Identify suitable methods of integration in solving practical problems. CO5: Solve practical problems of areas, volumes using multiple integrals.
21PH101 ENGINEERING PHYSICS	CO1: Understand the importance of mechanics. CO2: Express their knowledge in electromagnetic waves. CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers. CO4: Understand the importance of quantum physics. CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands.
21CH101 ENGINEERING CHEMISTRY	CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water. CO2: Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications. CO3: Apply the knowledge of phase rule and composites for material selection requirements. CO4: Recommend suitable fuels for engineering processes and applications. CO5: Recognize different forms of energy resources and apply them for suitable applications in energy sectors.
21CS101 PROBLEM SOLVING AND PYTHON PROGRAMMING	CO1: Develop algorithmic solutions to simple computational problems. CO2: Develop and execute simple python programs. CO3: Write simple python programs using conditionals and looping for solving problems. CO4: Decompose a python program into functions. CO5: Represent compound data using python lists, tuples, dictionaries etc. CO6: Read and write data from/to files in python programs.
21CS102 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	CO1: Develop algorithmic solutions to simple computational problems. CO2: Develop and execute simple python programs. CO3: Implement programs in python using conditionals and loops for solving problems. CO4: Deploy functions to decompose a python program. CO5: Process compound data using python data structures. CO6: Utilize python packages in developing software applications.

21PC101 PHYSICS AND CHEMISTRY LABORATORY	PHYSICS LABORATORY CO1:.Understand the functioning of various physics laboratory equipment CO2: Use graphical models to analyze laboratory data CO3:Use mathematical models as a medium for quantitative reasoning and describing physical reality. CO4: Access, process and analyze scientific information. CO5:Solve problems individually and collaboratively CHEMISTRY LABORATORY CO1: To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO. CO2: To determine the amount of metal ions through volumetric and spectroscopic techniques. CO3: To analyse and determine the composition of alloys. CO4: To learn simple method of synthesis of nanoparticles. CO5: To quantitatively analyse the impurities in solution by electro analytical techniques.
21EN102 ENGLISH – II	CO1: Read and interpret information in technical texts. CO2: Construct convincing job applications, resume and effective reports. CO3: Organize the technical ideas effectively in spoken and written forms. CO4: Interpret spoken language in lectures and talks. CO5: Demonstrate basic soft skills in life.
21MA102 VECTOR CALCULUS AND COMPLEX VARIABLES	CO1: Apply the concept of vector calculus which naturally arises in many engineering problems. CO2: Solve the Partial Differential Equations by using various techniques. CO3: Construct an analytic function using the properties of analytic function. CO4: Apply suitable formula to evaluate the given integral. CO5: Identify the suitable method to solve the given differential equation of first and second order.
21PH102 PHYSICS FOR CIVIL ENGINEERING	CO1: Acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation. CO2: Gain knowledge on the ventilation and air conditioning of buildings. CO3: Acquire knowledge on the acoustic properties of buildings. CO4: Know about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics. CO5: Get awareness on natural disasters such as earth quake, cyclone, fire and safety measures.
21ME101 ENGINEERING GRAPHICS	CO1: Develop orthographic projections of points, straight lines and plane surfaces. CO2: Develop the orthographic projections in solids CO3: Apply the orthographic projections in sectional solids and lateral surfaces of the solids. CO4: Construct the isometric projections and perspective projections of simple solids. CO5: Develop the free hand sketch from the pictorial views.
21CE101 CONSTRUCTION MATERIALS AND TECHNIQUES	CO1: Compare the properties of most common and advanced building materials. CO2: Understand the various practices in brick masonry and stone masonry construction, flooring and roofing. CO3: Classify the different kinds of structural systems and to know energy efficient buildings. CO4: Identify the various construction techniques and to plan the requirements for substructure construction. CO5: Explain the methods and techniques of superstructure construction.
21EE103 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	CO1: Understand the electric circuit parameters for simple problems. CO2: Infer about magnetic circuits and safety precautions in electrical installation. CO3: Outline the working principle and applications of electrical machines.

(Theory with Practical Course)	CO4: Explain the basic concepts of analog and digital electronics devices. CO5: Demonstrate the types and operating principles of sensors and transducers.
21EM101 ENGINEERING PRACTICES LABORATORY	CO1: Build various plumbing joints CO2: Develop various carpentry joints. CO3: Construct various wiring electrical joints in common household electrical wire work. CO4: Construct various welded joints, sheet metal and basic machining operations CO5: Develop the electronic circuit for soldering and testing using PCB board.
21CE102 COMPUTER AIDED BUILDING DRAWING LABORATORY	CO1: Sketch the detailed building plan, elevation and sectional views of the Load bearing structure of buildings. CO2: Sketch the detailed building plan, elevation and sectional views of the framed buildings. CO3: Sketch the detailed elevation and sectional views of the Panelled Door and Window. CO4: Sketch the detailed elevation and sectional views of the Dog legged staircase. CO5: Sketch the detailed building plan, elevation and sectional views of the industrial structures.
21MA201 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	CO1: Compute Laplace transform and inverse Laplace transform of different functions. CO2: Expand the Fourier series to represent the given function in the given interval. CO3: Classify the second order PDE and to know about solving initial and final value problems. CO4: Apply Fourier transform techniques to evaluate the given integral. CO5: Solve the given difference equations using Z-transforms.
21CE201 ENGINEERING GEOLOGY	CO1: Understand the importance of geological knowledge and the action of various geological agencies. CO2: Explain the properties of minerals. CO3: Compare the types of rocks, their distribution and uses. CO4: Interpret the geological structure by using geophysical methods. CO5: Summarize the application of geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbour and the remote sensing applications in Civil Engineering.
21CE202 MECHANICS OF SOLIDS	CO1: Compute resultant, resolve several concurrent forces and also to apply equilibrium concepts. CO2: Solve the friction and the effects by the laws of friction and rigid body kinetics. CO3: Compute simple stresses and strains in bars and composite materials. CO4: Construct shear force and bending moment diagrams in determinate structure. CO5: Compute geometric properties of sections and to determine the shear stress, bending stress and plot its variation across the section.
21CE203 WATER SUPPLY ENGINEERING	CO1: Estimate the total water demand for a town/city. CO2: Identify suitable sources of water to meet the demand. CO3: Design the conduits for transportation of water from the source to treatment plant and to the city. CO4: Determine the physical, Chemical and biological characteristics of different sources of water and design an appropriate treatment systems. CO5: Design a water distribution system for an individual building and for a community.
21CE204 FLUID MECHANICS (Theory with Practical Course)	CO1: Apply the basic knowledge of fluids in static, kinematic and dynamic equilibrium. CO2: Solve problems related to kinematics of fluid flow and equation of motion.

	CO3: Identify and solve dimensional and model analysis on fluid flow problems. CO4: Determine the types of flow and estimate losses of flow in pipes. CO5: Analyze the boundary layer problems in fluid flow.
21CE205 SURVEYING AND GEOMATICS (Theory with Practical Course)	CO1: prepare the map by understanding the concept of chain surveying, compass surveying and plane table surveying. CO2: locate the relative position of points on the earth surface using levelling principles and its application. CO3: computing distance, elevation and gradient between inaccessible objects using tacheometric principle. CO4: explain the concept of geodetic surveying and its application in Civil engineering field. CO5: explain the importance of advanced techniques in contemporary surveying practice.
21CE206 STRENGTH OF MATERIALS LABORATORY	CO1: examine the tension and compression strength of different materials. CO2: calculate the shear and torsion value of mild steel rod. CO3: evaluate the impact and hardness value of different materials. CO4: interpret modulus of elasticity of metal beam by deflection test. CO5: measure the compression and deflection value of springs.
21CE207 INTERNSHIP+SEMINAR (During II Semester Summer Vacation for 1 week)	CO1: Intricacies of implementation textbook knowledge into practice. CO2: Understand the concepts of developments and implementation of new techniques.
21MA204 PROBABILITY, STATISTICS AND NUMERICAL METHODS	CO1: Grasp the basic concepts of Probability and Random variables. CO2: Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and □2 test. CO3: Apply a suitable method to solve algebraic and transcendental equations. CO4: Explain the knowledge of various techniques and methods for solving first and second order ordinary differential equations. CO5: Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
21CH102 ENVIRONMENTAL SCIENCE	CO1: Explain the concept, structure and function of an ecosystem. CO2: Demonstrate the environmental impacts of energy sources. CO3: Select the suitable management method for solid wastes. CO4: Practice the suitable management method during disaster episode. CO5: Describe the Traditional values and Impact of modernization on Environment.
21CE208 STRENGTH OF MATERIALS	CO1: Calculate principal stresses and planes for an element in three dimensional state of stress and solve problems using theory of failures. CO2: Estimate the slope and deflection of beams by different methods. CO3: Analyze long and short columns and estimate stresses induced in cylinders. CO4: Comprehend the behaviour of members under pure torsion and shear and analysis of springs. CO5: Apply the concepts in beams subjected to unsymmetrical bending.
21CE209 WASTEWATER ENGINEERING	CO1: Characterize the wastewater generated from a town/ city. CO2: Estimate the quantity of wastewater and storm run-off generated from the town/ city and esign a suitable collection system for the generated wastewater. CO3: Design the necessary Primary treatment units for the wastewater collected from the town/city. CO4: Plan the Secondary treatment units for the wastewater collected from the town/city. CO5: Identify the suitable mode of disposal for the treated wastewater and sludge without endangering the environment.

21CE210 HYDRAULICS AND HYDRAULIC MACHINERY (Theory with Practical Course)	CO1: Identify and solve problems under uniform flow in open channels. CO2: Study gradually varied flows in steady state conditions. CO3: Examine rapidly varied flows in steady state conditions. CO4: Analyse the working and application of turbines. CO5: Investigate the working and application of pumps.
21CE211 CONCRETE TECHNOLOGY AND CONSTRUCTION EQUIPMENTS (Theory with Practical Course)	CO1: Determine the basic properties of cement and aggregates. CO2: Apply the concept and procedure of mix design as per IS method and determine the mix proportion of concrete. CO3: Summarize the properties of concrete at fresh and hardened state and know the Non-destructive testing of concrete. CO4: Illustrate the importance and application of special concretes. CO5: Explain the equipments used in the building construction sites.
21CE212 SOIL MECHANICS (Theory with Practical Course)	CO1: Categorize the soil and determine the index properties of soil. CO2: Estimate the stresses in soils and Permeability. CO3: Classify and determine the settlement in soils. CO4: Determine the shear strength of soil. CO5: Evaluate both finite and infinite slopes.
21CE213 SURVEY CAMP (During III Semester Winter Vacation for 2 weeks)	CO1: Plot / Map a building or structure using various surveying techniques. CO2: Determine the angles and elevations of a given location / point.
21CE214 WATER AND WASTEWATER ANALYSIS LABORATORY	CO1: Examine the physical and chemical and biological characteristics of water CO2: Investigate the physical and chemical and biological characteristics of wastewater CO3: Suggest the type of treatment required and amount of dosage required for the treatment. CO4: Study the conditions for the growth of micro-organisms. CO5: Determine the amount of sludge in wastewater.
21CE301 STRUCTURAL ANALYSIS I	CO1: Demonstrate the indeterminate beams by conventional methods. CO2: Solve the rigid frames and continuous beams using the slope defection technique. CO3: Utilise moment distribution method to build continuous beams and rigid frames with and without sway. CO4: Select the Matrix Flexibility Methods of Indeterminate Pin Jointed Plane Frames, Continuous Beams, and Rigid Frames. CO5: Choose the Matrix stiffness method analysis of indeterminate pin jointed planar frames, continuous beams, and rigid frames.
21CE302 DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS	CO1: Identify the various design approaches used to create RC components. CO2: Utilize the limit state approach for the analysis and design of flanged beams as well as the sign of the beams for torsion, bonding, and shear. CO3: Choose the design for various slab types and staircases using the limit state approach. CO4: Select from the options for axial, uniaxial, and biaxial eccentric loadings for columns. CO5: Apply the limit state technique to footing design.
21CE303 FOUNDATION ENGINEERING	CO1: Select the concept of site investigation and soil exploration methods in field. CO2: Apply design procedure for finding bearing capacity for various types of shallow foundations. CO3: Plan the foundation based on the in-situ requirements. CO4: Identify the load carrying capacity and settlement behavior for pile group. CO5: Solve the earth pressures acting on retaining wall.
21MCC01 CONSTITUTION OF INDIA	CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India.

	CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status. CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India. CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions. CO5: Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality.
21CE304 HIGHWAY AND RAILWAY ENGINEERING (Theory with Practical Course)	CO1: Explain the various highway development and design cross section elements. CO2: Illustrate the geometric features of road network and design of pavement as per IRC. CO3: Appraise the concept of pavement management system, evaluation of distress and maintenance of pavements. CO4: Relate the methods of route alignment and design elements in railway planning and constructions. CO5: Identify the construction techniques and maintenance of track laying and railway stations.
21EN301 PROFESSIONAL COMMUNICATION LABORATORY	CO1: Demonstrate effective communication skills through presentations. CO2: Utilize their knowledge of motivation in setting and achieving goals. CO3: Examine time and stress management. CO4: Formulate their ideas into an effective communication in formal contexts. CO5: Develop a well-composed resume and face interviews confidently.
21CE305 INTERNSHIP+SEMINAR (During IV Semester Summer Vacation for 2 weeks)	CO1: Connect the implementation of textbook knowledge into practice. CO2: Discover the concepts of developments and implementation of new techniques. CO3: Develop communication, interpersonal and other critical skills in the job interview process. CO4: Categorize their interest and create a record of work experience. CO5: Choose career alternatives prior to graduation.
21CE306 STRUCTURAL ANALYSIS II	CO1: Use strain energy method to analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames. CO2: Select between the concept of plastic analysis and the technique for analysing rigid beams and frames. CO3: Solve three hinged, two hinged and fixed arches. CO4: Sketch the influence lines for structures and able to calculate critical stress resultants. CO5: Interpret and analyze space constructions and suspension bridges with stiffening girders.
21CE307 DESIGN OF STEEL STRUCTURAL ELEMENTS	CO1: Interpret the fundamental knowledge of steel structural design. CO2: Select the bolted and welded connection design for steel constructions. CO3: Solve tension members and understand the effect of shear lag. CO4: Choose the design concept of axially loaded columns and column base connections. CO5: Model and design various types of flexural members.
21CE308 ESTIMATION, COSTING AND VALUATION ENGINEERING	CO1: Illustrate the method of Estimation and calculating the quantities for different structures. CO2: Calculate the rate analysis for all building works, canals, and roads and cost estimate. CO3: Use the different types of specifications, principles for report preparation, tender notices types. CO4: Identify and explain the different types of contracts. CO5: prepare the valuation for various building and land.

21MCC02 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge. CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge. CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being. CO4: Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle. CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry.
21CE310 COMPUTER AIDED STRUCTURAL DESIGN AND DRAWING LABORATORY	CO1: Analyze, design and prepare detailing drawing for residential building. CO2: Plan and draw reinforced concrete Cantilever Retaining Walls CO3: Analyze, design and prepare detailing drawing for steel roof truss and steel water tank. CO4: Sketch the Septic tank and Rapid sand filter CO5: Prepare the design of tank sluice with tower head and tank surplus weir
21CE401 PROJECT WORK - I	CO1: Survey any challenging practical problems in Civil Engineering. CO2: Simplify the problem from its identification and through literature reviews. CO3: Discover appropriate techniques, modern Engineering tools to solve the problems. CO4: Analyse the problem in context with societal and environmental need. CO5: Develop project reports, presentations and to face interviews.
21CE402 COMPREHENSION	CO1: Ouline the basic concepts of core engineering courses in the programme. CO2: Summarize the importance of mathematics and science in the programme and its correlation in core engineering courses of the programme. CO3: Solve basic problems in core engineering of the programme. CO4: Apply the concepts of core engineering, mathematics and science course to solve complex problems.
21CE403 INTERNSHIP+SEMINAR (During VI Semester Summer Vacation for 4 weeks)	CO1: Connect the implementation of textbook knowledge into practice. CO2: Discover the concepts of developments and implementation of new techniques. CO3: Develop communication, interpersonal and other critical skills in the job interview process. CO4: Categorize their interest and create a record of work experience. CO5: Choose career alternatives prior to graduation.
21CE404 PROJECT WORK - II	CO1: Survey any challenging practical problems in Civil Engineering. CO2: Simplify the problem from its identification and through literature reviews. CO3: Discover appropriate techniques, modern Engineering tools to solve the problems. CO4: Analyse the problem in context with societal and environmental need. CO5: Develop project reports, presentations and to face interviews.

COURSE OUTCOMES AND PROGRAM OUTCOMES - EEE

Course Outcomes (COs)

Autonomous Regulation R-2021.

I Year-Course Outcomes (odd semester)			
21EN101 Professional English-I	C101.1	K2	Describe the listening and comprehending complex academic texts
	C101.2	K2	Discuss on reading & inferring the denotative and connotative meanings of technical text
	C101.3	K3	Construct definitions, descriptions, narrations and essays on various topics
	C101.4	K3	Develop speaking fluently and accurately in formal and informal communicative context
	C101.5	K3	Organize opinions to express effectively in both oral and written medium of communication
21MA101 Matrices and Calculus	C102.1	K3	Apply eigen values to compute the inverse and positive powers of square matrix and use to diagonalise the given matrix by the concept of orthogonal reduction
	C102.2	K3	Apply differential calculus tools in solving various application problems
	C102.3	K3	Apply to use differential calculus ideas on several variable functions
	C102.4	K3	Demonstrate and apply the techniques of integration
	C102.5	K3	Apply integrals of multivariable to find areas enclosed between two
21PH101 Engineering Physics	C103.1	K2	Understand the importance of mechanics
	C103.2	K2	Express their knowledge in electromagnetic waves
	C103.3	K2	Demonstrate a strong foundational knowledge in oscillations, optics and Lasers
	C103.4	K2	Understand the importance of quantum physics
	C103.5	K2	Comprehend and apply quantum mechanical principles towards the formation of energy bonds
	C103.6	K2	Illustrate the applications of fibre optic sensor with applications
21CH101 Engineering Chemistry	C104.1	K1	Infer the water from quality parameter data and propose suitable treatment methodologies to treat water
	C104.2	K2	Identify and apply basic concepts of nanoscience and nanotechnology
	C104.3	K1	Apply the knowledge of phase rule and composite for material selection requirements
	C104.4	K1	Recommend suitable fuels for engineering processes and applications
	C104.5	K1	Recognize different forms of energy sources and apply them for suitable applications in energy sectors
	C104.6	K2	Capacitate themselves for higher level cognizance

21CS101 Problem Solving and Python Programming	C105.1	K4	Develop algorithmic solutions to simple computational problems
	C105.2	K2	Develop and execute simple Python programs
	C105.3	K3	Write simple Python programs using conditionals and loops for solving problems
	C105.4	K4	Decompose a Python program into functions
	C105.5	K2	Represent compound data using Python lists, tuples, dictionaries
	C105.6	K3	Read and write data from/to files in Python programs
	C105.7	K4	Demonstrate a mini project by applying and analyzing the concepts learnt in the course for the given requirements.
21CS102 Problem Solving and Python Programming Laboratory	C106.1	K4	Develop algorithmic solutions to simple computational problems
	C106.2	K4	Develop and execute simple Python programs.
	C106.3	K3	Implement programs in Python using conditionals and loops for solving problems.
	C106.4	K4	Deploy functions to decompose a Python program.
	C106.5	K3	Process compound data using Python data structures
	C106.6	K3	Utilize Python packages in developing software applications
21PC101 Physics and Chemistry Laboratory	C107.1	K2	Demonstrate the stress-strain behavior by uniform bending method
	C107.2	K2	Illustrate Young's modulus of the material of cantilever using simple harmonic oscillations
	C107.3	K2	Demonstrate the wavelength of the given Laser source of light using grating
	C107.4	K4	Analyze the thickness of a thin wire testing using air wedge arrangement
	C107.5	K2	Illustrate inertia of moment and inertia of rest and the modulus behind
	C107.6	K4	Analyze the wheatstone bridge to null deflection and determine the band gap of thermistor
	C107.7	K2	Demonstrate the stress-strain behavior by non-uniform bending method
I Year-Course Outcomes (Second semester)			
21EN102 English –II	C108.1	K2	Read and interpret information critically in technical texts
	C108.2	K3	Construct convincing job applications, resume and effective reports
	C108.3	K3	Make use of the technical ideas effectively in spoken and written forms
	C108.4	K2	Infer spoken language in lectures and talks
	C108.5	K3	Utilize basic soft skills ideas in life
	C108.6	K2	Summarize the extensive reading contents
21MA102/ Vector calculus and	C109.1	K3	Apply the concept of vector calculus in Engineering problems
	C109.2	K3	Solve the Partial Differential Equations by using various techniques

Complex Variables	C109.3	K3	Construct an analytic function using their properties and discuss the transformations
	C109.4	K3	Apply Cauchy theorem and Cauchy's integral formula to evaluate the given integral over the closed curve
	C109.5	K3	Choose the suitable method to solve the given differential equation of first and second order.
21PH105/ Physics for Electrical Engineering	C110.1	K2	Compare the basics of dielectric materials & insulation.
	C110.2	K2	Infer the electrical & magnetic properties of materials & their applications in devices
	C110.3	K2	Interpret the semiconductor physics & functioning of semiconductor devices
	C110.4	K2	Summarize the optical properties of optoelectronic materials
	C110.5	K2	Explain the basics of nanotechnology and nano devices
	C110.6	K2	Develop a model characterizing optical effects
21ME101 Engineering Graphics	C111.1	K3	Construct the orthographic projections of points, straight lines and plane surfaces.
	C111.2	K3	Sketch the orthographic projections of solids.
	C111.3	K3	Sketch the orthographic projections of sectioned solids and development of lateral surfaces of the solids.
	C111.4	K3	Construct the isometric and perspective projections of simple solids.
	C111.5	K3	Sketch the orthographic projection of objects using free hand.
21EE101 Electric Circuit Analysis	C112.1	K3	Apply basic circuit concepts using fundamental laws of electric
	C112.2	K3	Identify equivalent circuit parameters using network theorems
	C112.3	K3	Solve for power and energy in AC circuits
	C112.4	K3	Utilize the concept of resonance in electric circuits
	C112.5	K3	Construct the electric circuit simulation using software packages
21CH103 Environmental Science	C113.1	K2	Explain the concept, structure and function of an ecosystem
	C113.2	K2	Demonstrate the environmental impacts of energy sources.
	C113.3	K3	Select the suitable management method for solid wastes
	C113.4	K3	Practice the suitable management method during disaster episode
	C113.5	K2	Describe the Traditional values and Impact of modernization on
	C113.6	K3	Industrial Visit and report submission
21MC101 Basic Civil and Mechanical Engineering	C114.1	K2	Understanding profession of Civil Engineering
	C114.2	K3	Summarize the planning of materials used for construction of building and its process
	C114.3	K2	Understanding the Manufacturing processes
	C114.4	K2	Demonstrate the working principle of Power Plant and IC Engine
	C114.5	K2	Elaborate the components of refrigeration and air conditioning cycle

21EM101 Engineering Practices Laboratory	C115.1	K3	Construct the basic switch board wiring, fluorescent lamp wiring and staircase wiring using various electrical components
	C115.2	K3	Make use of energy meter to measure energy and with electrical equipment to measure resistance
	C115.3	K3	Identify the concepts of iron box wiring and fan regulator to study its construction, operation and repair
	C115.4	K3	Develop the electronic circuit for soldering and testing using PCB board
	C115.5	K3	Experiment with the study of Smartphone and assemble and dismantle of computer/laptop
	C115.6	K2	Demonstrate the measurement of AC signal parameters using CRO
21EE102 Electric Circuits Laboratory	C116.1	K3	Apply basic circuit concepts using fundamental laws of electric circuits
	C116.2	K3	Identify equivalent circuit parameters using network theorems
	C116.3	K3	Solve for power and energy in AC circuits
	C116.4	K3	Utilize the concept of resonance in electric circuits
	C116.5	K3	Construct the electric circuit simulation using software packages
II Year-Course Outcomes (Third Semester)			
21MA202/ Transform Techniques and its Applications	C201.1	K3	Evaluate the Laplace transform and inverse Laplace transform of differential functions
	C201.2	K3	Apply Laplace transform technique to solve second order differential equations with elementary functions
	C201.3	K3	Solve the given differential equations using Z transform
	C201.4	K3	Evaluate the given integral using Fourier Transform Technique
	C201.5	K3	Choose suitable fourier transform techniques to evaluate the given integral in wide variety of situations in Electrical Engineering
21EE201/ Field Theory	C202.1	K3	Outline the basic mathematical concepts related to electromagnetic waves
	C202.2	K3	Summarize the basic concepts of electrostatic fields, electrical potential, energy density capacitance and their applications
	C202.3	K2	Infer the knowledge in magneto static fields, magnetic flux density, vector potential, inductance and its applications
	C202.4	K2	Classify methods of EMF generation and Maxwell's equations of electrodynamic fields
	C202.5	K4	Illustrate the basic concepts of electromagnetic waves and characterizing parameters
21EE202/ DC Machines and Transformers	C203.1	K2	Explain the magnetic-circuits
	C203.2	K3	Build the knowledge in constructional details of transformers.
	C203.3	K3	Develop the concepts of electromechanical energy conversion.
	C203.4	K3	Show the working principle of DC Generator.
	C203.5	K3	Illustrate the working principle of DC Motor.

21EE203/ Transmission and Distribution	C204.1	K2	Outline the importance and the functioning of transmission line
	C204.2	K3	Identify the performance of transmission lines based on the length and environmental aspects.
	C204.3	K2	Explain the mechanical design of transmission lines and formation of corona.
	C204.4	K2	Illustrate about the insulators and cables based on the transmission voltage capacity.
	C204.5	K2	Compare the concepts of electric distribution system such as EHVAC, HVDC and FACTS.
21EE204/ Electronic Devices and Circuits	C205.1	K2	Outline the structure, operation and V- I characteristics of various PN diodes.
	C205.2	K3	Develop V-I characteristics of Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET).
	C205.3	K3	Identify the transistor application as amplifiers
	C205.4	K2	Infer the operation and characteristics and gain of multistage and differential amplifiers.
	C205.5	K2	Summarize the operation of feedback amplifiers and oscillators with their applications.
21EE205/ Digital Logic Circuits	C206.1	K2	Outline the various number systems and different logic families.
	C206.2	K3	Build combinational logic circuits using basic gates and simplification using Karnaugh maps.
	C206.3	K3	Model synchronous sequential circuits using flip flops.
	C206.4	K3	Develop asynchronous sequential circuits using flip flops.
	C206.5	K3	Explain the hardware functionality at system level using Programmable Logic device (PLD) and Hardware Description
21EE206/ DC Machines and Transformers Laboratory	C207.1	K3	Identify the performance characteristics of DC Generator.
	C207.2	K3	Develop the performance characteristics of DC motor.
	C207.3	K3	Experiment with DC machines to predetermine their performance.
	C207.4	K3	Make use of speed control techniques in DC motors.
	C207.5	K3	Build the performance characteristics of Transformers.
21EE207/ Electronic Devices and Digital Laboratory	C208.1	K3	Identify the VI characteristics of semiconductor diodes.
	C208.2	K3	Develop the VI characteristics of bipolar and unipolar devices.
	C208.3	K3	Construct combinational circuits using basic gates.
	C208.4	K3	Model synchronous and asynchronous counters using JK flip flop.
	C208.5	K3	Build shift registers using delay flip flop.
II Year-Course Outcomes (Fourth Semester)			
21MA207/	C209.1	K3	Evaluate the Laplace Transform and Inverse Laplace Transform of differential functions

Statistics and Numerical Methods	C209.2	K3	Apply Laplace transform technique to solve second order differential equations with elementary functions
	C209.3	K3	Solve the given difference equations using Z transform
	C209.4	K3	Evaluate the given integral using Fourier Transform techniques
	C209.5	K3	Choose suitable Fourier Transform techniques to evaluate the give integral in wide variety of situations in Electrical Engineering
21EE208/ Measurements and Instrumentation	C210.1	K2	Outline the basic concepts about measurement of analog and digital meters.
	C210.2	K2	Illustrate the fundamentals of electrical and electronic instruments.
	C210.3	K2	Compare the various measurement techniques for resistance, inductance and capacitance measurement using bridges.
	C210.4	K2	Summarize the concept of digital storage & display devices.
	C210.5	K2	Illustrate the operation of transducers and data acquisition system.
21EE209/ Induction and Synchronous Machines	C211.1	K3	Build the performance characteristics of 3 phase induction motors.
	C211.2	K3	Identify the method of starting, speed control and braking of 3 phase induction motors.
	C211.3	K2	Explain the performance characteristics of single phase induction motors and basic characteristics of special machines.
	C211.4	K3	Develop the performance characteristics of various types of alternators.
	C211.5	K2	Show the performance characteristics of synchronous motors.
21EE210/ Control Systems	C212.1	K3	Develop transfer function of systems based on the knowledge of Mathematics, Science and Engineering fundamentals.
	C212.2	K3	Apply the various time domain and frequency domain techniques to assess the system performance.
	C212.3	K3	Identify the effect of various compensation in frequency domain.
	C212.4	K3	Make use of knowledge about various stability techniques to different applications
	C212.5	K3	Solve Controllability and Observability using state space representation
21EE211/ Integrated Circuits	C213.1	K2	Explain the steps involved in IC fabrication and characterization of Op-Amp
	C213.2	K2	Outline the basic applications of Op-Amp.
	C213.3	K2	Summarize the role of Op-Amp in wave generator, comparator and converter circuit.
	C213.4	K2	Classify special ICs namely Timers, PLL circuits, regulator Circuits with
	C213.5	K2	Interpret the role of ICs in voltage regulator circuit.
21EE212/ Microprocessors, Microcontrollers and Interfacing	C214.1	K2	Illustrate the Pin diagram & Architecture of 8086 microprocessor.
	C214.2	K2	Interpret 8086processor with interfacing devices.
	C214.3	K2	Explain the Pin diagram & Architecture of 8051 microcontroller.

	C214.4	K2	Outline the interfacing concepts of 8051 microcontroller.
	C214.5	K2	Demonstrate the applications of 8051 microcontroller.
21EE213/ Induction and Synchronous Machines Laboratory	C215.1	K3	Experiment with 3 phase alternators to find voltage regulation by EMF, MMF, ZPF and ASA methods.
	C215.2	K3	Solve for direct axis reactance of salient pole alternator using slip test.
	C215.3	K3	Develop the characteristics of V and Inverted V curves in synchronous motors
	C215.4	K3	Identify the performance characteristics of single phase and three phase induction motor
	C215.5	K3	Construct the characteristics of single phase and three phase induction motor
21EE214/ Integrated Circuits and Instrumentation Laboratory	C216.1	K3	Model adder, comparator, differentiator and integrator using IC 741.
	C216.2	K3	Make use of linear ICs for verifying the function of voltage regulator, astable and mono-stable multivibrators.
	C216.3	K3	Build P, PI, PID controllers and compensators.
	C216.4	K3	Solve for unknown passive elements using D.C and A.C Bridges.
	C216.5	K3	Develop the characteristics of energy meter, transducers and converters.
III Year-Course Outcomes (Fifth Semester)			
21EE301 Power System Analysis	C301.1	K3	Construct admittance matrix of the power system under steady state condition.
	C301.2	K3	Apply Gauss-Siedel and Newton Raphson techniques for power flow analysis.
	C301.3	K3	Utilize Thevenin's theorem for symmetrical fault analysis.
	C301.4	K3	Solve Line to ground fault, Line to line fault and double line to ground faults using sequence networks
	C301.5	K3	Make use of equal area criterion for stability problem in power system.
21EE302/ Power Electronics	C302.1	K2	Outline the characteristics of various power electronic switching devices.
	C302.2	K3	Identify the performance parameters of phase controlled converters.
	C302.3	K2	Explain the performance parameters for DC-DC converters and Switching regulator.
	C302.4	K3	Develop the various PWM techniques applied to the inverters.
	C302.5	K3	Model the single phase and three phase AC voltage controllers and cyclo converter.
21EE303/ Digital Signal	C303.1	K2	Explain the importance of Fourier transform, digital filters and DS Processors

Processing	C303.2	K2	Summarize the knowledge on Signals and systems & their mathematical representation.
	C303.3	K2	Illustrate the transformation techniques and their computation
	C303.4	K2	Compare the types of filters and their design for digital implementation
	C303.5	K2	Outline the various applications of digital signal processing
21EE304/ Embedded Systems	C304.1	K2	Explain the building blocks of embedded system.
	C304.2	K2	Illustrate the interfacing of embedded network.
	C304.3	K2	Summarize the various embedded development strategies
	C304.4	K3	Develop the programs to interface memory, I/Os with processor.
	C304.5	K3	Build the embedded system blocks for simple applications
21CS308/ C and Data Structures	C305.1	K3	Develop C programs for simple applications using basic constructs and arrays.
	C305.2	K3	Construct C programs involving functions, recursion, pointers & structures.
	C305.3	K3	Build abstract data types for linear data structures.
	C305.4	K4	Categorize the different non-linear data structures to resolve problems.
	C305.5	K4	Solve the problems using various sorting algorithms and hashing techniques.
21PEE01/ Energy Utilization and Conservation	CV101.1	K2	Compare different illumination schemes.
	CV101.2	K2	Outline the concepts of Refrigeration and Air conditioning
	CV101.3	K2	Summarize various modes of heating and Welding with its applications
	CV101.4	K2	Illustrate the choice of electric drives and the different characteristics of motor for traction
	CV101.5	K2	Explain the various energy conservation methods
21PEE12/Special Electrical Machines	CV204.1	K2	Explain the performance of stepper motors.
	CV204.2	K2	Illustrate characteristics and performance of synchronous reluctance motors.
	CV204.3	K2	Demonstrate the controllers for switched reluctance motors.
	CV204.4	K2	Summarize the performance and applications of permanent magnet brushless DC motors.
	CV204.5	K2	Outline the performance and characteristics of permanent magnet synchronous motors

21PEE03 / Power Quality	CV103.1	K2	Explain the concepts of transients, sags and swells.
	CV103.2	K2	Illustrate the voltage sag performance and its mitigation techniques.
	CV103.3	K2	Summarize the effects of harmonics and distortions.
	CV103.4	K2	Demonstrate the passive shunt compensators design.
	CV103.5	K2	Outline the concepts of monitoring and diagnostic techniques of power quality problems.
21EE305/ Power Electronics Laboratory	C306.1	K3	Develop the characteristics curve of different switching devices.
	C306.2	K3	Organize the operation of AC/DC fully and half controlled converters.
	C306.3	K3	Solve the operation of switching devices in chopper circuits.
	C306.4	K3	Make use of the output of inverters for different duty cycle.
	C306.5	K3	Apply the power electronic circuits using suitable simulation tool.
III Year-Course Outcomes (Sixth Semester)			
21EE306 / Protection and Switchgear	C308.1	K2	Summarize Electromagnetic and Static Relays
	C308.2	K2	Explain the causes of abnormal operating conditions of the apparatus and system
	C308.3	K2	Outline the characteristics and functions of relays and protection schemes
	C308.4	K2	Illustrate the apparatus protection, static and numerical relays
	C308.5	K2	Interpret the knowledge on functioning and suitability of circuit breaker
21EE307/ Renewable Energy Systems	C309.1	K2	Summarize the different types of renewable energy sources
	C309.2	K2	Explain the components and working principle of wind power plants
	C309.3	K2	Illustrate the various types of solar thermal and solar PV systems
	C309.4	K2	Classify the different types of hydro power plant and biomass plant
	C309.5	K2	Outline the construction and working principle of renewable energy storage system and hybrid energy sources.
21EE308 / Control Systems and Electrical Drives	C310.1	K3	Build the characteristics of controllers.
	C310.2	K3	Analyze the modeling of systems
	C310.3	K3	Solve the characteristics of Compensators.
	C310.4	K3	Experiment with the output of BLDC Motor drive using digital simulation.
	C310.5	K3	Make use of speed control of the three phase induction motor drive using simulation.
21PEE04/	CV104.1	K2	Illustrate the restructuring of power industry.

Restructured Power Systems	CV104.2	K2	Outline the basics of various market models.
	CV104.3	K2	Illustrate about fundamentals of economics in Restructured Power System.
	CV104.4	K2	Explain the significance of pricing methods of transmission network.
	CV104.5	K2	Compare the various power sectors in India and Ancillary System.
21PEE05/ Power System Transients	CV105.1	K2	Summarize the causes of transients in power system
	CV105.2	K2	Outline the over voltages due to switching transients
	CV105.3	K2	Explain the effect of lightning strokes in power system
	CV105.4	K2	Interpret the concept of travelling waves in distributed lines
	CV105.5	K2	Illustrate the transient performance of integrated power system with EMTP software
21PEE09 / Modern Power Converters	CV603.1	K2	Interpret switched mode DC power supply for various industrial applications
	CV603.2	K3	Explain the characteristics of Switched mode AC-DC converters with and without isolation.
	CV603.3	K2	Summarize the different types of multilevel inverters.
	CV603.4	K3	Outline the bidirectional switch with and without DC link.
	CV603.5	K2	Illustrate the soft switching power converters with resonant DC link.
21PEE40 / Industrial Instrumentations	CV201.1	K2	Show the various methods used for measurement of force, torque and speed
	CV201.2	K2	Summarize the operating principle of vibration, acceleration and density measurement.
	CV201.3	K2	Outline working of viscosity, moisture and humidity measurement instrument
	CV201.4	K2	Classify the devices used for temperature sensing.
	CV201.5	K2	Explain the various methods used for pressure and vacuum measurement
21PEE07 / Energy Management	CV107.1	K2	Demonstrate the need for energy management and auditing process
	CV107.2	K2	Explain the load management and economic analysis performed in a system
	CV107.3	K2	Outline the energy management concepts for electrical equipment and metering system
	CV107.4	K2	Classify various lighting systems and energy standards
	CV107.5	K2	Interpret the performance assessment made on various utility systems
21OAD01/Artificial	CO1	K3	Explain the fundamental concepts of intelligent agents, including their definition, nature, structure, and problem-solving capabilities.

Intelligence and Machine Learning (OE)	CO2	K3	Apply uninformed and informed search techniques to solve various types of problems.
	CO3	K3	Analyze the different approaches to machine learning, including classification, regression.
	CO4	K3	**I**mplement supervised learning algorithms, such as neural networks, decision trees, and support vector machines
	CO5	K3	Evaluate unsupervised learning algorithms, such as self-organizing maps and clustering algorithms
III Year-Course Outcomes (Seventh Semester)			
21EE401 /Power System Operation and Control	C401.1	K3	Build the various power system operation problems for different loading conditions.
	C401.2	K2	Illustrate the need and importance of load frequency control.
	C401.3	K2	Explain the various control actions for maintaining the voltage profile under dynamic loading conditions.
	C401.4	K3	Solve the optimum scheduling and cost of generators using economic dispatch and unit commitment concepts.
	C401.5	K2	Explain the various control actions for monitoring the Power system security.
21EE402/Power System Simulation Lab	C402.1	K3	Model transmission line parameters
	C402.2	K3	Develop the network matrices for the load flow and fault analysis
	C402.3	K3	Solve for power flow using GS and NR method
	C402.4	K3	Solve the small signal and transient stability problems during fault from the network matrix
	C402.5	K3	Solve the load frequency dynamics and electromagnetic transient problems.
21EE403 / Project Phase I	C403.1	K2	Outline the problem identified in industries.
	C403.2	K3	Experiment with the innovative techniques.
	C403.3	K3	Make use of advanced tools for the solution.
	C403.4	K3	Select a suitable method for implementation.
	C403.5	K3	Analyze the developed prototype for future scope.
21PEE02 / Smart Grid (Honors)	CV102.1	K2	Illustrate the concepts of smart grid and its challenges
	CV102.2	K2	Outline the various types of smart grid technologies.
	CV102.3	K2	Compare the smart meters and advanced metering infrastructure
	CV102.4	K2	Explain about power quality management in smart grid.
	CV102.5	K3	Develop the knowledge on LAN, WAN and cloud computing for smart grid applications
21PEE03/ Power Quality	CV103.1	K2	Explain the concepts of transients, sags and swells.
	CV103.2	K2	Illustrate the voltage sag performance and its mitigation
	CV103.3	K2	Summarize the effects of harmonics and distortions.

	CV103.4	K3	Demonstrate the passive shunt compensators design.
	CV103.5	K2	Outline the concepts of monitoring and diagnostic techniques of
21PEE16/ Flexible AC Transmission System	CV208.1	K2	Outline the need for Flexible AC Transmission System (FACTS)
	CV208.2	K2	Summarize the applications of Static VAR Compensator (SVC) &
	CV208.3	K2	Illustrate the applications of Thyristor Controlled Series Capacitor
	CV208.4	K2	Interpret the operational characteristics of UPFC and Interline Power Flow Controllers
	CV208.5	K2	Explain the special purpose FACTS controllers in power system
21PEE43/ Soft Computing Techniques and Applications	CV606.1	K2	Interpret the difference between supervised and unsupervised learning network
	CV606.2	K2	Outline the applications of artificial neural network
	CV606.3	K2	Explain fuzzy rule and membership functions
	CV606.4	K2	Summarize the fuzzy logic control made in various applications
	CV606.5	K2	Show the various applications of genetic algorithm

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of ECE
Regulation 2021 – COURSE OUTCOMES

SEMESTER I

21EN101 - PROFESSIONAL ENGLISH-I

CO1: Listen and comprehend complex academic texts.

CO2: Read and infer the denotative and connotative meanings of technical texts.

CO3: Write definitions, descriptions, narrations and essays on various topics.

CO4: Speak fluently and accurately in formal and informal communicative contexts.

CO5: Express their opinions effectively in both oral and written medium of communication.

21MA101 - MATRICES AND CALCULUS

CO1: Use the matrix algebra methods for solving engineering problems.

CO2: Apply differential calculus tools in solving various application problems.

CO3: Make use of differential calculus ideas on several variable functions.

CO4: Identify suitable methods of integration in solving practical problems.

CO5: Solve practical problems of areas, volumes using multiple integrals.

21PH101 - ENGINEERING PHYSICS

CO1: Explain the importance of mechanics.

CO2: Extend their knowledge in electromagnetic waves.

CO3: Illustrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Interpret the importance of quantum physics.

CO5: Summarize quantum mechanical principles towards the formation of energy bands.

21CH101 - ENGINEERING CHEMISTRY

CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2: Describe the basic concepts of nano science and nanotechnology in designing the synthesis of nano materials for engineering and technology applications.

CO3: Apply the knowledge of phase rule and composites for material selection requirements.

CO4: Identify suitable fuels for engineering processes and applications.

CO5: Demonstrate different forms of energy resources and apply them for suitable applications in energy sectors.

21CS101 - PROBLEM SOLVING AND PYTHON PROGRAMMING

CO1: Use algorithmic solutions to solve simple computational problems.

CO2: Develop and execute simple Python programs.

CO3: Solve simple programs using conditionals, loops and functions for solving problems.

CO4: Construct compound data using Python lists, tuples, dictionaries etc.

CO5: Prepare read and write data from/to files in Python programs.

21CS102 - PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

CO1: Develop algorithmic solutions to solve simple computational problems.

CO2: Construct simple Python programs.

CO3: Build programs using conditionals, loops and functions for solving problems. CO4: Demonstrate compound data using Python data structures.

CO5: Utilize Python packages in developing software applications.

21PC101 - PHYSICS AND CHEMISTRY LABORATORY

CO1:Explain the functioning of various physics laboratory equipment.

CO2: Relate the graphical models to analyze laboratory data.

CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality.

CO4: Explain Access, process and analyze scientific information.

CO5:Translate students to solve problems individually and collaboratively.

CHEMISTRY LABORATORY

CO1: Extent the skills to choose and handle appropriate glass wares.

CO2: Interpret the water quality parameters using volumetric method.

CO3: Estimate the conductivity, pH &emf by electro chemical methods.

CO4: Infer the collected data for appropriate chemical analysis.

CO5: Demonstrate systematic approach to obtain accurate results.

SEMESTER II

21EN102 - ENGLISH-II

CO1: Interpret by reading information in technical texts

CO2: Choose appropriate language to write convincing job applications, resume and reports

CO3: Formulate the technical ideas effectively in spoken and written forms

CO4: Analyze and understand spoken language in lectures and talks

CO5: Demonstrate basic soft skills in life

21MA103 - SAMPLING TECHNIQUES AND NUMERICAL METHODS

CO1: Apply the concepts of Probability in Engineering problems.

CO2: Explain the test of hypothesis for small and large samples by using various test like t- test, F-test, Z-test and c2 test.

CO3: Apply the basic concepts of classifications of design of experiments.

CO4: Solve the system of equations and the eigen value problems using iterative procedure.

CO5: Calculate the value of an unknown function at any interpolated point of the given tabulated values.

21PH104 - PHYSICS FOR ELECTRONICS ENGINEERING

CO1: Know basics of crystallography and its importance for varied materials properties.

CO2: Gain knowledge on the electrical and magnetic properties of materials and their applications.

CO3: Understand clearly of semiconductor physics and functioning of semiconductor devices.

CO4: Understand the optical properties of materials and working principles of various optical devices.

CO5: Appreciate the importance of nanotechnology and nano devices.

21ME101 - ENGINEERING GRAPHICS

CO1: Construct the orthographic projections of points, straight lines and plane surfaces.

CO2: Sketch the orthographic projections of simple solids

CO3: Sketch the orthographic projections of sectional solids and lateral surfaces of the solids.

CO4: Construct the isometric projections and perspective projections of simple solids.

CO5: Sketch the orthographic projection of objects using free hand.

21EC101 - ELECTRONIC DEVICES

CO1: Explain the operation and characteristics of semiconductor diode.

CO2: Outline the construction and working of bipolar junction transistors.

CO3: Explain the construction and characteristics of field effect transistors devices. CO4: Summarize the working principles of special semiconductor devices.

CO5: Illustrate the construction and working of power & display devices.

21EC102 - CIRCUIT ANALYSIS

CO1: Make use of the basic voltage and current laws for analysis of DC and AC circuits.

CO2: Select suitable network theorems to analyze DC and AC circuits.

CO3: Examine the steady state response of R, L and C circuits.

CO4: Identify the transient and frequency response of RLC circuits.

CO5: Solve the various parameters of coupled circuits and infer the network topologies.

21CS105 - C PROGRAMMING

CO1: Develop simple applications using basic C components.

CO2: Build applications adopting array and string concepts.

CO2: Build applications adopting array and string concepts.

CO3: Develop and implement applications in C using functions and pointers.

CO4: Build applications in C by employing structure and union concepts.

CO5: Design simple applications that make use of C construct.

21EM101 - ENGINEERING PRACTICES LABORATORY

CO1: Build various plumbing joints.

CO2: Develop various carpentry joints.

CO3: Construct various wiring electrical joints in common household electrical wire work.

CO4: Construct various welded joints, sheet metal and basic machining operations.

CO5: Develop the electronic circuit for soldering and testing using PCB board.

21EC103 - ELECTRONIC DEVICES AND CIRCUITS LABORATORY

CO1: Build circuits to verify Kirchoff's laws and network theorems.

CO2: Make use of RLC circuits to determine their frequency response.

CO3: Examine the characteristics of PN and Zener diodes.

CO4: Compare the characteristics of BJT, FET and SCR.

CO5: Distinguish half wave rectifier with full wave rectifier.

SEMESTER III

21MA201 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

CO1: Calculate Laplace transform and inverse Laplace transform of different functions.

CO2: Express the Fourier series expansion to represent the given function in the given interval.

CO3: Classify the second order PDE and to know about solving initial and final value problems.

CO4: Apply Fourier transform techniques to evaluate the given integral.

CO5: Solve the given difference equations using Z-transforms.

21EC201 - DIGITAL PRINCIPLES AND SYSTEM DESIGN

CO1: Make use of minimization techniques to simplify Boolean algebraic equations.

CO2: Build various combinational circuits using logic gates.

CO3: Develop synchronous sequential circuits using flip flops.

CO4:Construct asynchronous sequential circuits using flip flops.

CO5: Explain various semiconductor memories and programmable logic devices.

21EC202 - ELECTRONIC CIRCUITS I

CO1: Analyze the biasing techniques of BJT using stability factor.

CO2: Interpret the working principle of various biasing techniques of

JFET and MOSFET.

CO3: Design CE, CB and CC single stage amplifiers based on hybrid-π equivalent model.

CO4: Inspect the effect of cascading BJT amplifiers on bandwidth.

CO5: Analyze the low frequency and high frequency response of BJT, JFET and MOSFET.

21EC203 - SIGNALS AND SYSTEMS

CO1: Interpret the classification of signals and systems.

CO2: Apply Fourier and Laplace transform for continuous time signals.

CO3: Apply Z transform and DTFT for discrete time signals.

CO4: Make use of Laplace transform, Fourier transform to analyze the continuous time systems.

CO5: Utilize Fourier and Z transform in discrete time system analysis.

21CS214 - OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES

CO1: Develop simple applications using Basic OOPS concepts.

CO2: Build C++ programs using inheritance.

CO3: Construct the concept of stack, linked list and memory allocation.

CO4: Solve problems related to trees and Graphs.

CO5: Compare different sorting and searching algorithms.

21EC204 - LINEAR INTEGRATED CIRCUITS

CO1: Outline the basic concepts of operational amplifiers.

CO2: Construct op-amp circuits for linear and non-linear applications.

CO3: Summarize about the analog multiplier and phase locked loop

circuits.

CO4: Build ADC and DAC circuits using op – amps.

CO5: Explain the concepts of waveform generating circuits and special function ICs.

21EC205 - ANALOG AND DIGITAL CIRCUITS LABORATORY

CO1: Build CE, CB, CC, CS, Cascode / Cascade Amplifiers and obtain the frequency response.

CO2: Analyze the transfer characteristics of Differential amplifier, Power amplifiers, bandwidth of single stage and Multistage amplifiers.

CO3: Construct BJT, JFET and MOSFET amplifiers with various biasing techniques using SPICE.

CO4: Develop multiplexer, de-multiplexer, encoder and decoder using logic gates.

CO5: Experiment with synchronous and asynchronous sequential circuits.

21CS215 - OBJECT ORIENTED PROGRAMMING LABORATORY

CO1: Develop simple applications using Basic OOPS concepts.

CO2: Execute and Implement programs using inheritance and use them in programs.

CO3: Construct the concept of stack, linked list and memory allocation.

CO4: Solve problems related to trees and Graphs.

CO5: Compare different sorting and searching algorithms.

SEMESTER IV

21MA206 - PROBABILITY AND RANDOM PROCESSES

CO1: Identify the basic concepts of Probability and Random variables.

CO2: Experiment the performance of random variables in terms of distributions.

CO3: Calculate the correlation and regression of two dimensional random variables.

CO4: Make use of random processes concept in engineering disciplines.

CO5: Apply the concept of correlation and spectral densities and the significance of linear systems with random inputs .

21CH103 - ENVIRONMENTAL SCIENCE

CO 1 : Explain the concept, structure and function of an ecosystem and biodiversity.

CO2 : Demonstrate the environmental impacts of natural resources.

CO 3 : Illustrate the suitable management method for pollution control.

CO 4 : Relate the proper way of managing disaster with environmental ethics.

CO5 : Apply social issues and adopt suitable sustainable practices.

21EC206 - ELECTRONIC CIRCUITS II

CO1: Identify the topologies of feedback amplifiers.

CO2: Compare the various types of RC and LC oscillators.

CO3: Experiment with different types of tuned amplifiers.

CO4: Illustrate wave shaping and multi vibrator circuits.

CO5: Describe the concept of Power amplifiers and DC converters.

21EC207 - ELECTROMAGNETIC FIELDS

CO1: Relate various coordinate systems and vector algebra.

CO2: Apply the basic laws to evaluate electric fields and potentials due to static charges.

CO3: Solve magnetic fields with the help of Biot Savart's law and Ampere circuital law.

CO4: Outline the principles of time varying fields and Maxwell's equations.

CO5: Explain the plane electromagnetic waves in lossless and lossy media.

21EC20-MICROPROCESSORSAND MICROCONTROLLERS

CO1: Explain the architecture of Microprocessors and Microcontrollers.

CO2: Analyze various types of Interfacing techniques.

CO3: Write assembly language program for 8086 Microprocessor, 8051 and MSP430 Microcontrollers.

CO4: Demonstrate the architecture of MSP430 Microcontroller.

CO5: Develop ALP for microcontroller based system design.

21EC209 - ANALOG COMMUNICATION

CO1: Design, Test and Compare various amplitude modulators and demodulators with practical design parameters.

CO2: Design, Test and Compare various angle modulators and

demodulators with practical design parameters.

CO3: Analyze the various noises in Analog systems.

CO4: Compare the performance of AM and FM modulation systems.

CO5: Apply various source coding techniques for the message Signals.

21EC210 - CIRCUIT DESIGN AND SIMULATION LABORATORY

CO1: Analyze the various types of negative feedback amplifiers

CO2: Construct RC and LC oscillators

CO3: Experiment with Single tuned amplifiers and Wave Shaping circuits

CO4: Build Astable and Monostable multivibrator circuits

CO5: Make use of PSPICE tool to simulate Oscillators, Multivibrator Circuits and PowerAmplifiers

21EC211-MICROPROCESSORSAND MICROCONTROLLERS LABORATORY

CO1: Write ALP Programmes for fixed and Floating Point and Arithmetic operations.

CO2: Interface different I/Os with processor.

CO3: Generate waveforms using Microprocessors.

CO4: Execute Programs in 8051.

CO5: Explain the difference between simulator and Emulator.

SEMESTER V

21EC301 - DIGITAL COMMUNICATION

CO1: Outline the parameters of information theory.

CO2: Compare different waveform coding and line coding techniques.

CO3: Illustrate the different baseband transmission and reception schemes.

CO4: Explain bandpass signaling schemes and its spectral characteristics.

CO5: Apply error control coding schemes for error correction.

21EC302 - TRANSMISSION LINES AND RF SYSTEMS

CO1: Illustrate the basic concepts of Transmission Line theory

CO2: Outline the signal propagation in Transmission Lines at High frequencies.

CO3: Develop impedance matching networks using Smith Chart.

CO4: Choose guided systems for electromagnetic wave propagation.

CO5: Design RF Transceivers.

21EC303 - DIGITAL SIGNAL PROCESSING

CO1: Apply the concepts of FFT for linear filtering.

CO2: Construct IIR filters using various transformation techniques.

CO3: Realize FIR Filters using Windowing and Frequency Sampling techniques.

CO4: Analyze the effects of finite word length in signal processing.

CO5: Outline multivariate signal processing techniques.

21EN301-PROFESSIONALCOMMUNICATION LABORATORY

CO1: Demonstrate effective communication skills through presentations.

CO2: Utilize their knowledge of motivation in setting and achieving goals.

CO3: Examine time and stress management.

CO4: Formulate their ideas into an effective communication in formal contexts.

CO5: Develop a well-composed resume and face interviews confidently.

SEMESTER VI

21EC304 - ANTENNAS AND WAVE PROPAGATION

CO1: Summarize the fundamentals of antennas.

CO2: Construct wire antennas and antenna arrays.

CO3: Analyze the characteristics aperture antennas.

CO4: Explain the characteristics of special antennas and procedure to measure antenna parameters.

CO5: Analyze the Atmospheric Effects on Radio Wave Propagation.

21EC305 - VLSI AND CHIP DESIGN

CO1: Outline the concepts of digital building blocks using MOS transistor.

CO2: Make use of Verilog HDL to synthesize combinational and sequential circuits.

CO3: Examine combinational MOS circuits and sequential circuits.

CO4: Develop arithmetic building blocks and memory subsystems using CMOS.

CO5: Summarize the methods of CMOS testing.

21EC306 - COMMUNICATION NETWORKS

CO1: Outline the layered architecture and functionalities of a network.

CO2: Make use of Media Access Control protocols for error detection and flow control.

CO3: Develop routing table to efficiently route data using routing protocols.

CO4: Explain end to end data delivery protocols to improve congestion control and QoS.

CO5: Summarize the functionalities of application layer protocols.

21EC307 - VLSI DESIGN LABORATORY

CO1: Develop programs for basic combinational circuits.

CO2: Utilize verilog HDL and simulate the sequential digital circuits.

CO3: Demonstrate the logic modules using FPGA boards.

CO4: Analyze the synthesis report and infer the utilization.

CO5: Develop the analog CMOS circuits using SPICE.

SEMESTER VII

21EC401 - MICROWAVE AND OPTICAL ENGINEERING

CO1: Design passive microwave components.

CO2: Demonstrate the working principles of semiconductor

microwave devices

CO3: Illustrate the principle of operation of microwave tubes and procedure to measure microwave power, wavelength, impedance, SWR, attenuation, Q and Phase shift.

CO4: Analyze optical fiber transmission characteristics

CO5: Analyze the various optical source materials and LED structures and photo detectors

21EC402 - MOBILE COMMUNICATION

CO1: Illustrate the basics of mobile telecommunication system.

CO2: Summarize the generations of telecommunication systems in wireless network.

CO3: Illustrate the architecture of wireless LAN technologies.

CO4: Interpret the functionality of network layer and Identify a routing protocol for a given Adhoc networks.

CO5: Summarize the functionalities of Transport and Application layer.

21EC403 - MICROWAVE AND OPTICAL LABORATORY

CO1: Compare the performance of different microwave generators

CO2: Analyze the performance of passive microwave components.

CO3: Interpret the characteristics of antennas using ADS package.

CO4: Analyze the characteristics of optical sources and detectors.

CO5: Examine various optical fiber links and their transmission losses.

21EC404 - PROJECT WORK I

CO1: Outline the problem identified in industries.

CO2: Experiment with the innovative techniques.

CO3: Make use of advanced tools for the solution.

CO4: Select a suitable method for implementation.

CO5: Analyze the developed prototype for future scope.

21EC405 - PROJECT WORK II

CO1: Solve engineering problem with social relevance.

CO2: Plan for writing report and viva voce examination.

CO3: Make use of the project reports for publications.

CO4: Choose a suitable methodology for a problem solving.

CO5: Organize the works related to project implementation.

PROFESSIONAL ELECTIVE COURSES

VERTICAL – I

RF CIRCUITS AND ANTENNA DESIGN

21PEC01 - RF TRANSCEIVERS

CO1: Apply the knowledge of RF electronics for characterizing RF Systems.

CO2: Design different types of RF amplifiers.

CO3: Illustrate the requirements and design procedure of RF power amplifiers.

CO4: Analyze the performance of practical RF circuits.

CO5: Design RFIC and understand the packaging techniques.

21PEC02 - RF MEMS

CO1: Illustrate the concepts of RF MEMS mechanism.

CO2: Design RF MEMS switches and passive components.

CO3: Design RF phase shifters and transmission lines.

CO4: Design an intelligent control based micromachining for antenna design.

CO5: Analyze properties of RF MEMS using CAD tools for application specific designs.

21PEC03 - RF TEST AND MEASUREMENT

CO1: Explain the basics of RF measurement and related parameters.

CO2: Explain the measurement techniques and procedure.

CO3: Demonstrate the testing of RF components/systems and measurement of electromagnetic emission.

CO4: Analyze the performance of RF components and systems

CO5: Demonstrate the issues with EMI/EMC through RF testing.

21PEC04 - ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

CO1: Infer the basic concepts of Electromagnetic Interference and Compatibility.

CO2: Utilize various EMI coupling principles to achieve compatibility.

CO3: Outline EMI mitigation techniques.

CO4: Summarize the EMC standards and regulations in measurement techniques.

CO5: Select EMI methods and equipments based on specific

requirements.

21PEC05 - ELECTROMAGNETIC METAMATERIALS

CO1: Illustrate the properties of metamaterials.
CO2: Construct metamaterial transmission lines.
CO3: Design the metamaterial structures.
CO4: Demonstrate the metamaterial inspired antennas.
CO5: Select the metamaterials for advanced applications.

21PEC06 - MODERN ANTENNA DESIGN

CO1: Evaluate the performance of different printed antennas.
CO2: Analyze the properties of wearable antennas.
CO3: Apply EM characterization to active integrated antennas.
CO4: Design reconfigurable antennas.
CO5: Develop metamaterials and metasurfaces.

21PEC07 - SIGNAL INTEGRITY

CO1: Outline the concept of signal integrity using electromagnetic theory, vector functions
CO2: Illustrate crosstalk that affects the integration.
CO3: Explain the properties of dielectric materials
CO4: Analyze differential signaling
CO5: Demonstrate a physical model for transmission lines

VERTICAL II

SIGNAL AND IMAGE PROCESSING

21PEC08 - STOCHASTIC SIGNAL PROCESSING

CO1: Explain the fundamental concepts of discrete random signal processing.

CO2: Apply various parametric and non parametric techniques to estimate the spectrum.

CO3: Develop algorithms for linear estimation and prediction techniques for processing signals.

CO4: Outline the various adaptive filtering techniques.

CO5: Summarize the working principles of multirate digital signal processing.

21PEC09 - DIGITAL IMAGE PROCESSING

CO1: Relate the fundamental concepts of digital image processing.

CO2: Illustrate the image enhancement techniques in spatial and frequency domains.

CO3: Apply the concepts of restoration and segmentation algorithms on images.

CO4: Select appropriate image compression techniques for various applications.

CO5: Summarize different image representation techniques and recognition methods.

21PEC10 - SPEECH PROCESSING

CO1: Interpret Speech Characteristics and Speech Analysis Techniques.

CO2: Demonstrate Speech Compression techniques.

CO3: Analyze speech recognition techniques.

CO4: Outline the speaker recognition systems.

CO5: Explain the text to speech synthesis systems.

21PEC11 - SOFTWARE DEFINED RADIO

CO1: Interpret Software radio concepts and case studies.

CO2: Illustrate the implementation of RF systems.

CO3: Infer the multirate signal processing concept.

CO4: Explain the data converters and smart antennas.

CO5: Summarize the choices of digital hardware and software.

21PEC12 - DSP ARCHITECTURE AND PROGRAMMING

CO1: Illustrate the basic architecture and programming concepts of DSP processor. CO2: Develop assembly language coding in TMS 320C5X.

CO3: Develop ALP in TMS 320C6X processors.

CO4: Apply DSP algorithms using ADSP processors.

CO5: Analyze the features of various advanced processors.

21PEC13 - WAVELETS AND MULTI RESOLUTION TRANSFORMS

CO1: Illustrate the relation between vector and signal concepts.

CO2: Outline multi resolution processes.

CO3: Analyze the wavelet systems.

CO4: Examine various continuous and discrete wavelet transforms.

CO5: Select the wavelets for specific applications.

21PEC14 - MULTIMEDIA COMPRESSION TECHNIQUES

CO1: Explain the requirement of compression in different real time applications.

CO2: Select relevant techniques for text compression.

CO3: Experiment with various image compression algorithms.

CO4: Compare the performance of audio compression techniques.

CO5: Illustrate the different standards applicable for video compression.

VERTICAL III

BIO MEDICAL TECHNOLOGIES

21PEC15 - WEARABLE DEVICES

CO1: Illustrate the need and design requirements for wearable systems.

CO2: Interpret the significance of smart fabric technology.

CO3: Demonstrate wearable computing systems.

CO4: Summarize the existing technology through demonstrations.

CO5: Design the smart fabric wearable systems for real time applications.

21PEC16 - HUMAN ASSIST DEVICES

CO1: Interpret various mechanical techniques that will help in assisting the heart functions.

CO2: Demonstrate the working principles and parameters of the dialysis unit.

CO3: Illustrate the characteristics of hearing aids.

CO4: Infer the various orthotic devices and prosthetic devices to overcome orthopedic problems.

CO5: Summarize the sensory impairments and its substitutions.

21PEC17 - THERAPEUTIC EQUIPMENTS

CO1: Outline the working and recording setup of basic cardiac equipment.

CO2: Infer the working and recording of basic neurological equipment.

CO3: Illustrate the recording of diagnostic and therapeutic equipment's related to EMG.

CO4: Explain laser based diagnostic equipment in medical.

CO5: Demonstrate the measurement techniques of sensory responses.

21PEC18 - MEDICAL IMAGING SYSTEMS

CO1: Discuss the principle and working of various radiographic equipments.

CO2: Explain the tomography concept and image reconstruction techniques.

CO3: Illustrate the concept of radio isotopic imaging techniques.

CO4: Describe the basic principle involved in Ultrasound Imaging technique.

CO5: Outline the basic principle and working of Magnetic resonance imaging technique.

21PEC19 - HUMAN COMPUTER INTERFACE

CO1: Outline the basic concepts of HCI.

CO2: Illustrate the screen design theory of human interaction.

CO3: Summarize the various components of HCI.

CO4: Interpret the available evaluation techniques.

CO5: Explain the models of HCI.

21PEC20 - WIRELESS BODY AREA NETWORKS

CO1: Illustrate the characteristics of wireless sensor networks. CO2: Outline the fundamentals of BAN and WBAN.

CO3: Summarize the salient features of Wireless Body Area Networks.

CO4: Relate the topologies and protocols of WBAN.

CO5: Interpret the approaches of wireless sensor networks for healthcare applications.

21PEC21 - BIO MEMS

CO1: Explain the design process of microsystems.

CO2: Demonstrate the mechanics involved in the design of sensors. CO3: Explain about the electrostatic sensors and actuators.

CO4: Infer the concepts of microfluidic systems.

CO5:Apply the knowledge of CAD tools for MEMS design.

VERTICAL IV

EMBEDDED SYSTEMS AND IOT

21PEC22 - WIRELESS SENSOR NETWORKS

CO1: Infer the basics of Wireless Sensor Networks.

CO2: Interpret the concepts of MAC Protocol.

CO3: Illustrate various routing protocols.

CO4: Summarize various operating systems for wireless sensor networks.

CO5: Outline various applications of wireless sensor networks.

21PEC23 - MEMS DESIGN

CO 1: Summarize about various MEMS devices.

CO 2: Apply their knowledge for fabrication of MEMS materials.

CO 3: Explicate the design of new MEMS devices based on various principles.

CO4: Illustrate the case studies of application specific MEMS.

CO5: Illustrate the principles of nano electronics with its applications.

21PEC24 - EMBEDDED AND REAL TIME SYSTEMS

CO1: Describe the architecture and programming of ARM processor.

CO2: Outline the concepts of embedded systems.

CO3: Illustrate the Multi rate task in real time operating system.

CO4: Demonstrate the system design techniques for embedded systems.

CO5: Model real-time consumer/industrial applications using embedded-system concepts.

21PEC25 - IOT BASED SYSTEM DESIGN

CO1: Design embedded programs for sensor applications.

CO2: Develop ARM basic and advanced programs.

CO3: Interface and deploy analog and digital sensors.

CO4: Develop communication system with sensor units.

CO5: Design IoT systems using Wi-Fi CC3200 and program the single board computers.

21PEC26 - CONTROL SYSTEMS FOR IOT APPLICATIONS

CO1: Demonstrate the various control system components and their representations.

CO2: Analyze the various time domain parameters.

CO3: Analyze the various frequency response plots and its system.
CO4: Outline the Sensors and Actuators used in control systems.

CO5: Summarize applications of IoT in real time scenario.

21PEC27-INDUSTRIAL IOT AND INDUSTRY 4.0

CO1: Classify the Industrial Internet of Things.

CO2: Illustrate the cyber system and Big Data Analytics.

CO3: Outline various IIoT Architecture and domains.

CO4: Interpret Communication Protocols used in IIoT.

CO5: Summarize the Business Issues in Industry 4.0.

21PEC28-IOT FOR SMART SYSTEMS

CO1: Analyze the concepts of IoT and its present developments.

CO2: Compare different platforms and infrastructures available for IoT.

CO3: Explain different protocols and communication technologies used in IoT.

CO4: Analyze the big data analytic and programming of IoT.

CO5: Implement IoT solutions for smart applications.

VERTICAL V

SPACE TECHNOLOGIES

21PEC29-SATELLITE COMMUNICATION

CO1: Summarize the basics of satellite orbits and launching procedures.

CO2: Illustrate the components of Space Segment and Earth Segment.

CO3: Outline the uplink and downlink analysis of satellite.

CO4: Compare multiple access schemes in satellite systems.

CO5: Summarize the applications of satellite systems.

21PEC30-AVIONICS

CO1: Summarize the technologies of avionics systems and its sub systems.

CO2: Compare the various architecture and functionalities of digital avionics.

CO3: Outline the various display and control technologies of decks and cockpit.

CO4: Interpret the design of navigation systems.

CO5: Develop an autopilot systems for small aircrafts using MATLAB.

21PEC31-POSITIONING AND NAVIGATION SYSTEMS

CO1: Outline the elements of satellite orbits.

CO2: Explain the techniques of development of satellites.

CO3: Infer the working of GPS receivers.

CO4: Demonstrate the error detection and correction methods of GPS data.

CO5: Illustrate the applications of Satellite Geodesy.

21PEC32 – RADAR TECHNOLOGIES

CO1: Infer the fundamental concepts behind radar systems.

CO2: Outline various signal models involved in radar systems.

CO3: Demonstrate the sampling and quantization techniques of pulsed radar signals.

CO4: Illustrate different types of radar waveforms.

CO5: Summarize the Doppler processing issues.

21PEC33 - REMOTE SENSING

CO1: Summarize the concepts and laws related to remote sensing.

CO2: Illustrate various remote sensing platforms.

CO3: Explain the characteristics of different types of remote sensors.

CO4: Outline the concepts of data reception, product generation, storage and ordering of satellite data.

CO5: Illustrate different image processing techniques and interpretation of satellite data.

21PEC34 - UNMANNED AERIAL VEHICLES AND DRONES

CO1: Explain the basics of unmanned systems and its applications.

CO2: Apply the aerodynamics and airframe configurations for UAV design. CO3: Make use of suitable avionics hardware for autopilot system.

CO4: Outline the various payloads and control devices of UAV.

CO5: Build an UAV system with ground control and waypoint navigation.

21PEC35 - ROCKETRY AND SPACE MECHANICS

CO1: Make use of the basic concepts of orbit mechanics to estimate the orbital parameters.

CO2: Apply the methods to calculate the satellite coordinates from orbital elements.

CO3: Illustrate the motion of rocket with metrics.

CO4: Explain the rocket motion by considering the aerodynamics.

CO5: Summarize the different staging and control of the rocket vehicles.

VERTICAL VI

HIGH SPEED COMMUNICATIONS

21PEC36 - WIRELESS COMMUNICATION

CO1: Outline the importance of improving capacity of wireless channel using MIMO.

CO2: Illustrate the propagation of radio wave and fading measurements.

CO3: Interpret the channel impairment mitigation using space-time

block codes.

CO4: Summarize the channel impairment mitigation using space-time Trellis codes. CO5: Outline the advanced MIMO system & MIMO OFDM systems.

21PEC37 - WIRELESS BROADBAND NETWORKS

CO1: Summarize the significance of broadband services.

CO2: Explain the network and transport layer protocols in wireless LANs

CO3: Compare the operation of various cellular technologies

CO4: Interpret the connection oriented services over 4G networks.

CO5: Outline the enabling technologies for 5G networks.

21PEC38 - 4G/5G COMMUNICATION NETWORKS

CO1: Explain the hardware requirements of transmitter and receiver for 4G wireless systems.

CO2: Evaluate OFDM and SCDMA based wireless system.

CO3: Evaluate Diversity and Spatial Multiplexing schemes in 4G wireless systems. CO4: Interpret transceiver for 4G wireless systems specifications.

CO5: Infer the state-of-the-art research on 5G systems.

21PEC39 - COGNITIVE RADIO NEWORKS

CO1: Compare SDR and Cognitive radio.

CO2: Analyze the various spectrum sensing techniques.

CO3: Summarize the cooperative spectrum acquisition.

CO4: Interpret the concepts of MAC protocols and network layer.

CO5: Outline the various attacks in cognitive radio networks.

21PEC40 - SPACE TIME WIRELESS COMMUNICATION

CO1: Illustrate signal and channel model multiple antenna systems.

CO2: Develop the channel fadings and capacity of space time channels.

CO3: Explain various diversity techniques.

CO4: Analyze the performance of various receiver structures.

CO5: Summarize the concepts of multi-antenna systems.

21PEC41 - MASSIVE MIMO SYSTEMS

CO1: Explain the major cellular communication standards and wireless communications networks.

CO2: Illustrate the 5G techniques for the design of communication systems.

CO3: Demonstrate various modulation and multiplexing techniques.

CO4: Outline Machine Learning algorithms in 5G Wireless Communications.

CO5: Summarize the recent research works in massive MIMO systems.

21PEC42 - MILLIMETER WAVE COMMUNICATIONS

CO1: Illustrate the characteristics of millimeter wave.

CO2: Infer the properties of millimeter wave devices and circuits.

CO3: Explain about the usage of millimeter wave communication systems.

CO4: Outline the characteristics of millimeter wave MIMO systems.

CO5: Design antenna for millimeter wave frequencies.

VERTICAL VII

SEMICONDUCTOR CHIP DESIGN AND TESTING

21PEC43 - WIDE BANDGAP DEVICES

CO1: Outline the fundamental properties of wide bandgap semiconductors.

CO2: Interpret the properties of various photonic devices.

CO3: Summarize various wide bandgap devices.

CO4: Illustrate nanostructure materials and related devices.

CO5: Analyze the characteristics of various heterostructure devices.

21PEC44 - ASIC DESIGN

CO1: Describe architecture of programmable devices.

CO2: Outline the concepts of programmable ASIC logic cells.

CO3: Demonstrate the Programmable ASIC Architecture.

CO4: Illustrate the logic synthesis, placement and routing.

CO5: Model real-time case studies of system on chip concepts.

21PEC45 - LOW POWER IC DESIGN

CO1: Analyze various sources of power dissipation in CMOS circuits

CO2: Develop optimized circuit structures to reduce the power consumption.

CO3: Demonstrate CMOS low power circuits using various techniques.

CO4: Summarize the power for CMOS circuits.

CO5: Make use of software design optimization to reduce the power consumption.

21PEC46 - DESIGN FOR TESTABILITY OF VLSI CIRCUITS

CO1: Illustrate the testing process and fault modeling for digital circuits.

CO2: Outline the generation of testing circuits for combinational and sequential circuits.

CO3: Develop the test circuits for testing the digital circuits.

CO4: Illustrate the testing algorithms and its patterns.

CO5: Analyze various fault diagnosis processes for combinational circuits.

21PEC47 - MIXED SIGNAL IC DESIGN

CO1: Outline the characteristics and model of MOS circuits.

CO2: Illustrate the Submicron circuits and its delay elements.

CO3: Explain the characteristics and architectures of different types of data converters.

CO4: Compare the SNR of data converters.

CO5: Develop switched capacitor circuits.

21PEC48 - SYSTEM ON CHIP

CO1: Outline the concepts of system architecture.

CO2: Illustrate the processor architecture and its basic elements.

CO3: Demonstrate the memory system of SoC.

CO4: Interpret the interconnect architecture and its configuration.

CO5: Analyze the various types of reconfigurable technologies.

21PEC49 - NETWORKS ON CHIP

CO1: Outline the basic concepts of NOC
CO2: Illustrate the various architectures of NOC
CO3: Summarize the routing methods and algorithms
CO4: Interpret the various tests and fault tolerance methods
CO5: Explain the 3D networks on chips and their advantages.

VERTICAL – VIII

COMPUTATIONAL INTELLIGENCE

21PEC50 - ARTIFICIAL INTELLIGENCE

CO1: Outline various strategies for AI.
CO2: Develop AI logics for planning.
CO3: Make use of Decision Making Rules for developing AI models.
CO4: Analyze various RL algorithms.
CO5: Demonstrate AI and RL based application specific systems.

21PEC51 - PATTERN RECOGNITION

CO1: Summarize the basics of Pattern Recognition.
CO2: Infer the various feature selection methods.
CO3:Categorize the various pattern recognition

techniques into supervised and unsupervised.

CO4: Illustrate the artificial neural network based pattern recognition.

CO5: Relate the applications of pattern recognition.

21PEC52 - SOFT COMPUTING TECHNIQUES

CO1: Outline soft computing techniques and their applications.

CO2: Analyze various neural network architectures.

CO3: Explain perceptrons and propagation networks.

CO4: Demonstrate the fuzzy systems and fuzzy rules.

CO5: Analyze the genetic algorithms and their applications.

21PEC53 - MACHINE LEARNING

CO1: Make use of the appropriate machine learning strategy for any given problem. CO2: Compare supervised, unsupervised and semi-supervised learnings.

CO3: Outline the role of Probabilistic models in learning.

CO4: Explain dimensionality reduction algorithms.

CO5: Illustrate the graph models of machine learning.

21PEC54 - DEEP LEARNING TECHNIQUES

CO1: Make use of mathematical concepts to know the fundamentals of deep learning algorithms.

CO2: Select a suitable optimization strategy for deep learning implementation. CO3: Outline the research modes of deep learning.

CO4: Illustrate suitable deep learning models with suitable justification.

CO5: Plan a suitable visualization technique for the deep learning

applications.

21PEC55 - DIGITAL FORENSICS

CO1: Illustrate the basics of digital forensics.
CO2: Outline different types of investigations.
CO3: Summarize evidence collection on digital devices.
CO4: Analyze and validate evidences collected from various sources.
CO5: Apply various tools to analyze collected evidence.

21PEC56 - SWARM INTELLIGENCE

CO1: Illustrate the concepts of swarm intelligence
CO2: Outline the theory of ant colony optimization algorithm
CO3: Explain the principles of particle swarm optimization
CO4: Interpret the applications of ABC optimization algorithm
CO5: Summarize the types of herd and grey wolf optimization

ONE CREDIT COURSES

21OCEC01 - A PRACTICAL COURSE ON COMMUNICATION SYSTEMS – SIGNAL GENERATION AND ANALYSIS

CO1: Interpret the terminologies of baseband communication
CO2: Design a module for a communication system with necessary constraints. CO3: Design a block for M-ary digital modulation scheme.

21OCEC02 - A PRACTICAL COURSE ON RF MEASUREMENTS

CO1: Make use of vector network analyzer to perform calibration for S parameter measurements.

CO2: Demonstrate convolution, correlation, frequency analysis and sampling.

CO3: Design RF transceivers.

21OCEC03 - A PRACTICAL COURSE ON ANTENNA DESIGN AND SIMULATION

CO1: Design and analyze Patch Antennas and Arrays.

CO2: Design antennas of frequency specific applications.

CO3: Make use of the simulation tools and analyze parameters in the design of array

antennas.

21OCEC04 - A PRACTICAL COURSE ON EMBEDDED SYSTEMS

CO1: Develop assembly language programs to perform specific tasks using ARM instructions.

CO2: Develop ARM microcontroller applications using Embedded C language.

CO3: Design and develop program to interface external hardware with LPC214x

micro controller.

21OCEC05 - A PRACTICAL COURSE ON UAV SYSTEM DESIGN

CO1: Design and calculation of multi rotor UAV.

CO2: Build and select suitable the propulsion system of UAV systems.

CO3: Model the auto pilot system using flight controller software.

21OCEC06 - ARTIFICIAL NEURAL NETWORKS – A PRACTICAL APPROACH

CO1: Apply the concept of neural in practical applications.

CO2: Analyze the performance of advanced neural networks.

CO3: Solve real world problems using Neural Techniques.

21OCEC07 - REMOTE SENSING IMAGE ANALYSIS USING ENVI PACKAGE

CO1: Apply the knowledge on Principles of Remote Sensing and GIS.

CO2: Analyze and interpret the remote sensing data.

CO3: Integrate GIS and Remote sensing data for specific applications.

21OCEC08 - ARDUINO FOR ENGINEERS

CO1: Understand the hardware architecture of Arduino.

CO2: Develop a program and interface the Arduino board with peripherals.

CO3: Design Arduino based practical real life applications.

21OCEC09 - IOT FOR HEALTHCARE MONITORING

CO1: Illustrate the basic concepts of IOT in healthcare.

CO2: Relate the existing hardware platforms and sensor interfaces for various healthcare based applications.

CO3: Build various applications in healthcare using IOT based approach and substantiate the same with appropriate case studies.

21OCEC10 - WEARABLE DEVICES FOR MEDICAL APPLICATIONS

CO1: Outline the need for development of wearable devices and its influence on Various sectors.

CO2: Explain the applications of wearable inertial sensors for biomedical applications.

CO3: Summarize the working principle of wearable assistive devices.

21OCEC11 - DESIGN THINKING

CO1: Illustrate the key concepts of design thinking.

CO2: Outline design thinking in all stages of problem solving.

CO3: Apply design thinking approach to real world problems.

21OCEC12 - EMOTIONAL INTELLIGENCE

CO1: Summarize the characteristics and components of EI.

CO2: Interpret the problem solving methods in enhancing relationships.

CO3: Illustrate the techniques to enhance collaboration and leadership skills.

MANDATORY COURSES

21MCC01 - CONSTITUTION OF INDIA

CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India.

CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status.

CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India.

CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions.

CO5: Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality.

21MCC02 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern knowledge.

CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.

CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being.

CO4: Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.

CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Course Name	Course Code	Course Outcome		CO Statement
		COs	K-Level	
Professional English – I	21EN101	21EN101.1	K2	Listen and comprehend complex academic text
		21EN101.2	K2	Read and infer the denotative and connotative meanings of technical texts
		21EN101.3	K3	Write definitions, descriptions, narrations and essays on various topic
		21EN101.4	K2	Speak fluently and accurately in formal and informal communicative contexts
		21EN101.5	K3	Apply their opinions effectively in both oral and written medium of communication to find the meaning in articles of general kind
Matrices and Calculus	21MA101	21MA101.1	K3	Use the matrix algebra methods for solving engineering problems.
		21MA101.2	K3	Apply differential calculus tools in solving various application problems
		21MA101.3	K3	Make use of differential calculus ideas on several variable functions.
		21MA101.4	K3	Identify suitable methods of integration in solving practical problems
		21MA101.5	K3	Solve practical problems of areas, volumes using multiple integrals.
Engineering Physics	21PH101	21PH101.1	K2	Explain the importance of mechanics
		21PH101.2	K2	Extend their knowledge in electromagentic waves
		21PH101.3	K2	Illustrate a strong fundamental knowledge in oscillations, optics and lasers
		21PH101.4	K2	Interpret the important of quantum physics
		21PH101.5	K2	Summarize quantum mechanical principles towards the formation of energy bands
Engineering Chemistry	21CH101	21CH101.1	K1	Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
		21CH101.2	K2	Describe the basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
		21CH101.3	K1	Apply the knowledge of phase rule and composites for material selection requirements.
		21CH101.4	K2	Identify suitable fuels for engineering processes and applications.
		21CH101.5	K3	Demonstrate different forms of energy resources and apply them for suitable applications in energy sectors.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Problem Solving and Python Programming	21CS101	21CS101.1	K2	Make use of design approaches to solve computational problems
		21CS101.2	K2	Develop and execute basic Python programs using expressions and input/output statements
		21CS101.3	K2	Utilize strings, functions and control statements to develop real world problems
		21CS101.4	K2	Construct programs using Python data types like lists, tuples and dictionaries
		21CS101.5	K2	Prepare a Python application by incorporating files and exceptions
Problem Solving and Python Programming Laboratory	21CS102	21CS102.1	K2	Develop algorithmic solution to simple computational problems
		21CS102.2	K2	Illustrate ans execute basic python program using simple statements
		21CS102.3	K2	Build program for scientific oroblems using strings, function and control statement
		21CS102.4	K2	Utilze compound data types lists, tuples and dictionaries for real - time applications
		21CS102.5	K2	Experiments the python packages, files and exception for developing software applications.
Physics and Chemistry Laboratory	21PC101	21PC101.1	K2	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO
		21PC101.2	K2	To determine the amount of metal ions through volumetric and spectroscopic techniques
		21PC101.3	K2	To analyse and determine the composition of alloys
		21PC101.4	K2	To learn simple method of synthesis of nanoparticles
		21PC101.5	K2	To quantitatively analyse the impurities in solution by electro analytical techniques
English – II	21EN102	21EN102.1	K2	Critically read and interpret information in technical texts
		21EN102.2	K3	Construct convincing job applications, resume and effective reports
		21EN102.3	K3	Make use of the technical ideas effectively in spoken and written forms
		21EN102.4	K2	Infer spoken language in lectures and talks
		21EN102.5	K3	Utilize basic soft skills ideas in life
		21EN102.6	K2	Summarize the extensive reading contents
Vector Calculus and Complex Variables	21MA102	21MA102.1	K3	Apply the concept of vector calculus which naturally arises in many engineering Problems.
		21MA102.2	K3	Solve the Partial Differential Equations by using various techniques.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21MA102.3	K3	Construct an analytic function using the properties of analytic function
		21MA102.4	K3	Apply suitable formula to evaluate the given integral.
		21MA102.5	K3	Identify the suitable method to solve the given differential equation of first and second order.
Physics for Mechanical Engineering	21PH105	21PH105.1	K2	Explain the basics of crystallography and its importance for various material properties
		21PH105.2	K2	Infer the electrical and magnetic properties of and their applications
		21PH105.3	K2	Relate the semiconductor physics and functioning of semi conductor devices
		21PH105.4	K2	Summarize the optical properties of materials and working principles of various optical devices
		21PH105.5	K2	Translate the importance of functional nanoelectric devices
Engineering Graphics	21ME101	21ME101.1	K3	Construct the orthographic projections of points, straight lines and plane surfaces.
		21ME101.2	K3	Sketch the orthographic projections of simple solids
		21ME101.3	K3	Sketch the orthographic projections of sectional solids and lateral surfaces of the solids
		21ME101.4	K3	Construct the isometric projections and perspective projections of simple solids.
		21ME101.5	K3	Sketch the orthographic projection of objects using freehand.
Engineering Mechanics	21ME102	21ME102.1	K3	Solve problems on particles and rigid bodies using the concept of static equilibrium
		21ME102.2	K3	Interpret the effect of structure on acting forces
		21ME102.3	K3	Calculate the centre of gravity and moment of inertia of the given geometry
		21ME102.4	K3	Determine suitable method for solving problems on kinematics and kinetics of particles
		21ME102.5	K3	Predict the effect of friction in rigid bodies.
Environmental Science	21CH103	21CH103.1	K1	Explain the concept, structure and function of an ecosystem and biodiversity.
		21CH103.2	K2	Demonstrate the environmental impacts of natural resources.
		21CH103.3	K1	Illustrate the suitable management method for pollution control.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21CH103.4	K1	Relate the proper way of managing disaster with environmental ethics.
		21CH103.5	K1	Apply social issues and adopt suitable sustainable practices.
Basic Electrical and Electronics Engineering	21EE103	21EE103.1	K1	Recall the electric circuit parameters for simple problems
		21EE103.2	K2	Infer about magnetic circuits and safety precautions in electrical installation
		21EE103.3	K2	Outline the working principle and applications of electrical machines
		21EE103.4	K2	Explain the basic concepts of analog and digital electronics devices
		21EE103.5	K2	Demonstrate the types and operating principles of sensors and transducers
Engineering Practices Laboratory	21EM101	21EM101.1	K3	Model Various carpentry joints
		21EM101.2	K3	Demonstrate various plumbing joints and connect pipe fitting.
		21EM101.3	K3	Model various welding joints
		21EM101.4	K3	Model rectangular tray using sheet metal
		21EM101.5	K3	Demonstrate the turning, facing and step turning operations using Lathe machine.
Transforms and Partial Differential Equations	21MA201	21MA201.1	K3	Compute Laplace transform and inverse Laplace transform of different functions.
		21MA201.2	K3	Expand the Fourier series to represent the given function in the given interval.
		21MA201.3	K3	Classify the second order PDE and to know about solving initial and final value problems.
		21MA201.4	K3	Apply Fourier transform techniques to evaluate the given integral.
		21MA201.5	K3	Solve the given difference equations using Z-transforms.
Engineering Thermodynamics	21ME201	21ME201.1	K3	Demonstrate the first law of thermodynamics for systems and processes.
		21ME201.2	K3	Apply the second law of thermodynamics for systems and processes
		21ME201.3	K3	Assess the thermodynamics laws for pure substances
		21ME201.4	K3	Apply the thermodynamics relations for ideal and real gases.
		21ME201.5	K3	Demonstrate the Psychrometric processes in air-water vapor mixtures

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Strength of Materials for Mechanical Engineers	21ME202	21ME202.1	K3	Apply Hooke's law in structural members
		21ME202.2	K3	Construct the shear force and bending moment diagrams for various beams
		21ME202.3	K3	Interpret the design of shafts and springs
		21ME202.4	K3	Calculate the slope and deflection of beams
		21ME202.5	K3	Solve the stresses and deformations in cylindrical and spherical shells
Engineering Metallurgy	21ME203	21ME203.1	K2	Interpret material constituents from phase diagram
		21ME203.2	K2	Prepare the various heat treatment process
		21ME203.3	K2	Predict the effect of alloying elements on ferrous and non-ferrous metals
		21ME203.4	K2	Illustrate the properties and applications of non-metallic materials
		21ME203.5	K2	Predict the various mechanical properties of materials
Manufacturing Technology – I	21ME204	21ME204.1	K2	Explain sand casting processes, moulding materials, and casting defects.
		21ME204.2	K2	Describe lathe operations, machining methods, and power estimation techniques.
		21ME204.3	K2	Summarize fusion and resistance welding processes and weld defects.
		21ME204.4	K2	Explain metal forming processes like forging, rolling, and sheet metal operations.
		21ME204.5	K2	Describe plastic forming methods and powder metallurgy processes.
Electrical Drives and Controls	21EE216	21EE216.1	K2	Classify different types of electrical drives and understand their performance in various loading factors
		21EE216.2	K2	Summarize various characteristics of Drive motors and understand their working principle.
		21EE216.3	K2	Compare the usage of different types of Starters in DC and AC motors
		21EE216.4	K2	Construct suitable Conventional and Solid-state Electric drives for DC motors.
		21EE216.5	K2	Interpret Conventional and Solid-state Electric drives for AC motors
Interpersonal Skills Laboratory -	21EN201	21EN201.1	K2	Recognize pronunciation and meaning of the native language speakers

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Listening & Speaking		21EN201.2	K3	Organize ideas for presentation, Group Discussion and Interview skills
		21EN201.3	K3	Infer meaning from reading different genres of text
		21EN201.4	K3	Develop ideas for answering various interview questions
		21EN201.5	K3	Demonstrate effective communication and soft skills as an employable and confident individual
Probability, Statistics and Numerical Methods	21MA204	21MA204.1	K3	Grasp the basic concepts of Probability and Random variables
		21MA204.2	K3	Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and 2 test.
		21MA204.3	K3	Apply a suitable method to solve algebraic and transcendental equations.
		21MA204.4	K3	Explain the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
		21MA204.5	K3	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
Manufacturing Technology – II	21ME209	21ME209.1	K3	Manipulate gear cutting operation in milling machine.
		21ME209.2	K3	Manipulate gear cutting operation in shaping and gear hobbing machine.
		21ME209.3	K3	Manipulate various operation in grinding machine
		21ME209.4	K3	Evaluate various cutting forces in lathe and milling machine.
		21ME209.5	K3	Write CNC part programing for given geometry
Kinematics and Dynamics of Machines	21ME206	21ME206.1	K3	Relate the fundamental principles of kinematics and kinetics for simple mechanisms
		21ME206.2	K3	Sketch the velocity and acceleration diagram for simple mechanisms
		21ME206.3	K3	Sketch the profile of the cam mechanisms
		21ME206.4	K3	Assess the law of toothed gearing in various gear trains
		21ME206.5	K3	Calculate the balancing of rotating and reciprocating masses
Thermal Engineering	21ME207	21ME207.1	K3	Apply thermodynamic concepts to different air standard cycles and solve problems.
		21ME207.2	K3	Solve problems in single stage and multistage air compressors
		21ME207.3	K3	Calculate the functioning and features of IC engines, components and performance parameters of IC Engines

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21ME207.4	K3	Solve problems for steam nozzle and boilers.
		21ME207.5	K4	Solve problems using refrigerant table.
Fluid Mechanics and Machinery	21ME208	21ME208.1	K4	Apply mathematical knowledge to predict the properties and characteristics of a fluid
		21ME208.2	K4	Relate and correlate major and minor losses associated with pipe flow in piping network
		21ME208.3	K3	Solve the dimensional analysis
		21ME208.4	K4	Calculate the performance of pumps
		21ME208.5	K4	Illustrate the performance of turbines
Manufacturing Technology Laboratory – II	21ME209	21ME209.1	K3	Manipulate gear cutting operation in milling machine
		21ME209.2	K3	Manipulate gear cutting operation in shaping and gear hobbing machine
		21ME209.3	K3	Manipulate various operation in grinding machine.
		21ME209.4	K3	Evaluate various cutting forces in lathe and milling machine.
		21ME209.5	K3	Write CNC part programing for given geometry
Thermal Engineering Laboratory	21ME210	21ME210.1	K3	To illustrate value timing-V diagram and performance of IC Engines.
		21ME210.2	K3	To demonstrate characteristics of fuels/Lubricates used in IC Engines.
		21ME210.3	K3	To illustrate of steam generator/ turbine.
		21ME210.4	K3	To demonstrate Load test on a single cylinder -Diesel engine.
		21ME210.5	K3	To illustrate Load test on multi-cylinder petrol engine
Kinematics and Dynamics Laboratory	21ME211	21ME211.1	K3	Calculate mass moment of inertia
		21ME211.2	K3	Interpret the effect of gyroscope and governors
		21ME211.3	K3	Sketch the cam profile for various applications
		21ME211.4	K3	Demonstrate the vibrations effect for spring mass system
		21ME211.5	K3	Calculate the critical speed for shaft under different loading systems
Advanced Reading and Writing Laboratory	21EN202	21EN202.1	K3	Develop and understand the basic pronunciations of academic features
		21EN202.2	K3	Make use of stress in syllables and intonation patterns in day-to-day conversations
		21EN202.3	K3	Construct lexical chunking for enhancing English fluency with accuracy
		21EN202.4	K3	Take part in group discussion & offer verbal, non-verbal feedback

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21EN202.5	K3	Make effective presentations and negotiation disagreements in group work
Design of Machine Elements	21ME301	21ME301.1	K4	Explain the concepts of stress in design of machine elements subjected to steady and variable loading
		21ME301.2	K4	Use design procedure to validate strength of shafts and couplings
		21ME301.3	K4	Execute the design procedure for spring and connecting rod to validate the strength based upon the application and requirements
		21ME301.4	K4	Apply the design procedure for joints and suggest the suitable dimension for various mechanical applications
		21ME301.5	K4	Demonstrate the appropriate bearings based on standard procedure for specific applications
Productivity and Quality Management	21ME302	21ME302.1	K2	Discuss the need for Productivity and Quality
		21ME302.2	K2	Demonstrate the various productivity tools and techniques
		21ME302.3	K2	Apply the various TQM principles in meeting the customer expectations from a product/service
		21ME302.4	K2	Demonstrate various quality management tools, techniques and systems
		21ME302.5	K2	Discuss the need for Implement the Productivity and Quality Management Systems in a different organization environment
Fluid power automation	21ME303	21ME303.1	K3	Explain the Fluid power and operation of different types of pumps.
		21ME303.2	K3	Summarize the features and functions of Hydraulic motors, actuators and Flow control valves
		21ME303.3	K3	Explain the different types of Hydraulic circuits and systems
		21ME303.4	K3	Explain the working of different pneumatic circuits and systems
		21ME303.5	K3	Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.
Professional Electives I				
Design Concepts in Engineering	21PME01	21PME01.1	K3	Explain the principles of CAE/concurrent engineering/forecasting techniques for new product design and development
		21PME01.2	K3	Describe the appropriate design strategies complying with established standards in devising systems for customer needs

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21PME01.3	K3	Use the various design techniques through modelling/simulation and optimize design
		21PME01.4	K3	Apply the appropriate material selection strategy for various Design concepts.
		21PME01.5	K3	Demonstrate the various design and analysis tools for improving the quality and reliability of products performance
Non-Traditional Machining Processes	21PME08	21PME08.1	K2	Explain the mechanical energy based processes and its classification
		21PME08.2	K2	Identify the various thermal energy and electrical energy based processes
		21PME08.3	K2	Demonstrate the various chemical and electro-chemical energy based processes
		21PME08.4	K2	Choose various advanced nano finishing processes
		21PME08.5	K2	Identify the recent trends in non- machining processes
Constitution of India		21MCC01.1	K1	CO1: Understand the significance of the Constitution of India and its historical background.
		21MCC01.2	K2	CO2: Explain the fundamental rights, duties, and directive principles enshrined in the Constitution.
		21MCC01.3	K2	CO3: Analyze the role and functions of the Legislature, Executive, and Judiciary in India.
		21MCC01.4	K2	CO4: Evaluate the federal structure, center-state relations, and the importance of local governance.
		21MCC01.5	K2	CO5: Apply constitutional provisions to resolve contemporary legal and social issues
Heat and Mass Transfer	21ME304	21ME304.1	K4	Demonstrate the problems on conductive Heat transfer
		21ME304.2	K4	Apply the problems on convective Heat Transfer.
		21ME304.3	K4	Solve the problems on radioactive Heat Transfer
		21ME304.4	K4	Calculate the Heat Exchanger parameters.
		21ME304.5	K3	Calculate the problems on Mass Transfer
Metrology and Measurements	21ME305	21ME305.1	K2	Summarize the Metrological basis, concept of measurement errors, uncertainty in measurements
		21ME305.2	K2	Explain the linear and angular measuring instruments and their applications
		21ME305.3	K2	Apply measurement strategies and diagnose various methods of measuring Mechanical parameters
		21ME305.4	K2	Demonstrate effective methods of various form measurements
		21ME305.5	K2	Calculate power, flow and temperature using measuring instruments

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Computer Aided Product Development	21ME306	21ME306.1	K3	Demonstrate the concept of product development and its applications.
		21ME306.2	K3	Apply concept evaluation process.
		21ME306.3	K3	Demonstrate the suitable product architecture.
		21ME306.4	K2	Discuss the product planning process based on the customer need.
		21ME306.5	K2	Discuss product specification with cost, aesthetic and ergonomics aspects
Design of Transmission System	21ME307	21ME307.1	K3	Apply principles and procedure for the design of flexible Transmission elements
		21ME307.2	K3	Interpret the standard procedure for the design Spur and Helical Gears.
		21ME307.3	K3	Interpret the standard procedure for the design Bevel and Worm Gears.
		21ME307.4	K3	-Demonstrate procedure for designing a gear box.
		21ME307.5	K3	Illustrate the concepts for designing clutches and brakes.
Non Destructive Testing	21PME10	21PME10.1	K2	Illustrate the fundamental concepts of NDT
		21PME10.2	K2	Demonstrate the different methods of surface NDE
		21PME10.3	K2	Use the concept of Thermography and Eddy current testing
		21PME10.4	K2	Demonstrate the concept of Ultrasonic Testing and Acoustic Emission
		21PME10.5	K2	Illustrate the concept of Radiography
Open Elective – I				
Data Science Fundamentals	21OAD03	21OAD03.1	K2	Explain the concept of data science and role of data analytics.
		21OAD03.2	K2	Understand the overview of life cycle of data analytics.
		21OAD03.3	K3	Apply data analytics on data and use different analytics method related to data.
		21OAD03.4	K3	Create informative visualization and summarize data sets.
		21OAD03.5	K4	Analyze applications using data analysis.
Finite Element Analysis	21ME308	21ME308.1	K3	Illustrate the engineering problems using the concept of engineering model
		21ME308.2	K3	Solve the one dimensional structural and thermal elements.
		21ME308.3	K3	Solve the two dimensional scalar variable equations structural and thermal elements.
		21ME308.4	K3	Solve planar stresses using two dimensional vector variable equations.
		21ME308.5	K3	Demonstrate isoparametric element, shape function and Gaussian quadrature.
Mechatronics and IoT		21ME309.1	K3	Select various Sensors and Transducers in Mechatronics systems

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21ME309.2	K3	Demonstrate 8085 Microprocessors and 8051 Micro controller
		21ME309.3	K3	Operate the fundamentals of IOT and Programmable Peripheral Interface
		21ME309.4	K3	Interpret programmable logic controller
		21ME309.5	K3	Demonstrate various actuators and appraise mechatronics systems
Design Thinking and Prototype Development	21ME310	21ME310.1	K3	Apply the fundamental concepts of design the product.
		21ME310.2	K3	Demonstrate the various parts of the product.
		21ME310.3	K4	Relate various operation and material selected for the product.
		21ME310.4	K4	Interpret the cost analysis of the product.
		21ME310.5	K3	Show the applications of the complete working model.
Professional Communication Laboratory	21EN301	21EN301.1	K3	Demonstrate effective communication skills through presentations.
		21EN301.2	K3	Utilize their knowledge of motivation in setting and achieving goals.
		21EN301.3	K3	Examine time and stress management.
		21EN301.4	K3	Formulate their ideas into an effective communication in formal context
		21EN301.5	K3	Develop a well-composed resume and face interviews confidently.
Power Plant Engineering	21PME33	21PME33.1	K2	Examine the function and the parts of the coal based Thermal Power plant
		21PME33.2	K2	Demonstrate the power plants based on gas power cycles
		21PME33.3	K2	Examine the Nuclear Reactors in Nuclear power plant.
		21PME33.4	K2	Illustrate power from Renewable energy sources.
		21PME33.5	K2	Report the energy, economic and Environmental issues of power plant.
Total Quality Management	21PME35	21PME35.1	K2	Explain the quality management philosophies and Framework.
		21PME35.2	K2	Demonstrate the need of customer expectations, employee involvement and Supplier Partnership.
		21PME35.3	K3	Illustrate TQM tools and Techniques to improve the product and process Quality
		21PME35.4	K3	Use the modern tools to improve quality of the product.
		21PME35.5	K2	Explain the Management Standards and certification process
Green Building	21PCE07	21PCE07.1	K3	Develop knowledge on environmental implications of buildings
		21PCE07.2	K3	Apply the implications of building technologies in embodied energy of buildings
		21PCE07.3	K3	Make use of knowledge on comforts in building

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21PCE07.4	K3	Discover utility of solar energy in buildings
		21PCE07.5	K3	Interpret the concept of green composites for buildings
Renewable Energy Engineering	21PME14	21PME14.1	K2	Identify the importance of renewable Energy Sources
		21PME14.2	K2	Describe the solar energy and its application
		21PME14.3	K2	Describe the wind energy and its application
		21PME14.4	K2	Classify the Bio energy and its production methods
		21PME14.5	K2	Report the availability of new energy sources like OTEC, Tidal, Geo thermal and Hydel Energy
Project Work – I	21ME401	21ME401.1	K3	Identify an engineering problem using scientific tools
		21ME401.2	K3	Analyse physical systems to address an engineering problem
		21ME401.3	K3	Formulate objectives and timelines for executing a project
		21ME401.4	K3	Apply multidisciplinary knowledge to develop sustainable solutions
		21ME401.5	K3	Report solutions and their outcomes through documentation
Automobile Engineering	21PME29	21PME29	K2	Explain the construction and working principle of various parts of an automobile.
		21PME29	K2	Discuss the engine auxiliary system.
		21PME29	K2	Demonstrate the transmission systems in vehicle.
		21PME29	K2	Discuss the steering, brakes and suspension systems.
		21PME29	K3	Demonstrate assembling and dismantling of engine parts and transmission system.
Entrepreneurship Development		21PME40.1		CO1: Explain the entrepreneurial skills and factors
		21PME40.2		CO2: Illustrate the need of motivation for Entrepreneur
		21PME40.3		CO3: Describe the requirement to run the business efficiently and effectively
		21PME40.4		CO4: Estimate the sources of Finance and Loan
		21PME40.5		CO5: Express to support the entrepreneurs policy
Project Work II	21ME402	21ME402.1	K1	CO1:Identify an engineering problem using scientific tools
		21ME402.2	K3	CO2:Analyse physical systems to address an engineering problem
		21ME402.3	K3	CO3:Formulate objectives and timelines for executing a project
		21ME402.4	K3	CO4:Apply multidisciplinary knowledge to develop sustainable solutions
		21ME402.5	K1	CO5:Report solutions and their outcomes through documentation
Product Life Cycle Management	21PME02	21PME02.1	K2	Complete the history, concepts and terminology of PLM
		21PME02.2	K2	Illustrate the functions and features of PLM/PDM
		21PME02.3	K3	Discover the different modules offered in commercial PLM/PDM tools.
		21PME02.4	K3	Demonstrate the PLM/PDM approaches for industrial applications.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21PME02.5	K3	Apply the integration of PLM/PDM with legacy data base & ERP systems.
Computer Integrated Manufacturing	21PME03	21PME03.1	K2	Describe the basis of Computer Integrated Manufacturing
		21PME03.2	K2	Apply the fundamentals of process and production planning
		21PME03.3	K2	Explain cellular manufacturing and group technology concepts
		21PME03.4	K2	Explain the concepts of FMS and AGV Systems
		21PME03.5	K2	Describe the working of Industrial Robotics in manufacturing systems
Additive Manufacturing	21PME04	21PME04.1	K2	Demonstrate additive manufacturing and its role in product development
		21PME04.2	K2	Apply the CAE processes in additive manufacturing
		21PME04.3	K2	Apply the various liquid and solid-based additive manufacturing techniques
		21PME04.4	K2	Illustrate the different powder-based additive manufacturing techniques
		21PME04.5	K2	Summarize other additive manufacturing techniques
Composite Materials in Product Development	21PME05	21PME05.1	K2	Develop understanding of composite materials and its types
		21PME05.2	K2	Comprehend knowledge on matrix, reinforcement and its interactions
		21PME05.3	K2	Understand fundamentals and processing of polymer matrix composites
		21PME05.4	K2	Understand fundamentals and processing of metal matrix composites
		21PME05.5	K2	Identify the significance of composite materials in product development
Design for Manufacturing and Assembly	21PME07	21PME07.1		Explain the appropriate design for economical production.
		21PME07.2		Demonstrate the factors influencing form design.
		21PME07.3		Interpret various machining operation for economical production and assembly.
		21PME07.4		Use the casting concepts to design component for DFMA.
		21PME07.5		Use the compliance analysis for design of assembly and environment.
Casting and Welding Processes	21PME09	21PME09.1	K2	Apply casting process with knowledge of foundry and moulding machines.
		21PME09.2	K2	Illustrate the various casting furnaces and different mould casting methods.
		21PME09.3	K2	Describe the Solidification process and Casting of Non-Ferrous Metals.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

		21PME09.4	K2	Explain the different welding processes used in manufacturing
		21PME09.5	K2	Illustrate the metallurgical aspects in welding, soldering and brazing process
Non Destructive Testing	21PME10	21PME10.1	K2	Illustrate the fundamental concepts of NDT
		21PME10.2	K2	Demonstrate the different methods of surface NDE
		21PME10.3	K2	Use the concept of Thermography and Eddy current testing
		21PME10.4	K2	Demonstrate the concept of Ultrasonic Testing and Acoustic Emission
		21PME10.5	K2	Illustrate the concept of Radiography
Surface Engineering	21PME11	21PME11.1	K2	Illustrate the fundamental surface engineering techniques
		21PME11.2	K2	Demonstrate the conventional surface engineered structures.
		21PME11.3	K2	Relate the advanced practices in surface engineering.
		21PME11.4	K2	Experiment with characterization of coatings and surfaces
		21PME11.5	K2	Demonstrate the functional coatings and applications.
Green Supply Chain Management	21PME13	21PME13 .1	K2	Apply the fundamental concepts of Green Supply Chain.
		21PME13 .2	K2	Demonstrate the Eco design
		21PME13 .3	K2	Relate Green Procurement and Purchasing
		21PME13 .4	K2	Interpret Closed-loop Supply Chain.
		21PME13 .5	K2	Show the applications of Green Logistics and Transportation
Modern Material Characterization Techniques	21OPH01	21OPH01.1	K2	Comprehend the X-ray diffraction to identify the phase present in the analyzed crystal system
		21OPH01.2	K2	Understand the importance of thermal analysis.
		21OPH01.3	K2	Express the knowledge in scanning electron microscope and transmission electron microscope
		21OPH01.4	K2	Demonstrate a strong foundational knowledge in spectroscopy.
		21OPH01.5	K2	Understand the importance of electrical characterization
Bioenergy Conversion Technologies	21PME15	21PME15.1	K2	Illustrate the properties of biomass and energy conversion process
		21PME15.2	K2	Explain the characteristics of products obtained from biomass pyrolysis
		21PME15.3	K2	Relate the basics of biomass gasification with gasifier design
		21PME15.4	K2	Assess the potential of electrical power production from biomass
		21PME15.5	K2	Interpret the separation of gases.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Energy Storage Devices		21PME16.1	K2	Describe the basic principles to study about energy storage systems.
		21PME16.2	K2	Discuss the performance parameters of various thermal energy storage systems.
		21PME16.3	K2	Explain the various electro chemical energy conversion systems and its drawbacks.
		21PME16.4	K2	Summarize the various fuel cell and its types.
		21PME16.5	K2	Discuss the concept of energy storage systems for commercial applications.
Solar Energy Technologies	21PME17	21PME17.1	K2	Illustrate solar radiation and its measurement
		21PME17.2	K2	Identify various solar thermal energy technologies and their applications
		21PME17.3	K2	Compare various solar PV cell materials and interpret factors influencing of conversion efficiency
		21PME17.4	K2	Infer various SPV systems designs and their applications
		21PME17.5	K2	Evaluate various solar passive building techniques for cooling and heating applications
Energy Conservation in Industries	21PME18	21PME18.1	K2	CO1: Explain the stoichiometric air for fuel and suggest measures for efficient combustion
		21PME18.2	K2	CO2: Describe the cause for underperformance of thermal utilities and suggest suitable remedial measures
		21PME18.3	K2	CO3: Summarize the factors affecting the COP of a VCR and VAR system
		21PME18.4	K2	CO4: Describe the performance of induction motors and transformers
		21PME18.5	K2	CO5: Exaplin energy conservation avenues of thermal and electrical utilities
Equipment for Pollution Control	21PME19	21PME19.1	K2	CO1: Summarize knowledge and understanding of causes and effects of air pollution and their controlling mechanisms.
		21PME19.2	K2	CO2: Explain knowledge on the principle and design of control of Indoor.
		21PME19.3	K2	CO3:Demonstrate a design of control of Particulate Contaminants
		21PME19.4	K2	CO4:Discuss a model for controlling Gaseous Contaminants
		21PME19.5	K2	CO5:Explain the knowledge in air pollutant and its emerging trends

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Environment Sustainability and Impact Assessment	21PME20	21PME20.1	K2	CO1: Describe the impacts and risks that will be caused by projects or industries and the methods to overcome these impacts.
		21PME20.2	K2	CO2: Explain the cost benefit analysis of environmental impact assessment
		21PME20.3	K2	CO3: Discuss the concept of environmental impact assessment documentation for proper findings.
		21PME20.4	K2	CO4: Summarize the environment management plan.
		21PME20.5	K2	CO5: Explain the methods of risk assessment and management
Logistics in Manufacturing, Supply Chain and Distribution		21PME21.1	K2	CO1: Demonstrate the various functions of logistics
		21PME21.2	K2	CO2: Explain the various types of logistics strategies
		21PME21.3	K2	CO3: Apply the operations in supply chain to increase the productivity
		21PME21.4	K2	CO4: Explain the importance of distribution in supply chain.
		21PME21.5	K2	CO5: Show the applications of planning in Distribution
Materials Management		21PME22.1	K2	CO1: Apply the various the Functions of Purchase Department
		21PME22.2	K2	CO2: Relate various meaning of ABC Analysis.
		21PME22.3	K2	CO3: Relate the characteristics of coding System and its benefits.
		21PME22.4	K2	CO4: Interpret the functions and responsibilities of Purchase Department.
		21PME22.5	K2	CO5: Explain the objectives of Negotiation and its factors.
Enterprise Resource Planning		21PME40.1	K2	CO1: Explain the entrepreneurial skills and factors
		21PME40.2	K2	CO2: Illustrate the need of motivation for Entrepreneur
		21PME40.3	K2	CO3: Describe the requirement to run the business efficiently and effectively
		21PME40.4	K2	CO4: Estimate the sources of Finance and Loan
		21PME40.5	K2	CO5: Express to support the entrepreneurs policy
Warehousing Automation and Container Logistics		21PME24.1	K2	CO1: Apply the various functions of Warehouse.
		21PME24.2	K2	CO2: Relate various types of warehouses and their advantages
		21PME24.3	K2	CO3: Relate the metrics of warehouse operations.
		21PME24.4	K2	CO4: Apply the various functions in containers.
		21PME24.5	K2	CO5: Show the various applications procedures in containers.
		21PME25.1	K2	CO1: Illustrate the material handling system for the application

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Material Handling Equipment, Repair and Maintenance		21PME25.2	K2	CO2: Choose the various material handling equipment and systems
		21PME25.3	K2	CO3: Construct suitable mechanical handling system for the requirement
		21PME25.4	K2	CO4: Discover the repair methods for material handling devices
		21PME25.5	K2	CO5: Prepare maintenance management system for industrial case studies
Process Planning and Cost Estimation		21PME26.1	K2	CO1: Explain the process planning concepts and appropriate selection of equipment and tools for various industrial products.
		21PME26.2	K2	CO2: Interpret the process planning activity chart.
		21PME26.3	K2	CO3: calculate the various types of cost in the development of product.
		21PME26.4	K2	CO4: Manipulate the costs of forging, welding and casting process to make or buy the product.
		21PME26.5	K2	CO5: Calculate the machining time for various machining operations.
Production Planning and Control		21PME27.1	K2	CO1: Explain the various components and function of production planning and control.
		21PME27.2	K2	CO2: Apply the principles of work study and time study activities.
		21PME27.3	K2	CO3: Use the principles of product planning and process planning.
		21PME27.4	K2	CO4: Prepare various production scheduling and dispatching techniques.
		21PME27.5	K2	CO5: Describe the recent trends like Manufacturing Requirement Planning (MRP-II) & Enterprise Resource Planning (ERP).
Thermal Power Engineering	21PME28	21PME28.1	K3	CO1: Solve the concepts of thermodynamics law
		21PME28.2	K3	CO2: Interpret the air standard cycles.
		21PME28.3	K3	CO3: Analyze the function of thermal power plant
		21PME28.4	K3	CO4: Analyze the process of waste heat recovery systems
		21PME28.5	K3	CO5: Calculate the various types of Cogeneration
Advanced Internal Combustion Engines	21PME30	21PME30.1	K2	CO1: Demonstrate various functions of SI engines.
		21PME30.2	K2	CO2: Illustrate various functions of CI engines.
		21PME30.3	K2	CO3: Illustrate the pollution formations and their control
		21PME30.4	K2	CO4: Explain various alternate fuels and their properties
		21PME30.5	K2	CO5: Demonstrate various recent development in IC engines.

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Refrigeration and Air Conditioning	21PME31	21PME31.1	K3	CO1: Illustrate the different properties of the refrigerants
		21PME31.2	K3	CO2: Demonstrate the concepts of vapor compression refrigeration system.
		21PME31.3	K3	CO3: Demonstrate the concepts of various refrigeration systems.
		21PME31.4	K3	CO4: Manipulate the psychrometric properties and processes.
		21PME31.5	K3	CO5: Demonstrate the load estimation of air conditioning system
Gas Turbines and Jet Propulsion	21PME32	21PME32.1	K3	CO1: Interpret the concept of compressible flows in variable area ducts.
		21PME32.2	K3	CO2: Apply the concept of compressible flows in constant area ducts.
		21PME32.3	K3	CO3: Examine the effect of compression and expansion waves in compressible flow.
		21PME32.4	K3	CO4: Use the concept of gas dynamics in Jet Propulsion.
		21PME32.5	K3	CO5: Apply the concept of gas dynamics in Space Propulsion
Materials Chemistry	21PME33	21PME33.1	K2	CO 1: Understand the working principle of adhesives and lubricants.
		21PME33.2	K2	CO 2: Identify the characteristics of explosives and propellants.
		21PME33.3	K2	CO 3: Apprehend the applications glasses and abrasives.
		21PME33.4	K2	CO 4: Interpret the characteristics of smart materials and relevant applications.
		21PME33.5	K2	CO 5: Relate the importance of sensor materials.
Principles of Management	21PME34	21PME34.1	K2	Apply the foundational knowledge in management.
		21PME34.2	K2	Relate the various planning
		21PME34.3	K2	Illustrate various functions of organization.
		21PME34.4	K2	Interpret the functions of motivation.
		21PME34.5	K2	Demonstrate the practices in budget and reporting.
Lean Manufacturing		21PME36.1	K2	Apply various Lean Manufacturing tools to eliminate wastes.
		21PME36.2	K2	Apply various lean manufacturing tools for productivity improvements.
		21PME36.3	K2	Demonstrate the concepts to reduce the process time
		21PME36.4	K2	Apply the process of Six Sigma in industries.
		21PME36.5	K2	Use the suitable Lean Tools for the identified cases and justify

Velammal College of Engineering and Technology, Madurai – 625 009.
(Autonomous)
Department of Mechanical Engineering
List of CO for R2021

Industrial safety	21PME37	21PME37.1	K2	Interpret operational safety in industrial process
		21PME37.2	K2	Calculate safety risk by executing safety appraisal using HAZOP
		21PME37.3	K2	Discover the occupational health hazards presents in the workplace
		21PME37.4	K2	Relate the safety and health regulations in workplace
		21PME37.5	K2	Choose safety system to run an industry with utmost safety precautions
Industry 4.0		21PME38.1	K2	Show the basics of Industrial Revolution
		21PME38.2	K2	Interpret the basic concepts of Industry 4.0
		21PME38.3	K2	Relate the Concepts of Industrial IOT in various sectors
		21PME38.4	K2	Demonstrate the applications of Industrial IOT
		21PME38.5	K2	Solve the Business issues in Industry 4.0
Professional Ethics		21PME39.1	K2	Apply the foundational knowledge in Human Values.
		21PME39.2	K2	Relate the various Engineering Ethics.
		21PME39.3	K2	Illustrate various Engineering as Social Experimentation.
		21PME39.4	K2	Interpret the functions of Safety, Responsibilities and Rights.
		21PME39.5	K2	Apply the knowledge of human values and social values to contemporary ethical values and global issues.
Operations Research		21PME41.1	K2	Construct the LPP and solve by Graphical method
		21PME41.2	K2	Solve the Transportation and Network models
		21PME41.3	K2	Solve the Assignment and Inventory models
		21PME41.4	K2	Construct the project network using CPM and PERT
		21PME41.5	K2	Solve by using Game theory and Queuing models

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI-625 009
(Autonomous)
REGULATIONS-2021
B.E COMPUTER SCIENCE AND ENGINEERING
List of Course Outcomes

COURSE CODE/COURSE NAME	**COURSE OUTCOME**
21EN101/ PROFESSIONAL ENGLISH-1	CO1: Listen and comprehend complex academic texts CO2: Read and infer the denotative and connotative meanings of technical texts CO3: Write definitions, descriptions, narrations and essays on various topics CO4: Speak fluently and accurately in formal and informal communicative contexts CO5: Express their opinions effectively in both oral and written medium of communication
21MA101/MATRICES AND CALCULUS	CO1: Use the matrix algebra methods for solving engineering problems. CO2: Apply differential calculus tools in solving various application problems. CO3: Make use of differential calculus ideas on several variable functions. CO4: Identify suitable methods of integration in solving practical problems. CO5: Solve practical problems of areas, volumes using multiple integrals.
21PH101/ENGINEERING PHYSICS	CO1: Explain the importance of mechanics. CO2: Extend their knowledge in electromagnetic waves. CO3: Illustrate a strong foundational knowledge in oscillations, optics and lasers. CO4: Interpret the importance of quantum physics. CO5: Summarize quantum mechanical principles towards the formation of energy bands.
21CH101/ENGINEERING CHEMISTRY	CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water. CO2: Describe the basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications. CO3: Apply the knowledge of phase rule and composites for material selection requirements. CO4: Identify suitable fuels for engineering processes and applications. CO5: Demonstrate different forms of energy resources and apply them for suitable applications in energy sectors
21CS101/PROBLEM SOLVING AND PYTHON PROGRAMMING	CO1: Make use of design approaches to solve computational problems. CO2: Develop and execute basic Python programs using expressions and input/output statements. CO3: Utilize strings, functions and control statements to develop real world problems.

	CO4: Construct programs using Python data types like lists, tuples and dictionaries. CO5:Prepare a Python application by incorporating files and exceptions
21CS102/PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	CO1:Develop algorithmic solutions to simple computational Problems CO2: Illustrate and execute basic Python programs using simple statements. CO3: Build program for scientific problems using strings, functions and control statements. CO4: Utilize compound data types lists, tuples and dictionaries for real-time applications. CO5: Experiment the python packages, files and exceptions for developing software applications
21PC101/PHYSICS AND CHEMISTRY LABORATORY	PHYSICS: CO1:.Explain the functioning of various physics laboratory equipment CO2: Relate the graphical models to analyze laboratory data CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality. CO4: Explain Access, process and analyze scientific information. CO5: Translate students to solve problems individually and collaboratively CHEMISTRY: CO1: Extent the skills to choose and handle appropriate glass wares. CO2: Interpret the water quality parameters using volumetric method. CO3: Estimate the conductivity, pH & emf by electro chemical methods. CO4: Infer the collected data for appropriate chemical analysis. CO5: Demonstrate systematic approach to obtain accurate results
21EN102/ENGLISH-II	CO1: Critically read and interpret information in technical texts CO2: Write convincing job applications, resume and effective reports CO3: Present the technical ideas effectively in spoken and written forms CO4: Understand spoken language in lectures and talks CO5: Demonstrate basic soft skills in life
21MA103/SAMPLING TECHNIQUES AND NUMERICAL METHODS	CO1: Apply the concepts of Probability in Engineering problems. CO2:Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and □2 test. CO3: Apply the basic concepts of classifications of design of experiments. CO4: Solve the system of equations and the eigen value problems using iterative procedure. CO5:Interpret the value of an unknown function at any interpolated point of the given tabulated values.
21PH103/PHYSICS FOR INFORMATION SCIENCE	CO1: Demonstrate the classical and quantum electron theories, and energy band structures.

	CO2: Infer knowledge on basics of semiconductor physics and its applications in various devices. CO3: Summarize magnetic properties of materials and their applications in data storage. CO4: Extend the functioning of optical materials for optoelectronics CO5: Translate the basics of quantum structures towards quantum computing.
21ME101/ENGINEERING GRAPHICS	CO1: Construct the orthographic projections of points, straight lines and plane surfaces. CO2: Sketch the orthographic projections of simple solids CO3: Sketch the orthographic projections of sectional solids and lateral surfaces of the solids. CO4: Construct the isometric projections and perspective projections of simple solids. CO5: Sketch the orthographic projection of objects using freehand.
21EE104/BASIC ELECTRICAL AND ELECTRONICS ENGINEERING FOR INFORMATION SCIENCE	CO1: Interpret the electric circuit parameters of simple DC Circuits. CO2: Explain the working principle and applications of DC machines. CO3: Demonstrate the working principle of AC machines. CO4: Describe the characteristics of analog electronic devices. CO5: Summarize the basic concepts of operational amplifiers.
21CS103/PROGRAMMING IN C	CO1: Develop simple applications using basic C components. CO2: Solve applications adopting array and string concepts. CO3: Construct and implement applications in C using functions and pointers. CO4: Prepare applications in C by employing structure and union concepts. CO5: Build applications using sequential and random access file processing.
21CH103/ENVIRONMENTAL SCIENCE	CO1: Explain the concept, structure and function of an ecosystem and biodiversity. CO2: Demonstrate the environmental impacts of natural resources. CO3: Illustrate the suitable management method for pollution control. CO4: Relate the proper way of managing disaster with environmental ethics. CO5: Apply social issues and adopt suitable sustainable practices.
21EM101/ENGINEERING PRACTICES LABORATORY	CO1: Build various plumbing joints CO2: Develop various carpentry joints. CO3: Construct various wiring electrical joints in common household electrical wire work. CO4: Construct various welded joints, sheet metal and basic machining operations CO5: Develop the electronic circuit for soldering and testing using PCB board.
21CS104/PROGRAMMING IN C LABORATORY	CO1: Develop simple applications using basic C components. CO2: Solve applications adopting array and string concepts. CO3: Construct and implement applications in C using functions and pointers. CO4: Prepare applications in C by employing structure and union concepts.

	CO5: Build applications using sequential and random access file processing.
21MA203/DISCRETE MATHEMATICS	CO1: Extend student's logical and mathematical maturity and ability to deal with abstraction. CO2: Explain the basic concepts of combinatorics. CO3: Make use of the concept of graph theory in computer science and engineering. CO4: Manipulate the applications of algebraic structures. CO5: Demonstrate the basic theorems and properties of Lattices and Boolean Algebra.
21EC201/DIGITAL PRINCIPLES AND SYSTEM DESIGN	CO1: Make use of minimization techniques to simplify Boolean algebraic equations. CO2: Build various combinational circuits using logic gates. CO3: Develop synchronous sequential circuits using flip flops. CO4: Build asynchronous sequential circuits using flip flops. CO5: Explain various semiconductor memories and programmable logic devices.
21CS201/COMPUTER ORGANIZATION AND ARCHITECTURE	CO1: Illustrate the basics structure of computers, operations and instructions. CO2: Build arithmetic and logic unit to perform the arithmetic operations. CO3: Utilize the data path to develop control unit. CO4: Identify multithreading techniques to achieve parallelism. CO5: Experiment with the performance of various memory and I/O technologies.
21CS202/DATA STRUCTURES	CO1: Build abstract data types for linear data structures. CO2: Make use of the different linear data structures for problem solving. CO3: Select nonlinear tree data structures to resolve computing problems. CO4: Utilize advanced nonlinear data structure and hashing for solving problems. CO5: Infer data using graph structure and apply their algorithms for problem solving.
21CS203/OBJECT ORIENTED PROGRAMMING	CO1: Develop programs using basic java concepts. CO2: Prepare java applications employing exception handling and strings CO3: Construct java applications adopting thread and I/O concepts. CO4: Solve java programming problems by incorporating Generics and collections. CO5: Build GUI for java applications with database connectivity.
21EC212/DIGITAL SYSTEMS LABORATORY	CO1: Outline the basic working principles of logic gates. CO2: Build simplified combinational circuits using basic logic gates. CO3: Model combinational circuits using MSI devices. CO4: Develop sequential circuits like registers and counters. CO5: Solve combinational and sequential circuits using HDL.
21CS204/DATA STRUCTURES LABORATORY	CO1: Develop functions for implementing linear data structures. CO2: Make use of the different linear data structures for computational problem solving. CO3: Build functions for implementing nonlinear tree data structures.

	CO4: Choose appropriate hashing functions for collision free data storage and retrieval. CO5: Utilize graph structure for manipulating data and problem solving.
21CS205/OBJECT ORIENTED PROGRAMMING LABORATORY	CO1: Develop programs using basic java concepts. CO2: Prepare java applications employing exception handling and strings CO3: Construct java applications adopting thread and I/O concepts. CO4: Solve java programming problems by incorporating Generics and collections. CO5: Build GUI for java applications with database connectivity.
21MA205/STOCHASTIC PROCESS AND ITS APPLICATIONS	CO1: Apply the basic concepts of Random variables and standard discrete and continuous distributions. CO2: Calculate the correlation and regression of two dimensional random variables. CO3 :Construct the functions of time when the probability measure is associated through random Process. CO4: Develop the knowledge of various queueing models. CO5: Solve the given network (open) problem using the suitable techniques.
21CS206/DATA BASE MANAGEMENT SYSTEM	CO1: Build and manipulate relational database using Structured Query Language and relational languages CO2: Prepare database using ER-Diagram for real time Applications. CO3:Make use of Normalization techniques to reduce cost due to redundancy constraints CO4:Illustrate different types of scheduling and recovery techniques for concurrent transactions CO5:Construct data structures like indexes and hash tables for the fast retrieval of data and Validate the query evaluation plan
21CS207/DESIGN AND ANALYSIS OF ALGORITHM	CO1:Examine mathematically the notion of algorithm, asymptotic notations, and algorithmic efficiency with properties. CO2: Discover the efficiency of algorithms of time and space complexity using brute force and divide and conquer strategies. CO3: Inspect the time and space complexity of the algorithms designed using Dynamic Programming and Greedy techniques. CO4: Identify various iterative improvement techniques for problem solving CO5: Construct the best solution for the given problem using backtracking and Branch & Bound technique.
21CS208/OPERATING SYSTEMS	CO1: Examine the elements with various data structures used in development of language processors. CO2: Make use of process scheduling, deadlocks and synchronization concepts to develop solutions for Multi-programmed environment. CO3: Compare and contrast various memory management schemes. CO4: Discover the functionality of file systems and disk. CO5: Distinguish various schemes for I/O Management and File Systems.
21CS209/INTERNET PROGRAMMING	CO1: Construct Web pages using HTML/XML and style sheets. CO2: Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

	CO3: Prepare dynamic web pages using server side scripting. CO4: Make use of PHP programming to develop web applications. CO5: Develop web applications using AJAX and web services.
21CS210/DATABASE MANAGEMENT SYSTEMS LABORATORY	CO1: Use data definition language commands and declare and enforce integrity constraints on a database. CO2: Populate and query a database using simple SQL queries and complex SQL queries. CO3: Make use of database objects such as views, sequences and synonyms using SQL. CO4: Prepare database Triggers, stored procedures, stored functions and cursors using PL/SQL. CO5: Construct Mongo DB for database creation.
21CS211/OPERATING SYSTEMS LABORATORY	CO1: Develop the programs on Assembler, Macro Processor, Loader and Linker CO2:Make use of Scheduling Algorithms such as FCFS, SJF , Priority and Round Robin to schedule a given set of processes. CO3: Utilize Banker's Algorithm for Deadlock avoidance. CO4: Infer Solutions to Critical Section Problem using Semaphores. CO5: Compare the performance of the various Memory management techniques.
21CS212/INTERNET PROGRAMMING LABORATORY	CO1: Construct Web pages using HTML/XML and style sheets. CO2: Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms. CO3: Prepare dynamic web pages using server side scripting. CO4: Make use of PHP programming to develop web applications. CO5: Develop web applications using AJAX and web services.
21CS301/THEORY OF COMPUTATION	CO1: Construct finite automata to recognize the patterns for the real world problems. CO2:Make use of algebraic laws and properties to write a regular language CO3:Simplify the context free grammar by applying normal forms CO4: Construct Pushdown automata and linear bound automata for the given Language. CO5: Examine the suitable programming techniques for the construction of Turing Machine.
21MCCS01/CONSTITUTION OF INDIA	CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India. CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status. CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India. CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions. CO5: Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality.
21CS302/COMPUTER NETWORKS	CO1: Make use of evaluation metrics to measure the performance of packet switched network.

	CO2: Utilize the Link layer services for various IEEE standards. CO3: Experiment with subnetting to optimize network configuration and various routing algorithms for unicast routing. CO4: Choose protocols for Process to Process communication in various application. CO5: Utilize application layer protocols for real time Scenario.
21CS303/ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	CO1: Choose appropriate search algorithms for AI based problems. CO2: Make use of reasoning under uncertainty in Bayesian networks. CO3:Utilize first order and predicate logic to solve AI based problems CO4: Identify and apply Supervised Machine Learning algorithms to solve real world problems. CO5: Build classifier models using Machine Learning algorithms for unstructured data.
21CS304/OBJECT ORIENTED SOFTWARE ENGINEERING	CO1: Illustrate the fundamental concepts of software engineering to build software projects CO2. Develop SRS document for a real-time application CO3. Identify various Modeling with UML diagrams based on software requirements to construct UML Diagrams CO4. Examine key techniques involved in testing the software based on requirements CO5.Examine various software development process and requirement management techniques
21CS305/COMPILER DESIGN	CO1: Construct the Deterministic Finite Automata and simulate using LEX Tool CO2: Build a suitable parser for the Context free Grammar to validate the given inputs and simulate using YACC tool CO3:Construct the semantics rules for the given context free grammar and generate the intermediate code for programming construct CO4:Apply various types of local and global optimization techniques for the given Programming construct CO5:Develop a target program for the given programming language construct
21CS306/DATA SCIENCE	CO1: Illustrate the data science process and data exploration. CO2: Experiment with probability, statistics and linear algebra in data science applications. CO3: Utilize R programming packages for real time data analysis. CO4: Make use of data wrangling for different real world datasets. CO5: Examine real-time data analysis using visualization techniques.
21MCCS02/ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge. CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge. CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being. CO4: Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.

	CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry.
21EN301/PROFESSIONAL COMMUNICATION LABORATORY	CO1: Demonstrate effective communication skills through presentations. CO2: Utilize their knowledge of motivation in setting and achieving goals. CO3: Examine time and stress management. CO4: Formulate their ideas into an effective communication in formal contexts. CO5: Develop a well-composed resume and face interviews confidently.
21CS401/DISTRIBUTED SYSTEMS	CO1: Illustrate the models of communication in building a distributed environment CO2: Interpret the order of message in communication network for synchronous and asynchronous system CO3: Use the Mutex and Deadlock detection algorithm in real time application CO4: Discover the issues of check pointing and rollback recovery mechanisms in distributed environment CO5: Relate the features of peer-to-peer and memory consistency models for a given application.
21PCS01/DATA SCIENCE AND BIG DATA ANALYTICS	CO1: Utilize probability, statistics and linear algebra for data science process and data exploration. CO2: Make use of PYTHON for statistical data analytics on real world data applications. CO3: Utilize Hadoop and Map Reduce technologies for huge data storage and management. CO4: Experiment the NoSQL database using MongoDB. CO5: Examine the variants of data analytic techniques to analyze the data of various domains.
21PCS02/EXPLORATORY DATA ANALYSIS	CO1: Make use of modern tools to explore the data and its characteristics. CO2. Illustrate the relationship and groups among the data for decision Making. CO3. Experiment with the statistics and group the nature of the data. CO4. Develop the data models using regression and classification techniques for real world data. CO5. Complete appropriate analysis technique for solving the data.
21PCS03/NEURAL NETWORKS AND DEEP LEARNING	CO1:Utilize different methodologies to create application using neural network CO2: Make use of activation function and parameters to train the neural network CO3: Experiment with working knowledge of deep learning models for solving problem CO4: Identify appropriate deep learning models for analyzing the data for a variety of problems. CO5: Build deep learning models for solving real world problems.
21PCS04/INFORMATION RECOMMENDER SYSTEMS	CO1: Relate the basic knowledge of recommender systems for real world problems CO2: Prepare the concepts of collaborative filtering for measuring the similarity

	CO3: Make use of content based and knowledge based techniques for solving real world applications CO4: Choose hybrid approaches for current applications to generate precise recommendations CO5: Develop a simple recommender system using R programming
21PCS05/COMPUTER VISION ALGORITHMS AND APPLICATIONS	CO1: Demonstrate the image processing foundations for computer vision. CO2: Make use of edge detection techniques for image segmentation and data extraction CO3: Classify the elements of digital morphology techniques CO4: Make use of 3D vision, motion for object recognition techniques CO5: Develop applications to recognize the face and human gait analysis
21PCS06/IMAGE AND VIDEO ANALYTICS	CO1: Demonstrate the steps involved image processing system CO2: Classify the feature extraction for real time applications. CO3: Make use of the image retrieval and object recognition. CO4: Demonstrate the video enhancement and noise reduction CO5: Develop an applications in video analysis action recognition
21PCS07/TEXT AND SPEECH ANALYSIS	CO1: Make use of Ngram viewer as a tool for text analysis. CO2: Choose the available tools for text pre-processing. CO3: Utilize Supervised classification algorithms to perform text classification. CO4: Experiment with filter and Transformation methods for speech processing. CO5: Select the appropriate Classification methods for pattern analysis.
21PCS08/ESSENTIALS OF BUSINESS ANALYTICS	CO1: Discover the knowledge of business analytics to solve the business problems. CO2: Choose the organizational structures for small business. CO3: Make use of technical skills in descriptive analytics for real world problems. CO4: Demonstrate the concept of predictive analytics and prescriptive analytics to establish best decision for the small business. CO5: Develop data-driven solutions to support decision-making in real-world business situations.
21PCS09/PRINCIPLES OF PROGRAMMING LANGUAGES	CO1: Illustrate data types, functions, syntax and semantics of all programming languages CO2: Classify the design of subprograms CO3: Develop a dynamic subprograms CO4: Examine the concepts of Functional Programming LISP and F# CO5: Inspect Prolog Programming to solve logical problems
21PCS10/WEB TECHNOLOGY AND DESIGN	CO1: Construct Web pages using HTML5. CO2: Make use of CSS3 to create interactive webpages. CO3: Build dynamic web pages with validation using Java Script objects. CO4: Make use of PHP programming to develop web applications. CO5: Construct web applications using XML and AJAX.

21PCS11/CLOUD SERVICES MANAGEMENT	CO1: Build Web Applications using cloud CO2: Make use of IaaS Model in Cloud Ecosystem along with Amazon VPC CO3: Construct Paas, SaaS Models to meet the real-world challenges. CO4: Utilize security Tools to avoid the security risk on the web services CO5: Develop applications using Amazon Web Services
21PCS12/ANDROID APP DEVELOPMENT	CO1: Sketch the basics of Android applications. CO2: Build user interface for mobile applications. CO3: Make use of database to store mobile data of android applications. CO4: Examine native capabilities of android applications. CO5: Utilize Sensors and GPS for Android applications
21PCS13/WEB APPLICATION SECURITY	CO1: Make use of OWASP to understand the need of web application security. CO2: Discover and prevent web security vulnerabilities CO3: Examine the various SQL Injections and the possible Vulnerabilities CO4: Develop the practices of applying the File Security Principles. CO5: Identify and aid in fixing any security vulnerabilities during the web development process.
21PCS14/SOFTWARE TESTING AND AUTOMATION	CO1: Infer the basic concepts and terminologies of testing to test simple applications CO2: Develop test cases using design strategies by employing suitable techniques CO3: Utilize the various levels of testing to validate the systems CO4: Choose suitable organizational structures for managing the issues in testing CO5: Develop the skills needed for various automation testing techniques
21PCS15/INTRODUCTION TO DEV-OPS	CO1: Utilize the basic concepts of DevOps. CO2: Make use of the development life cycle using pipelining. CO3: Develop the DevOps code by applying the basic concepts. CO4: Model the continuous integration and continuous deployment Pipeline in GIT. CO5: Construct the real time applications for given scenario using Docker and Kubernetes.
21PCS16/PYTHON APPLICATION PROGRAMMING INTERFACE DEVELOPMENT	CO1: Demonstrate the concept of APIs to interface the web services with the backend. CO2: Build a Restful API service using the Flask-Restful package. CO3: Make use of Python APIs for database management. CO4: Develop a user login/logout function using JWT CO5: Utilize Python APIs for sending mails and working with image.
21PCS17/DATA WAREHOUSING CONCEPTS AND	CO1: Identify the warehousing components and tools for organizing large database CO2: Outline the issues for Modeling and measuring data warehousing Quality. CO3: Classify various Source integration tools to solve the real time problems.

	CO4: Determine the Multidimensional Data Models and Aggregation to analyze Multidimensional Information. CO5: Develop Multidimensional Queries for process and Optimization.
21PCS18/ DATA STORAGE TECHNOLOGIES	CO1: Discuss the challenges in data Storage Management for business Environment. CO2: Select a suitable data storage for an application. CO3: Identify the efficiency for improving the data storage CO4: Develop the Storage system architecture for data storage CO5: Build the different network storage area systems for real time scenario.
21PCS19/SOFTWARE DEFINED NETWORKS	CO1: Distinguish between the features of Software Defined Network with traditional network CO2: Outline the various components and functionalities of SDN CO3: Examine the role of SDN in data centers CO4: Make use of SDN Northbound APIs to communicate between the SDN Controller and the services CO5: Experiment with the applications and use cases of SDN
21PCS20/CLOUD COMPUTING AND VIRTUALIZATION	CO1: Complete in-depth and comprehensive knowledge of the Cloud Computing fundamentals CO2: Discover the architecture of cloud computing and storage in cloud CO3: Relate the cloud knowledge and enabling technologies that help in the development of cloud CO4: Illustrate the various types of virtualizations and its importance CO5: Demonstrate the server, desktop and storage virtualization concepts.
21PCS21/INFORMATION STORAGE AND MANAGEMENT	CO1:Categorize the components and functions of information storage systems CO2: Illustrate the functionalities of storage networking. CO3: Demonstrate the process of business continuity for storage networking system CO4: Show the process of backup and replication CO5: Choose the storage components and security mechanism for the storage networking models
21PCS22/STREAM PROCESSING FRAMEWORK	CO1: Illustrate the concepts of distributed stateful stream processing. CO2: Demonstrate the architecture of Apache Flink for event-time processing mode and fault-tolerance model. CO3: Build the fundamentals of DataStream API. CO4: Experiment with time-based and window operators. CO5: Evaluate and implement the Stateful Operators and Applications
21PCS03/FOG AND EDGE COMPUTING	CO1: Illustrate the concept of fog and edge computing for relevant business models CO2: Use the integration modelling techniques for IOT and FOG infrastructure CO3: Relate the orchestration of slicing concept in different network models CO4: Solve the issues of formal modeling framework using optimization

	CO5: Demonstrate the technologies of fog and edge computing for a given real time scenarios
21PCS24/CLOUD DATA CENTRE NETWORK ARCHITECTURES	CO1: Summarize the basis of Cloud DCNs. CO2: Make use of Architecture and Technology Evolution of DCNs. CO3: Utilize the Interaction Technologies between Cloud DCN components. CO4: Develop the knowledge on Cloud DCN Security. CO5: Build the cloud applications using Cutting -Edge Technologies.
21PIT01/CRYPTOGRAPHIC TECHNIQUES	CO1: Explain the fundamentals of classical encryption techniques. CO2: Apply the different operations of symmetric cryptographic algorithms. CO3: Make use of different cryptographic operations of public key cryptography. CO4: Build the various authentication schemes to simulate different applications. CO5: Summarize the various aspects of Modern Cryptography principles.
21PIT02/PARADIGMS OF NETWORK SECURITY	CO1: Outline the security attacks, services and mechanisms. CO2: Make use of encryption techniques for authentication. CO3: Apply public key cryptography algorithm for authentication. CO4: Experiment with Email privacy and security. CO5: Build a model of Firewall and test the security issues.
21PIT03/ENGINEERING SECURE SOFTWARE SYSTEMS	CO1: Compare and contrast the critical and non-critical systems. CO2: Explain the software requirements document and formal specification for a software system. CO3: Summarize the distributed system architectures and design. CO4: Identify the system security failures. CO5: Build a framework for highly secure software.
21PIT04/DIGITAL AND MOBILE FORENSICS	CO1: Summarize forensic analysis tools to recover important evidence for identifying Computer crime. CO2: Demonstrate as well-trained computer crime investigators. CO3: Apply the knowledge for processing evidence using forensic tools. CO4: Make use of the various tools involved in forensic investigation. CO5: Explain the various phases of mobile forensics extraction.
21PIT05/ETHICAL HACKING EXPLOIT DEVELOPMENT	CO1: Summarize the various security tools to assess the computing system. CO2: Experiment with the vulnerabilities across any computing system using penetration testing. CO3: Make use of prediction mechanism to prevent any kind of attacks. CO4: Utilize the various techniques to protect the system from malicious software and worms. CO5: Identify the wireless network flaws and apply security patches.
21PIT06/SOCIAL NETWORK SECURITY	CO1: Explain the components of the social network analysis. CO2: Interpret knowledge about the privacy in social networks. CO3: Illustrate about data mining and text mining. CO4: Demonstrate web mining in social network.

	CO5: Develop the application related to real time systems.
21PIT07/SECURITY AND PRIVACY IN CLOUD	CO1: Interpret the concept of cloud computing. CO2: Summarize the architecture and services of cloud. CO3: Experiment with IAM practices in cloud computing. CO4: Explain the privacy issues in cloud computing. CO5: Outline cloud security polices for audit and compliance.
21PIT08/CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	CO1: Outline the concepts of Blockchain technologies. CO2: Develop Ethereum block chain contract. CO3: Make use of the concepts of Bitcoin and their usage. CO4: Experiment with the basic principles of Cryptocurrencies. CO5: Utilize the knowledge of blockchain technologies to develop various applications.
21PIT09/MULTIMEDIA AND ANIMATION	CO1: Outline the design of Multimedia System Design. CO2: Develop various types of Multimedia File handing methods and experiments with various shapes and hypermedia files. CO3: Make use of various types of animation in developing applications. CO4: Identify various techniques in animation. CO5: Experiment with types of drawings.
21PIT10/MULTIMEDIA DATA COMPRESSION AND STORAGE	CO1: Outline the fundamentals of multimedia compression techniques. CO2: Summarize the various algorithms of Text and Image compression. CO3: Apply the various compression techniques for multimedia processing applications. CO4: Compare various video compression techniques. CO5: Explain the basic concepts of multimedia communication and retrieval.
21PIT11/UI AND UX DESIGN	CO1: Explain the design of graphical user interfaces. CO2: Summarize the User Interfaces to design a good product. CO3: Relate the concepts and principles of UX. CO4: Experiment with UX plane. CO5: Develop a simple application incorporating UI and UX.
21PIT12/VIDEO PROCESSING AND ANALYTICS	CO1: Explain the basic video processing functions. CO2: Experiment with optical flow and motion estimation. CO3: Make use of segmentation techniques for video analytics. CO4: Select techniques to index and retrieve videos for faster access CO5: Develop applications for video analytics.
21PIT13/TECHNIQUES FOR VISUAL EFFECTS	CO1: Explain the concept of Visual Effects. CO2: Outline about various compositing and tools. CO3: Utilize the concepts of Intermediate compositing for animation. CO4: Make use of advanced compositing techniques. CO5: Experiment with 2D and 3D animation techniques.
21PIT14/GAME DESIGN AND DEVELOPMENT	CO1: Explain the basic concepts of game programming. CO2: Experiment with 3D graphics concepts. CO3: Make use of the concepts of sound, physics and cameras to develop simple games. CO4: Apply the concepts of user interfaces and scripting to develop games. CO5: Utilize the gaming concepts to develop games in various platforms.

21PIT15/CONCEPTS OF AUGMENTED REALITY AND VIRTUAL REALITY	CO1: Explain the basic knowledge of AR and VR. CO2: Outline the scientific, technical and engineering aspects of AR. CO3: Outline the scientific, technical and engineering aspects of VR. CO4: Experiment with technologies related to AR and VR software development. CO5: Summarize the applications of AR and VR engineering.
21PIT16/STRATEGIES OF DIGITAL MARKETING	CO1: Explain the fundamentals of Digital Marketing. CO2: Summarize about search engine optimization techniques. CO3: Make use of most popular social media platforms to grow business. CO4: Apply the knowledge about various online advertisement techniques. CO5: Plan case studies for understanding real world scenarios.
21PIT17/TECHNIQUES OF ROBOTIC PROCESS AUTOMATION	CO1: Explain the fundamentals of Robotic Process Automation. CO2: Identify the different Robotic Process Automation tools and its usage. CO3: Outline the automation techniques of Robotic Process Automation. CO4: Apply the various triggering concept for monitoring bots. CO5: Plan, develop and deploy bots.
21PIT18/CYBER SECURITY ESSENTIALS	CO1: Explain the basic concepts of computer security. CO2: Illustrate methods for Security in operating system and networks. CO3: Identify the various security counter measures. CO4: Summarize the privacy principles and policies. CO5: Interpret the management strategies of cyber space.
21PIT19/3D PRINTING AND DESIGN	CO1: Outline the basics of 3D printing. CO2: Explain different 3D printing Technologies. CO3: Identify suitable materials for 3D printing. CO4: Make use of different methods for Post-processing of 3D printing parts. CO5: Plan 3D printing for medical applications and commercial applications.
21PIT20/EMBEDDED SYSTEM DESIGN	CO1: Explain the architecture and programming of ARM processor. CO2: Outline the concepts of embedded systems. CO3: Make use of system design techniques to develop software for embedded systems. CO4: Compare the general purpose system with real time operating system. CO5: Model real-time consumer/industrial applications using system concepts.
21PIT21/PRINCIPLES OF QUANTUM COMPUTING	CO1: Explain the foundations of traditional computing CO2: Interpret the knowledge on the modeling of quantum circuit CO3: Infer the knowledge of basic quantum computing. CO4: Extend the knowledge of advanced quantum algorithms. CO5: Summarize the quantum computational complexity and error correction methods.
21PIT22/AUTONOMOUS GROUND VEHICLE SYSTEMS	CO1: Identify the requirements and design challenges of AGVs. CO2: Select suitable sensors to sense the internal state and external world of AGVs.

	CO3: Make use of lane detection, road detection & vehicle detection algorithms. CO4: Utilize ground vehicle navigation algorithms. CO5: Develop ground vehicle control systems.
21PIT23/E-LEARNING TECHNIQUES	CO1: Compare the phases of activities in models of E-learning CO2: Identify appropriate instructional methods and delivery strategies CO3: Choose appropriate E-learning Authoring tools. CO4: Develop interactive E-learning courseware. CO5: Organize the E-learning courseware.
21PIT24/NEXT GENERATION NETWORKS	CO1: Compare the 5G network with older generations of networks. CO2: Identify suitable small cells for different applications in 5G networks. CO3: Explain 5G network scenarios. CO4: Develop applications to mobile cloud. CO5: Utilize applications with 5G network support.
21PCS25/ETHICS AND ARTIFICIAL INTELLIGENCE	CO1: Summarize the ethical issues in the development of AI agents. CO2: Illustrate the ethical considerations of AI with perspectives on ethical values. CO3: Experiment with the ethical policies in AI based applications and Robot development. CO4: Make use of the AI concepts for addressing societal problems by adapting the legal concepts and securing fundamental rights. CO5: Choose the AI concepts to overcome the evil genesis.
21PCS26/INTRODUCTION TO KNOWLEDGE ENGINEERING	CO1: Summarize the concept of Data, Information and knowledge. CO2: Identify the concepts of knowledge acquisition for an expert system CO3: Model the knowledge using object oriented representation for real-world phenomena. CO4: Make use of knowledge organization to index and design knowledge. CO5: Construct Semantic Web using the knowledge based system design practices.
21PCS27/PRINCIPLES OF SOFT COMPUTING	CO1: Identify neural network techniques and their roles in building intelligent machines CO2: Make use of Backpropagation network for real world problems CO3. Experiment with fuzzy logic and reasoning to handle uncertainty CO4: Examine fuzzy systems for solving complex problem CO5: Compare various soft computing approaches for a given problem
21PCS28/OPTIMIZATION TECHNIQUES AND APPLICATIONS	CO1: Summarize the basics of Optimization Techniques. CO2: Make use of Linear Programming for solving optimization problems. CO3: Identify the usage of Non Linear Programming for solving optimization problems. CO4: Express the multi stage decision problems using sequential optimization CO5: Develop the knowledge of various metaheuristic algorithms for real world problems.

21OMA01/GRAPH THEORY AND ITS APPLICATIONS	CO1: Demonstrate the nature of graphs and illustrate isomorphism on graphs. CO2: Construct the adjacent matrix and incident matrix for the given graph and also develop the chromatic polynomial for the given graph. CO3: Apply various types of graphs and determine the existence of Eulerian, Hamiltonian path & circuits. CO4: Interpret the planarity of graphs and the classes of trees with properties. CO5: Identify the types of directed graphs with its properties.
21PCS29/INTRODUCTION TO GAME THEORY	CO1: Demonstrate the game theory concepts. CO2: Illustrate the various types of non-cooperative game theory concepts. CO3: Relate the normal and extensive games CO4: Discover the various mechanism design concepts. CO5: Construct the auctions concepts
21PCS30/COGNITIVE SCIENCE THEORY AND APPLICATIONS	CO1: Summarize the basics of Cognitive Science using python Libraries. CO2: Make use of knowledge by individual minds, brains, and machines. CO3: Utilize the knowledge of neuroscience in the cognitive field. CO4: Interpret advanced analytics to cognitive computing. CO5: Illustrate various applications of cognitive computing.
21OCS31/STATISTICAL NATURAL LANGUAGE PROCESSING	CO1: Apply the principles and Process of Human Languages such as English and other Indian Languages using computers. CO2: Make use of semantics and pragmatics of English language for text processing CO3: Develop CORPUS linguistics based on digestive approach to check a current methods for statistical approaches to machine translation. CO4: Build POS tagging for a given natural language for a suitable language modelling technique based on the structure of the language. CO5: Develop a Statistical Methods for Real World Applications and explore deep learning based NLP.
21PCS32/INTRODUCTION TO C	CO1: Illustrate the concepts of Computer Organization and Number Systems. CO2: Develop simple programs using expressions, branching control and looping control statements. CO3: Execute simple applications in C using arrays and strings. CO4: Build simple applications in C by employing functions and pointers concepts. CO5: Prepare small application projects using structures or unions.
21PCS33/FUNDAMENTALS OF DATA STRUCTURES	CO1: Build abstract data types for linear data structures. CO2: Utilize the linear data structures like stack for problem solving. CO3:Choose the different linear data structure like queue to various computing problems CO4: Select nonlinear tree data structures to resolve the computing problems. CO5: Make use of data using graph structure and apply their algorithms for problem solving.

21PCS34/DATA BASE PROGRAMMING WITH PL/SQL	CO1: Construct SQL concepts in PL/SQL Programming CO2: Make use of control and conditional structures in PL/SQL Programming CO3: Develop PL/SQL Programs with exception handling and cursors CO4: Utilize procedures and functions in PL/SQL Programming CO5: Build triggers and packages for a given application
21PCS35/JAVA PROGRAMMING	CO1:Demonstrate java applications using classes, inheritance, interfaces and packages CO2:Outline java applications using exception handling and strings CO3:Illustrate java applications using threads and I/O concepts CO4:Develop an applications using Generics and collections CO5: Build GUI using swing components.
21PCS36/FUNDAMENTALS OF COMPUTER NETWORKS	CO1: Identify the role of each layer in computer networks and physical layer services. CO2: Utilize the Link layer services in the various standards defined by IEEE standards. CO3: Apply subnetting to optimize network configuration and various routing algorithms for unicast routing. CO4: Choose protocols for Process to Process communication in different application. CO5: Utilize the different application layer protocols for real time application.
21PCS37/SOFTWARE TESTING AND TOOLS	CO1: Illustrate the basic concepts of testing. CO2: Make use of the different types of testing to design simple applications. CO3: Experiment with various levels of developing a simple test case. CO4: Choose the testing techniques to simple applications. CO5: Relate the tools needed for different types of testing.
21PCS38/WEB PROGRAMMING	CO1:Demonstrate the fundamentals of web programming CO2:Develop web application using PHP CO3:Illustrate the concepts of CSS and templates for web page design CO4:Construct web applications using java script CO5: Build an interactive webpage using AJAX.
21PCS39/MACHINE LEARNING USING PYTHON	CO1: Examine the different style of machine learning methods. CO2: Make use of PYTHON for machine learning techniques. CO3: Choose suitable supervised ML method for categorical and numerical data to build models. CO4: Select suitable unsupervised ML method to build models for decision making. CO5: Prepare evaluation metrics to interpret and improve the model performance.

Velammal College of Engineering and Technology

(Autonomous), Madurai – 625 009

Department of Information Technology

Course Outcome

SEMESTER - I

21EN101	**PROFESSIONAL ENGLISH-1**

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Listen and comprehend complex academic texts.

CO2: Read and infer the denotative and connotative meanings of technical texts.

CO3: Write definitions, descriptions, narrations and essays on various topics.

CO4: Speak fluently and accurately in formal and informal communicative contexts.

CO5: Express their opinions effectively in both oral and written medium of communication.

21MA101	**MATRICES AND CALCULUS**

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Use the matrix algebra methods for solving engineering problems

CO2: Apply differential calculus tools in solving various application problems.

CO3: Make use of differential calculus ideas on several variable functions.

CO4: Identify suitable methods of integration in solving practical problems.

CO5**:** Solve practical problems of areas, volumes using multiple integrals

21PH101	**ENGINEERING PHYSICS**

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the importance of mechanics.

CO2: Extend their knowledge in electromagnetic waves.

CO3: Illustrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Interpret the importance of quantum physics.

CO5: Summarize quantum mechanical principles towards the formation of energy bands.

21CH101	**ENGINEERING CHEMISTRY**

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO 1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO 2: Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO 3: Apply the knowledge of phase rule and composites for material selection requirements.
CO 4: Recommend suitable fuels for engineering processes and applications.
CO 5: Recognize different forms of energy resources and apply them for suitable applications in energy sectors

21CS101	PROBLEM SOLVING AND PYTHON PROGRAMMING

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Make use of design approaches to solve computational problems.
CO2: Develop and execute basic Python programs using expressions and input/output statements.
CO3: Utilize strings, functions and control statements to develop real world problems.
CO4: Construct programs using Python data types like lists, tuples and dictionaries.
CO5: Prepare a Python application by incorporating files and exceptions

21CS102	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1:Develop algorithmic solutions to simple computational Problems
CO2: Illustrate and execute basic Python programs using simple statements.
CO3: Build program for scientific problems using strings, functions and control statements.
CO4: Utilize compound data types lists, tuples and dictionaries for real-time applications.
CO5: Experiment the python packages, files and exceptions for developing software applications

21PC101	PHYSICS AND CHEMISTRY LABORATORY

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1:.Explain the functioning of various physics laboratory equipment
CO2: Relate the graphical models to analyze laboratory data
CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4: Explain Access, process and analyze scientific information.
CO5:Translate students to solve problems individually and collaboratively

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2: To determine the amount of metal ions through volumetric and spectroscopic techniques.
CO3: To analyse and determine the composition of alloys.
CO4: To learn simple method of synthesis of nanoparticles.
CO5: To quantitatively analyse the impurities in solution by electro analytical techniques.

SEMESTER II

21EN102	**ENGLISH-II**

COURSE OUTCOMES :
At the end of the course, learners will be able to:
CO1: Interpret by reading information in technical texts.
CO2: Choose appropriate language to write convincing job applications, resume and reports.
CO3: Formulate the technical ideas effectively in spoken and written forms.
CO4: Analyze and understand spoken language in lectures and talks.
CO5: Demonstrate basic soft skills in life

21MA103	**SAMPLING TECHNIQUES AND NUMERICAL METHODS**

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Apply the concepts of Probability in Engineering problems.
CO2: Explain the test of hypothesis for small and large samples by using various test like t-test, F test, Z-test and $\chi 2$ test.
CO3**:** Apply the basic concepts of classifications of design of experiments.
CO4: Solve the system of equations and the eigen value problems using iterative procedure.
CO5: Calculate the value of an unknown function at any interpolated point of the given tabulated values

21PH103	**PHYSICS FOR INFORMATION SCIENCE**

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Demonstrate the classical and quantum electron theories, and energy band structures.
CO2: Infer knowledge on basics of semiconductor physics and its applications in various devices.

CO3: Summarize magnetic properties of materials and their applications in data storage.
CO4: Extend the functioning of optical materials for optoelectronics
CO5: Translate the basics of quantum structures towards quantum computing

21ME101	ENGINEERING GRAPHICS

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Construct the orthographic projections of points, straight lines and plane surfaces.
CO2: Sketch the orthographic projections of simple solids
CO3: Sketch the orthographic projections of sectional solids and lateral surfaces of the solids.
CO4: Construct the isometric projections and perspective projections of simple solids.
CO5: Sketch the orthographic projection of objects using freehand

21CS103	PROGRAMMING IN C

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Develop simple applications using basic C components.
CO2: Solve applications adopting array and string concepts.
CO3: Construct and implement applications in C using functions and pointers.
CO4: Prepare applications in C by employing structure and union concepts.
CO5: Build applications using sequential and random access file processing

21CH103	ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain the concept, structure and function of an ecosystem and biodiversity.
CO2: Demonstrate the environmental impacts of natural resources.
CO3: Illustrate the suitable management method for pollution control.
CO4: Relate the proper way of managing disaster with environmental ethics.
CO5: Apply social issues and adopt suitable sustainable practices.

21EE104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING FOR INFORMATION SCIENCE

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Interpret the electric circuit parameters of simple DC Circuits.

CO2: Explain the working principle and applications of DC machines.
CO3: Demonstrate the working principle of AC machines.
CO4: Describe the characteristics of analog electronic devices.
CO5: Summarize the basic concepts of operational amplifiers

21EM101	ENGINEERING PRACTICES LABORATORY

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Build various plumbing joints
CO2: Develop various carpentry joints.
CO3: Construct various wiring electrical joints in common household electrical wire work.
CO4: Construct various welded joints, sheet metal and basic machining operations
CO5: Develop the electronic circuit for soldering and testing using PCB board

21CS104	PROGRAMMING IN C LABORATORY

COURSE OUTCOMES:
At the end of the course, the learners will be able to
CO1: Develop simple applications using basic C components.
CO2: Solve applications adopting array and string concepts.
CO3: Construct and implement applications in C using functions and pointers.
CO4: Prepare applications in C by employing structure and union concepts.
CO5: Build applications using sequential and random access file processing

SEMESTER - III

21MA203	DISCRETE MATHEMATICS

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Extend student's logical and mathematical maturity and ability to deal with abstraction.
CO2: Explain the basic concepts of Combinatorics.
CO3: Make use of the concept of graph theory in computer science and engineering.
CO4: Manipulate the applications of algebraic structures.
CO5**:** Demonstrate the basic theorems and properties of Lattices and Boolean Algebra

21EC201	DIGITAL PRINCIPLES AND SYSTEM DESIGN

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Make use of minimization techniques to simplify Boolean algebraic equations.
CO2: Build various combinational circuits using logic gates.
CO3: Develop synchronous sequential circuits using flip flops.
CO4: Build asynchronous sequential circuits using flip flops.
CO5: Explain various semiconductor memories and programmable logic devices

21CS201	COMPUTER ORGANIZATION AND ARCHITECTURE

COURSE OUTCOMES

At the end of the course, learners will be able to:

CO1: Illustrate the basics structure of computers, operations and instructions.
CO2: Build arithmetic and logic unit to perform the arithmetic operations.
CO3: Utilize the data path to develop control unit.
CO4: Identify multithreading techniques to achieve parallelism.
CO5: Experiment with the performance of various memory and I/O technologies

21CS202	DATA STRUCTURES

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Build abstract data types for linear data structures.
CO2:Make use of the different linear data structures for problem solving.
CO3: Select nonlinear tree data structures to resolve computing problems.
CO4: Utilize advanced nonlinear data structure and hashing for solving problems.
CO5: Infer data using graph structure and apply their algorithms for problem solving

21CS203	OBJECT ORIENTED PROGRAMMING

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop programs using basic java concepts.
CO2: Prepare java applications employing exception handling and strings
CO3: Construct java applications adopting thread and I/O concepts.
CO4: Solve java programming problems by incorporating Generics and collections.
CO5: Build GUI for java applications with database connectivity.

21EC213	ANALOG AND DIGITAL COMMUNICATION

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply analog communication techniques.

CO2: Demonstrate pulse and data communication techniques

CO3: Explain digital communication techniques

CO4: Analyze Source and Error control coding

CO5: Describe multi user radio communication techniques

21EC212	DIGITAL SYSTEMS LABORATORY

COURSE OUTCOMES:

At the end of this course, learners will be able to

CO1: Outline the basic working principles of logic gates.

CO2: Build simplified combinational circuits using basic logic gates.

CO3: Model combinational circuits using MSI devices.

CO4: Develop sequential circuits like registers and counters.

CO5: Solve combinational and sequential circuits using HDL

21CS204	DATA STRUCTURES LABORATORY

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop functions for implementing linear data structures.

CO2: Make use of the different linear data structures for computational problem solving.

CO3: Build functions for implementing nonlinear tree data structures.

CO4: Choose appropriate hashing functions for collision free data storage and retrieval.

CO5: Utilize graph structure for manipulating data and problem solving

21CS205	OBJECT ORIENTED PROGRAMMING LABORATORY

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Develop programs using basic java concepts.

CO2: Prepare java applications employing exception handling and strings

CO3: Construct java applications adopting thread and I/O concepts.

CO4: Solve java programming problems by incorporating Generics and collections.

CO5: Build GUI for java applications with database connectivity

SEMESTER IV

21MA205	STOCHASTIC PROCESS AND ITS APPLICATIONS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply the basic concepts of Random variables and standard discrete and continuous distributions.

CO2: Calculate the correlation and regression of two dimensional random variables.

CO3 :Construct the functions of time when the probability measure is associated through random process

CO4: Develop the knowledge of various queueing models.

CO5: Solve the given network (open) problem using the suitable techniques

21CS206	DATA BASE MANAGEMENT SYSTEM

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Build and manipulate relational database using Structured Query Language and relational
languages

CO2: Prepare database using ER-Diagram for real time Applications.

CO3:Make use of Normalization techniques to reduce cost due to redundancy constraints

CO4:Illustrate different types of scheduling and recovery techniques for concurrent transactions

CO5:Construct data structures like indexes and hash tables for the fast retrieval of data and Validate the query evaluation plan

21CS207	DESIGN AND ANALYSIS OF ALGORITHM

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1:Examine mathematically the notion of algorithm, asymptotic notations, and algorithmic efficiency with properties.

CO2: Discover the efficiency of algorithms of time and space complexity using brute force and divide and conquer strategies

CO3: Inspect the time and space complexity of the algorithms designed using Dynamic Programming and Greedy techniques.

CO4: Identify various iterative improvement techniques for problem solving

CO5: Construct the best solution for the given problem using backtracking and Branch & Bound technique.

21CS208	OPERATING SYSTEMS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Examine the elements with various data structures used in development of language processors.

CO2: Make use of process scheduling, deadlocks and synchronization concepts to develop solutions for multi-programmed environment

CO3: Compare and contrast various memory management schemes.

CO4: Discover the functionality of file systems and disk.

CO5: Distinguish various schemes for I/O Management and File Systems.

21IT201	COMPUTER NETWORKS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Summarize the basic concepts of protocol layer and its function.

CO2: Identify the characteristics of data link layer.

CO3: Outline the functions of network layer.

CO4: Interpret the various transport layer protocols in the network.

CO5: Explain the various protocols of the application layer.

21IT202	DESIGN THINKING AND PRODUCT INNOVATION

COURSE OUTCOMES

At the end of the course, learners will be able to:

CO1: Explain the various design process procedure.

CO2: Infer the design ideas through different technique.

CO3: Identify the significance of reverse Engineering to Understand products.

CO4: Develop the technical drawing for design ideas.

CO5: Model the ways to organise design thinking workshop.

21CS210	DATABASE MANAGEMENT SYSTEMS LABORATORY

COURSE OUTCOMES:

At the end of the course, learners will able to

CO1: Use data definition language commands and declare and enforce integrity constraints on a database.

CO2: Populate and query a database using simple SQL queries and complex SQL queries.

CO3: Make use of database objects such as views, sequences and synonyms using SQL.

CO4: Prepare database Triggers, stored procedures, stored functions and cursors using PL/SQL.

CO5: Construct Mongo DBfor database creation

21CS211	OPERATING SYSTEMS LAB

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Develop the programson Assembler, Macro Processor, Loader and Linker

CO2:Make use of Scheduling Algorithms such as FCFS, SJF , Priority and Round Robin to schedule a given set of processes

CO3: Utilize Banker's Algorithm for Deadlock avoidance.

CO4: Infer Solutions to Critical Section Problem using Semaphores.

CO5: Compare the performance of the various Memory management techniques

SEMESTER- V

21IT301	FOUNDATIONS OF DATA SCIENCE

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the methods for data inspecting and cleansing.

CO2: Compare the statistical methods for data science.

CO3: Make use of the packages in Python for data science.

CO4: Outline the prediction techniques using regression models.

CO5: Experiment with different visualization techniques.

21IT302	PRINCIPLES OF CLOUD COMPUTING

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the fundamentals of cloud computing.

CO2: Outline about various virtualization tools.

CO3: Experiment with various cloud storage techniques.

CO4: Identify the different qualities of services.

CO5: Make use of various cloud computing frameworks for implementing software applications

21IT303	SOFTWARE ENGINEERING

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Summarize software engineering process models.

CO2: Translate end-user requirements in to software requirements

CO3: Make use of systematic approaches and diagnostic tools for developing end to end solutions.

CO4: Experiment with different Software testing methods.
CO5: Plan the cost of developing software and studying the risk associated with it

21IT304	FOSS AND CLOUD LABORATORY

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Make use of virtualization tools such as Virtual Box, VMware work station.
CO2: Build web application in a PaaS environment.
CO3: Model a cloud environment to implement new schedulers.
CO4: Utilize a generic cloud environment that can be used as a private cloud.
CO5: Develop web applications and deploy them in a cloud based environment.

SEMESTER- VI

21IT305	MOBILE COMPUTING

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the basics of mobile telecommunication systems.
CO2: Illustrate the generations of telecommunication systems in wireless networks.
CO3: Summarize the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
CO4: Explain the functionality of transport and application layers.
CO5: Develop a mobile application using android/blackberry/ios/Windows SDK

21IT306	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the awareness of intelligent agents and problem solving using different search Algorithms.
CO2: Outline the use of different knowledge representation methods
CO3: Identify uncertain knowledge for planning and reasoning in AI applications
CO4: Infer the basics of decision making.
CO5: Build the knowledge of machine learning methods in AI applications

21IT307	INTERNET OF THINGS

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain about the fundamentals of Internet of Things (IoT).

CO2: Interpret the knowledge about the basics of IoT protocols.
CO3: Summarize about IoT Design and Development.
CO4: Experiment with the information using data analytics for IoT.
CO5: Apply IoT in Real World Design Constraints.

21EN301	PROFESSIONAL COMMUNICATION LABORATORY

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Demonstrate effective communication skills through presentations.
CO2: Utilize their knowledge of motivation in setting and achieving goals.
CO3: Examine time and stress management.
CO4: Formulate their ideas into an effective communication in formal contexts.
CO5: Develop a well-composed resume and face interviews confidently

SEMESTER- VII

21IT401	BIG DATA ENGINEERING

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Outline the big data technologies used for storage, analysis and manipulation of data.
CO2: Develop simple applications using Hadoop MapReduce framework.
CO3: Outline the concepts of data analytics.
CO4: Make use of technology and tools for data modeling.
CO5: Explain the MongoDB architecture and its operations

21IT402	SOFTWARE PROJECT MANAGEMENT

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Plan for project evaluation using basic principles
CO2: Summarize about project life cycle and effort estimation.
CO3: Build activity diagram to determine project duration.
CO4: Construct various reporting structure for monitoring the progress of project.
CO5: Explain the staffing pattern in software projects

PROFESSIONAL ELECTIVE COURSES: VERTICALS
VERTICAL 1: DATA SCIENCE

21PCS01	DATA SCIENCE AND BIG DATA ANALYTICS

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Utilize probability, statistics and linear algebra for data science process and data exploration.
CO2: Make use of PYTHON for statistical data analytics on real world data applications.
CO3: Utilize Hadoop and Map Reduce technologies for huge data storage and management.
CO4: Experiment the NoSQL database usingMongoDB.
CO5: Examine the variants of data analytic techniques to analyze the data of various domains

21PCS02	EXPLORATORY DATA ANALYSIS

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Make use of modern tools to explore the data and its characteristics.
CO2. Illustrate the relationship and groups among the data for decision Making.
CO3. Experiment with the statistics and group the nature of the data.
CO4. Develop the data models using regression and classification techniques for real world data.
CO5: Complete appropriate analysis technique for solving the data

21PCS03	NEURAL NETWORKS AND DEEP LEARNING

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1.Utilize different methodologies to create application using neural network
CO2. Make use of activation function and parameters to train the neural network
CO3. Experiment with working knowledge of deep learning models for solving problem
CO4. Identify appropriate deep learning models for analyzing the data for a variety of problems.
CO5. Build deep learning models for solving real world problems

21PCS04	INFORMATION RECOMMENDER SYSTEMS

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Relate the basic knowledge of recommender systems for real world problems.
CO2: Prepare the concepts of collaborative filtering for measuring the similarity.

CO3: Make use of content based and knowledge based techniques for solving real world applications.
CO4: Choose hybrid approaches for current applications to generate precise recommendations.
CO5: Develop a simple recommender system using R programming

21PCS05	COMPUTER VISION ALGORITHMS AND APPLICATIONS

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Demonstrate the image processing foundations for computer vision
CO2: Make use of edge detection techniques for image segmentation and data extraction.
CO3: Classify the elements of digital morphology techniques.
CO4: Make use of 3D vision, motion for object recognition techniques.
CO5: Develop applications to recognize the face and human gait analysis

21PCS06	IMAGE AND VIDEO ANALYTICS

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Demonstrate the steps involved image processing system.
CO2: Classify the feature extraction for real time applications.
CO3: Make use of the image retrieval and object recognition.
CO4: Demonstrate the video enhancement and noise reduction.
CO5: Develop applications in video analysis action recognition

21PCS07	TEXT AND SPEECH ANALYSIS

COURSE OUTCOMES
At the end of the course, learners will be able to
CO1: Make use of Ngram viewer as a tool for text analysis.
CO2: Choose the available tools for text preprocessing.
CO3: Utilize Supervised classification algorithms to perform text classification.
CO4: Experiment with filter and Transformation methods for speech processing.
CO5: Select the appropriate Classification methods for pattern analysis

21PCS08	ESSENTIALS OF BUSINESS ANALYTICS

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Discover the knowledge of business analytics to solve the business problems.
CO2: Choose the organizational structures for small business.
CO3: Make use of technical skills in descriptive analytics for real world problems.

CO4: Demonstrate the concept of predictive analytics and prescriptive analytics to establish best decision for the small business. CO5: Develop data-driven solutions to support decision-making in real-world business situations

VERTICAL 2: FULL STACK DEVELOPEMENT

21PCS09	PRINCIPLES OF PROGRAMMING LANGUAGES

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Illustrate data types, functions, syntax and semantics of all programming languages
CO2: Classify the design of subprograms
CO3: Develop a dynamic subprograms
CO4: Examine the concepts of Functional Programming LISP and F#
CO5: Inspect Prolog Programming to solve logical problems

21PCS10	WEB TECHNOLOGY AND DESIGN

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Construct Web pages using HTML5.
CO2: Make use of CSS3 to create interactive webpages.
CO3: Build dynamic web pages with validation using Java Script objects.
CO4: Make use of PHP programming to develop web applications.
CO5: Construct web applications using XML and AJAX

21PCS11	CLOUD SERVICES MANAGEMENT

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Build Web Applications using cloud.
CO2: Make use of IaaS Model in Cloud Ecosystem along with Amazon VPC.
CO3: Construct Paas, SaaS Models to meet the real-world challenges.
CO4: Utilize security Tools to avoid the security risk on the web services.
CO5: Develop applications using Amazon Web Services.

21PCS12	ANDROID APP DEVELOPMENT

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Sketch the basics of Android applications.
CO2: Build user interface for mobile applications.
CO3: Make use of database to store mobile data of android applications.
CO4: Examine native capabilities of android applications.
CO5: Utilize Sensors and GPS for Android applications

21PCS13	WEB APPLICATION SECURITY

COURSE OUTCOMES:
At end of the course, learners will be able to:
CO1: Make use of OWASP to understand the need of web application security.
CO2: Discover and prevent web security vulnerabilities.
CO3: Examine the various SQL Injections and the possible Vulnerabilities.
CO4: Develop the practices of applying the File Security Principles.
CO5: Identify and aid in fixing any security vulnerabilities during the web development process

21PCS14	SOFTWARE TESTING AND AUTOMATION

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Infer the basic concepts and terminologies of testing to test simple applications.
CO2: Develop test cases using design strategies by employing suitable techniques.
CO3: Utilize the various levels of testing to validate the systems.
CO4: Choose suitable organizational structures for managing the issues in testing.
CO5: Develop the skills needed for various automation testing techniques

21PCS15	INTRODUCTION TO DEV-OPS

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Utilize the basic concepts of DevOps.
CO2: Make use of the development life cycle using pipelining.
CO3: Develop the DevOps code by applying the basic concepts.
CO4: Model the continuous integration and continuous deployment Pipeline in GIT.
CO5: Construct the real time applications for given scenario using Docker and Kubernetes

21PCS16	PYTHON APPLICATION PROGRAMMING INTERFACE DEVELOPMENT

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Demonstrate the concept of APIs to interface the web services with the backend.
CO2: Build a Restful API service using the Flask-Restful package.
CO3: Make use of Python APIs for database management.
CO4: Develop a user login/logout function using JWT.
CO5: Utilize Python APIs for sending mails and working with image.

VERTICAL 3: DATA CENTRE TECHNOLOGIES

21PCS17	DATA WAREHOUSING CONCEPTS AND IMPLEMENTATION

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1:Identify the warehousing components and tools for organizing large database
CO2: Outline the issues for Modeling and measuring data warehousing Quality.
CO3: Classify various Source integration tools to solve the real time problems.
CO4: Determine the Multidimensional Data Models and Aggregation to analyze Multidimensional
Information.
CO5: Develop Multidimensional Queries for process and Optimization

21PCS18	DATA STORAGE TECHNOLOGIES

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Discuss the challenges in data Storage Management for business Environment.
CO2: Select suitable data storage for an application.
CO3: Identify the efficiency for improving the data storage.
CO4: Develop the Storage system architecture for data storage.
CO5: Build the different network storage area systems for real time scenario

21PCS19	SOFTWARE DEFINED NETWORKS

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Distinguish between the features of Software Defined Network with traditional network
CO2: Outline the various components and functionalities of SDN
CO3: Examine the role of SDN in data centers
CO4: Make use of SDN Northbound APIs to communicate between the SDN Controller and the services
CO5: Experiment with the applications and use cases of SDN

21PCS20	CLOUD COMPUTING AND VIRTUALIZATION

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Complete in-depth and comprehensive knowledge of the Cloud Computing fundamentals.

CO2: Discover the architecture of cloud computing and storage in cloud.

CO3:Relate the cloud knowledge and enabling technologies that help in the development of cloud.

CO4: Illustrate the various types of virtualizations and its importance.

CO5: Demonstrate the server, desktop and storage virtualization concepts

21PCS21	INFORMATION STORAGE AND MANAGEMENT

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Categorize the components and functions of information storage systems

CO2: Illustrate the functionalities of storage networking.

CO3: Demonstrate the process of business continuity for storage networking system

CO4: Show the process of backup and replication

CO5: Choose the storage components and security mechanism for the storage networking models

21PCS22	STREAM PROCESSING FRAMEWORK

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Illustrate the concepts of distributed stateful stream processing.

CO2: Demonstrate the architecture of Apache Flink for event-time processing mode and fault tolerance model.

CO3: Build the fundamentals of DataStream API.

CO4: Experiment with time-based and window operators.

CO5: Evaluate and implement the Stateful Operators and Applications

21PCS23	FOG AND EDGE COMPUTING

COURSE OUTCOMES

At end of the course, learners will be able to:

CO1: Illustrate the concept of fog and edge computing for relevant business models.

CO2: Use the integration modelling techniques for IOT and FOG infrastructure.

CO3: Relate the orchestration of slicing concept in different network models

CO4: Solve the issues of formal modeling framework using optimization.

CO5: Demonstrate the technologies of fog and edge computing for a given real time scenarios

21PCS24	CLOUD DATA CENTRE NETWORK ARCHITECTURES

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize the basis of Cloud DCNs.

CO2: Make use of Architecture and Technology Evolution of DCNs.

CO3: Utilize the Interaction Technologies between Cloud DCN components.

CO4: Develop the knowledge on Cloud DCN Security.

CO5: Build the cloud applications using Cutting -Edge Technologies

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

21PIT01	CRYPTOGRAPHIC TECHNIQUES

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the fundamentals of classical encryption techniques.

CO2: Apply the different operations of symmetric cryptographic algorithms.

CO3: Make use of different cryptographic operations of public key cryptography.

CO4: Build the various authentication schemes to simulate different applications.

CO5: Summarize the various aspects of Modern Cryptography principles

21PIT02	PARADIGMS OF NETWORK SECURITY

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Outline the security attacks, services and mechanisms.

CO2: Make use of encryption techniques for authentication.

CO3: Apply public key cryptography algorithm for authentication.

CO4: Experiment with Email privacy and security.

CO5: Build a model of Firewall and test the security issues

21PIT03	ENGINEERING SECURE SOFTWARE SYSTEMS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Compare and contrast the critical and non-critical systems.

CO2: Explain the software requirements document and formal specification for a software system.

CO3: Summarize the distributed system architectures and design.

CO4: Identify the system security failures.
CO5: Build a framework for highly secure software

21PIT04	DIGITAL AND MOBILE FORENSICS

COURSE OUTCOMES:

At the end of the course, learners will be able to:
CO1: Summarize forensic analysis tools to recover important evidence for identifying Computer crime.
CO2: Demonstrate as well-trained computer crime investigators
CO3: Apply the knowledge for processing evidence using forensic tools.
CO4: Make use of the various tools involved in forensic investigation.
CO5: Explain the various phases of mobile forensics extraction

21PIT05	ETHICAL HACKING EXPLOIT DEVELOPMENT

COURSE OUTCOMES:

At the end of the course, learners will be able to:
CO1: Summarize the various security tools to assess the computing system.
CO2: Experiment with the vulnerabilities across any computing system using penetration testing.
CO3: Make use of prediction mechanism to prevent any kind of attacks.
CO4: Utilize the various techniques to protect the system from malicious software and worms.
CO5: Identify the wireless network flaws and apply security patches

21PIT06	SOCIAL NETWORK SECURITY

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Explain the components of the social network analysis.
CO2: Interpret knowledge about the privacy in social networks.
CO3: Illustrate about data mining and text mining.
CO4: Demonstrate web mining in social network.
CO5: Develop the application related to real time systems.

21PIT07	SECURITY AND PRIVACY IN CLOUD

COURSE OUTCOMES:

At the end of the course, learners will be able to:
CO1: Interpret the concept of cloud computing.
CO2: Summarize the architecture and services of cloud.

CO3: Experiment with IAM practices in cloud computing.
CO4: Explain the privacy issues in cloud computing
CO5: Outline cloud security polices for audit and compliance.

21PIT08	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Outline the concepts of Blockchain technologies.
CO2: Develop Ethereum block chain contract.
CO3: Make use of the concepts of Bitcoin and their usage.
CO4: Experiment with the basic principles of Cryptocurrencies.
CO5: Utilize the knowledge of blockchain technologies to develop various applications

VERTICAL 5: CREATIVE MEDIA

21PIT09	MULTIMEDIA AND ANIMATION

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Outline the design of Multimedia System Design.
CO2: Develop various types of Multimedia File handing methods and experiments with various shapes and hypermedia files.
CO3: Make use of various types of animation in developing applications.
CO4: Identify various techniques in animation.
CO5: Experiment with types of drawings

21PIT10	MULTIMEDIA DATA COMPRESSION AND STORAGE

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Outline the fundamentals of multimedia compression techniques
CO2: Summarize the various algorithms of Text and Image compression.
CO3: Apply the various compression techniques for multimedia processing applications.
CO4: Compare various video compression techniques.
CO5: Explain the basic concepts of multimedia communication and retrieval.

21PIT11	UI AND UX DESIGN

COURSE OUTCOMES:
At the end of the course, learners will be able to

CO1: Explain the design of graphical user interfaces.
CO2: Summarize the User Interfaces to design a good product.
CO3: Relate the concepts and principles of UX.
CO4: Experiment with UX plane.
CO5: Develop a simple application incorporating UI and UX

21PIT12	VIDEO PROCESSING AND ANALYTICS

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the basic video processing functions.
CO2: Experiment with optical flow and motion estimation.
CO3: Make use of segmentation techniques for video analytics.
CO4: Select techniques to index and retrieve videos for faster access.
CO5: Develop applications for video analytics

21PIT13	TECHNIQUES FOR VISUAL EFFECTS

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the concept of Visual Effects
CO2: Outline about various compositing and tools.
CO3: Utilize the concepts of Intermediate compositing for animation.
CO4: Make use of advanced compositing techniques.
CO5: Experiment with 2D and 3D animation techniques

21PIT14	GAME DESIGN AND DEVELOPMENT

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain the basic concepts of game programming.
CO2: Experiment with 3D graphics concepts.
CO3: Make use of the concepts of sound, physics and cameras to develop simple games.
CO4: Apply the concepts of user interfaces and scripting to develop games.
CO5: Utilize the gaming concepts to develop games in various platforms

21PIT15	CONCEPTS OF AUGMENTED REALITY AND VIRTUAL REALITY

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the basic knowledge of AR and VR.
CO2: Outline the scientific, technical and engineering aspects of AR.
CO3: Outline the scientific, technical and engineering aspects of VR.
CO4: Experiment with technologies related to AR and VR software development.
CO5: Summarize the applications of AR and VR engineering

21PIT16	STRATEGIES OF DIGITAL MARKETING

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the fundamentals of Digital Marketing.
CO2: Summarize about search engine optimization techniques.
CO3: Make use of most popular social media platforms to grow business.
CO4: Apply the knowledge about various online advertisement techniques.
CO5: Plan case studies for understanding real world scenarios

VERTICAL 6: PROGRESSIVE TECHNOLOGIES

21PIT17	TECHNIQUES OF ROBOTIC PROCESS AUTOMATION

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the fundamentals of Robotic Process Automation.
CO2: Identify the different Robotic Process Automation tools and its usage.
CO3: Outline the automation techniques of Robotic Process Automation.
CO4: Apply the various triggering concept for monitoring bots.
CO5: Plan, develop and deploy bots

21PIT18	CYBER SECURITY ESSENTIALS

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the basic concepts of computer security.
CO2: Illustrate methods for Security in operating system and networks.
CO3: Identify the various security counter measures.
CO4: Summarize the privacy principles and policies.
CO5: Interpret the management strategies of cyber space

21PIT19	3D PRINTING AND DESIGN

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Outline the basics of 3D printing.

CO2: Explain different 3D printing Technologies.

CO3: Identify suitable materials for 3D printing.

CO4: Make use of different methods for Post-processing of 3D printing parts.

CO5: Plan 3D printing for medical applications and commercial applications

21PIT20	EMBEDDED SYSTEM DESIGN

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Explain the architecture and programming of ARM processor.

CO2: Outline the concepts of embedded systems.

CO3: Make use of system design techniques to develop software for embedded systems.

CO4: Compare the general purpose system with real time operating system.

CO5: Model real-time consumer/industrial applications using system concepts

21PIT21	PRINCIPLES OF QUANTUM COMPUTING

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the foundations of traditional computing

CO2: Interpret the knowledge on the modeling of quantum circuit

CO3: Infer the knowledge of basic quantum computing.

CO4: Extend the knowledge of advanced quantum algorithms.

CO5: Summarize the quantum computational complexity and error correction methods.

21PIT22	AUTONOMOUS GROUND VEHICLE SYSTEMS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Identify the requirements and design challenges of AGVs.

CO2: Select suitable sensors to sense the internal state and external world of AGVs.

CO3: Make use of lane detection, road detection & vehicle detection algorithms.

CO4: Utilize ground vehicle navigation algorithms.

CO5: Develop ground vehicle control systems

21PIT23	E-LEARNING TECHNIQUES

COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Compare the phases of activities in models of E-learning CO2: Identify appropriate instructional methods and delivery strategies CO3: Choose appropriate E-learning Authoring tools. CO4: Develop interactive E-learning courseware. CO5: Organize the E-learning courseware	

21PIT24	**NEXT GENERATION NETWORKS**
COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Compare the 5G network with older generations of networks CO2: Identify suitable small cells for different applications in 5G networks. CO3: Explain 5G network scenarios. CO4: Develop applications to mobile cloud. CO5: Utilize applications with 5G network support	

VERTICAL 7: COGNITIVE COMPUTING

21PCS25	**ETHICS AND ARTIFICIAL INTELLIGENCE**
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Summarize the ethical issues in the development of AI agents. CO2: Illustrate the ethical considerations of AI with perspectives on ethical values. CO3: Experiment with the ethical policies in AI based applications and Robot development. CO4: Make use of the AI concepts for addressing societal problems by adapting the legal concepts and securing fundamental rights. CO5: Choose the AI concepts to overcome the evil genesis	

21PCS26	**INTRODUCTION TO KNOWLEDGE ENGINEERING**
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Summarize the concept of Data, Information and knowledge. CO2: Identify the concepts of knowledge acquisition for an expert system.	

CO3: Model the knowledge using object oriented representation for real-world phenomena.
CO4: Make use of knowledge organization to index and design knowledge.
CO5: Construct Semantic Web using the knowledge based system design practices

21PCS27	PRINCIPLES OF SOFT COMPUTING

COURSE OUTCOMES

At end of the course, learners will be able to:
CO1: Identify neural network techniques and their roles in building intelligent machines
CO2: Make use of Backpropagation network for real world problems
CO3. Experiment with fuzzy logic and reasoning to handle uncertainty
CO4: Examine fuzzy systems for solving complex problem
CO5: Compare various soft computing approaches for a given problem

21PCS28	OPTIMIZATION TECHNIQUES AND APPLICATIONS

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Summarize the basics of Optimization Techniques.
CO2: Make use of Linear Programming for solving optimization problems.
CO3: Identify the usage of Non Linear Programming for solving optimization problems.
CO4: Express the multi stage decision problems using sequential optimization.
CO5: Develop the knowledge of various metaheuristic algorithms for real world problems

21OMA01	GRAPH THEORY AND ITS APPLICATIONS

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Demonstrate the nature of graphs and illustrate isomorphism on graphs.
CO2: Construct the adjacent matrix and incident matrix for the given graph and also develop the chromatic polynomial for the given graph.
CO3: Apply various types of graphs and determine the existence of Eulerian, Hamiltonian path & circuits.
CO4: Interpret the planarity of graphs and the classes of trees with properties.
CO5: Identify the types of directed graphs with its properties

21PCS29	INTRODUCTION TO GAME THEORY

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Demonstrate the game theory concepts.

CO2: Illustrate the various types of non-cooperative game theory concepts.

CO3: Relate the normal and extensive games.

CO4: Discover the various mechanism design concepts.

CO5: Construct the auctions concepts

21PCS30	COGNITIVE SCIENCE THEORY AND APPLICATIONS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Summarize the basics of Cognitive Science using python Libraries.

CO2: Make use of knowledge by individual minds, brains, and machines.

CO3: Utilize the knowledge of neuroscience in the cognitive field.

CO4: Interpret advanced analytics to cognitive computing.

CO5: Illustrate various applications of cognitive computing

21PCS31	STATISTICAL NATURAL LANGUAGE PROCESSING

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO1: Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.

CO2:Make use of semantics and pragmatics of English language for text processing

CO3: Develop CORPUS linguistics based on digestive approach to check a current methods for statistical approaches to machine translation.

CO4:Build POS tagging for a given natural language for a suitable language modelling technique based on the structure of the language.

CO5: Develop a Statistical Methods for Real World Applications and explore deep learning based NLP.

VERTICAL 8: EMERGING TECHNOLOGIES
(OPEN ELECTIVES I & II FOR EEE, CIVIL AND MECH PROGRAMMES)

21OIT01	FUNDAMENTALS OF AUGMENTED REALITY AND VIRTUAL REALITY

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the basic concepts of AR and VR.
CO2: Outline the scientific, technical and engineering aspects of AR.
CO3: Outline the scientific, technical and engineering aspects of VR.
CO4: Experiment with technologies related to AR and VR software development.
CO5: Illustrate the applications of AR and VR Engineering

21OIT02	FUNDAMENTALS OF ROBOTIC PROCESS AUTOMATION

COURSE OUTCOMES:
After successful completion of this course, the students should be able to
CO1: Explain the fundamentals of Robotic Process Automation.
CO2: Identify the different Robotic Process Automation tools and its usage.
CO3: Outline the automation techniques of Robotic Process Automation.
CO4: Apply the various triggering concept for monitoring bots.
CO5: Plan, develop and deploy bots

21OIT03	DEEP LEARNING TECHNIQUES

COURSE OUTCOMES
At end of the course, learners will be able to:
CO1: Explain the fundamentals of neural networks and deep learning.
CO2: Summarize the concepts of neural network training.
CO3: Experiment with regularization, training optimization, and hyper parameter selection on deep
learning models.
CO4: Apply working knowledge of deep learning models for problem solving.
CO5: Outline about deep learning models for processing images or video

21PIT18	CYBER SECURITY ESSENTIALS

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain the basic concepts of computer security.

CO2: Illustrate methods for Security in operating system and networks.
CO3: Identify the various security counter measures.
CO4: Summarize the privacy principles and policies.
CO5: Interpret the management strategies of cyber space

21OIT04	FUNDAMENTALS OF BLOCKCHAIN

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Explain about fundamental concept of blockchain.
CO2: Summarize the concept of cryptocurrency and Bitcoin.
CO3: Identify the components of Ethereum and Ethereum Programming Languages.
CO4: Outline the basics of Hyperledger and its development framework.
CO5: Compare different blockchain technologies

21OIT05	GAME DEVELOPMENT FOR NOVICE

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain the basic concepts of game programming.
CO2: Summarize about 3D graphics.
CO3: Infer about sound, physics and cameras in game development.
CO4: Outline about user interfaces and scripting.
CO5: Make use of gaming concepts to develop simple games

21OIT06	INTRODUCTION TO 3D PRINTING AND DESIGN

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Outline the basics of 3D printing.
CO2: Explain different 3D printing Technologies.
CO3: Identify suitable materials for 3D printing.
CO4: Make use of different methods for Post-processing of 3D printing parts.
CO5: Plan 3D printing for medical applications and commercial applications

21OIT07	FUNDAMENTALS OF MACHINE LEARNING

COURSE OUTCOMES:
At the end of the course, learners will be able to:
CO1: Summarize the fundamental concept of machine learning.

CO2: Explain the concept of decision Tree for classification in ML.
CO3: Make use of SVM for classification in ML.
CO4: Outline the concept of unsupervised learning for classification in ML.
CO5: Explain the concept of Reinforcement Learning to make best decision

21OIT08	INTERNET OF THINGS CONCEPTS AND APPLICATIONS

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain about the fundamentals of Internet of Things (IoT).
CO2: Interpret the knowledge about the basics of Engineering IoT.
CO3: Summarize about IoT Design and Development.
CO4: Experiment with the information using data analytics for IoT.
CO5: Make use of IoT technologies for real world problems

21IT301	FOUNDATIONS OF DATA SCIENCE

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain the methods for data inspecting and cleansing.
CO2: Compare the statistical methods for data science.
CO3: Make use of the packages in Python for data science.
CO4: Outline the prediction techniques using regression models.
CO5: Experiment with different visualization techniques

21OCIT01	AUTOMATION TOOL

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO 1: Utilize Selenium testing tool for writing test cases and test scripts.
CO 2: Develop test plan using Selenium tool for web application

21OCIT02	AZURE CLOUD ESSENTIALS

COURSE OUTCOMES:
At the end of the course, learners will be able to
CO1: Explain the fundamental concept of Azure cloud.
CO2: Make use of cloud concepts to deploy an application

21OCIT03	MONGO DB BASICS

COURSE OUTCOMES:

At the end of the course, learners will be able to

CO 1: Infer the difference between and Non-relational database.

CO 2: Build database for manipulating unstructured data using MongoDB.

21MCC01	CONSTITUTION OF INDIA

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India.

CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status.

CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India.

CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions

CO5: Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality

21MCC02	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.

CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.

CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being.

CO4: Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.

CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry

Velammal College of Engineering & Technology, Madurai (Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21EN101

COURSE NAME: Professional English – I **YEAR/SEM: I/I**

CO no.	Course Outcome
C101.1	Listen and comprehend complex academic texts
C101.2	Read and infer the denotative and connotative meanings of technical texts
C101.3	Write definitions, descriptions, narrations and essays on various topics
C101.4	Speak fluently and accurately in formal and informal communicative contexts
C101.5	Express their opinions effectively in both oral and written medium of communication

COURSE CODE: 21MA101

COURSE NAME: Matrices and Calculus **YEAR/SEM: I/I**

CO no.	Course Outcome
C102.1	Use the matrix algebra methods for solving engineering problems.
C102.2	Apply differential calculus tools in solving various application problems.
C102.3	Make use of differential calculus ideas on several variable functions.
C102.4	Identify suitable methods of integration in solving practical problems.
C102.5	Solve practical problems of areas, volumes using multiple integrals

Velammal College of Engineering & Technology, Madurai (Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21PH101

COURSE NAME: Engineering Physics **YEAR/SEM: I/I**

CO no.	Course Outcome
C103.1	Explain the importance of mechanics.
C103.2	Extend their knowledge in electromagnetic waves.
C103.3	Illustrate a strong foundational knowledge in oscillations, optics and lasers.
C103.4	Interpret the importance of quantum physics.
C103.5	Explain the importance of mechanics.

COURSE CODE: 21CH101

COURSE NAME: Engineering Chemistry **YEAR/SEM: I/I**

CO no.	Course Outcome
C104.1	Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
C104.2	Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications
C104.3	Apply the knowledge of phase rule and composites for material selection requirements.
C104.4	Recommend suitable fuels for engineering processes and applications.
C104.5	Recognize different forms of energy resources and apply them for suitable applications in energy sectors.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21CS101

COURSE NAME: Problem Solving and Python Programming YEAR/SEM: I/I

CO no.	Course Outcome
C105.1	Make use of design approaches to solve computational problems.
C105.2	Develop and execute basic Python programs using expressions and input/output statements.
C105.3	Utilize strings, functions and control statements to develop real world problems.
C105.4	Construct programs using Python data types like lists, tuples and dictionaries.
C105.5	Prepare a Python application by incorporating files and exceptions.

COURSE CODE: 21CS102

COURSE NAME: Problem Solving and Python Programming Laboratory YEAR/SEM: I/I

CO no.	Course Outcome
C106.1	Develop algorithmic solutions to simple computational Problems
C106.2	Illustrate and execute basic Python programs using simple statements.
C106.3	Build program for scientific problems using strings, functions and control statements.
C106.4	Utilize compound data types lists, tuples and dictionaries for real-time applications.
C106.5	Experiment the python packages, files and exceptions for developing software applications

Velammal College of Engineering & Technology, Madurai (Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21PC101

COURSE NAME: Physics and Chemistry Laboratory **YEAR/SEM: I/I**

PHYSICS

CO no.	Course Outcome
C107.1	Explain the functioning of various physics laboratory equipment
C107.2	Relate the graphical models to analyze laboratory data
C107.3	Interpret mathematical models as a medium for quantitative reasoning and describing physical reality.
C107.4	Explain Access, process and analyze scientific information.
C107.5	Translate students to solve problems individually and collaboratively

CO no.	Course Outcome
C107.1	To analyze the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
C107.2	To determine the amount of metal ions through volumetric and spectroscopic techniques.
C107.3	To analyze and determine the composition of alloys.
C107.4	To learn simple method of synthesis of nanoparticles.
C107.5	To quantitatively analyze the impurities in solution by electro analytical techniques.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21EN102

COURSE NAME: English – II **YEAR/SEM: I/II**

CO no.	Course Outcome
C108.1	Interpret by reading information in technical texts
C108.2	Choose appropriate language to write convincing job applications, resume and reports
C108.3	Formulate the technical ideas effectively in spoken and written forms
C108.4	Analyze and understand spoken language in lectures and talks
C108.5	Demonstrate basic soft skills in life

COURSE CODE: 21MA103

COURSE NAME: Sampling Techniques and Numerical Methods **YEAR/SEM: I/II**

CO no.	Course Outcome
C109.1	Apply the concepts of Probability in Engineering problems.
C109.2	Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and $\chi 2$ test
C109.3	Apply the basic concepts of classifications of design of experiments.
C109.4	Solve the system of equations and the eigen value problems using iterative procedure.
C109.5	Interpret the value of an unknown function at any interpolated point of the given tabulated values**.**

Velammal College of Engineering & Technology, Madurai (Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21PH103

COURSE NAME: Physics for Information Science **YEAR/SEM: I/II**

CO no.	Course Outcome
C110.1	Demonstrate the classical and quantum electron theories, and energy band structures.
C110.2	Infer knowledge on basics of semiconductor physics and its applications in various devices.
C110.3	Summarize magnetic properties of materials and their applications in data storage.
C110.4	Extend the functioning of optical materials for optoelectronics
C110.5	Translate the basics of quantum structures towards quantum computing.

COURSE CODE: 21ME101

COURSE NAME: Engineering Graphics **YEAR/SEM: I/II**

CO no.	Course Outcome
C111.1	Construct the orthographic projections of points, straight lines and plane surfaces.
C111.2	Sketch the orthographic projections of simple solids
C111.3	Sketch the orthographic projections of sectional solids and lateral surfaces of the solids.
C111.4	Construct the isometric projections and perspective projections of simple solids.
C111.5	Sketch the orthographic projection of objects using freehand.

Velammal College of Engineering & Technology, Madurai (Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21EE104 **YEAR/SEM: I/II**

COURSE NAME: Basic Electrical and Electronics Engineering for Information Science

CO no.	Course Outcome
C112.1	Interpret the electric circuit parameters of simple DC Circuits.
C112.2	Explain the working principle and applications of AC and DC machines.
C112.3	Demonstrate the domestic and industrial wiring.
C112.4	Describe the characteristics of analog electronic devices.
C112.5	Summarize the basic concepts of operational amplifiers.

COURSE CODE: 21AD101 **YEAR/SEM: I/II**

COURSE NAME: Programming Paradigm in C

CO no.	Course Outcome
C113.1	Demonstrate knowledge on C Programming constructs
C113.2	Design and implement applications using arrays and strings
C113.3	Develop and implement modular applications in C using functions.
C113.4	Develop applications in C using structures and pointers.
C113.5	Design applications using data analytics in C programming.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21CH103 **YEAR/SEM: I/II**

COURSE NAME: Environmental Science

CO no.	Course Outcome
C114.1	Explain the concept, structure and function of an ecosystem and biodiversity.
C114.2	Demonstrate the environmental impacts of natural resources.
C114.3	Select the suitable management method for pollution control.
C114.4	Practice the proper way of managing disaster with environmental ethics.
C114.5	Recognize social issues and adopt suitable sustainable practices.

COURSE CODE: 21EM101 **YEAR/SEM: I/II**

COURSE NAME: Engineering Practices Laboratory

CO no.	Course Outcome
C115.1	Build various plumbing joints
C115.2	Develop various carpentry joints.
C115.3	Construct various wiring electrical joints in common household electrical wire work.
C115.4	Construct various welded joints, sheet metal and basic machining operations
C115.5	Develop the electronic circuit for soldering and testing using PCB board.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD102 **YEAR/SEM: I/II**

COURSE NAME: Programming Paradigm in C Laboratory

CO no.	Course Outcome
C116.1	Develop programs in C using basic constructs
C116.2	Develop programs in C using arrays
C116.3	Develop **applications** in C using strings, pointers, functions
C116.4	Develop applications in C using structures.
C116.5	Develop applications in C using file processing and Data analytics

COURSE CODE: 21MA203 **YEAR/SEM: II/III**

COURSE NAME: Discrete Mathematics

CO no.	Course Outcome
C201.1	Extend student's logical and mathematical maturity and ability to deal with abstraction.
C201.2	Explain the basic concepts of Combinatorics.
C201.3	Make use of the concept of graph theory in computer science and engineering.
C201.4	Disseminate the applications of algebraic structures.
C201.5	Examine the basic theorems and properties of Lattices and Boolean Algebra.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD201 **YEAR/SEM: II/III**

COURSE NAME: Operating System Principles

CO no.	Course Outcome
C202.1	Analyze various scheduling algorithms and process synchronization.
C202.2	Explain deadlock, prevention and avoidance algorithms.
C202.3	Compare and contrast various memory management schemes.
C202.4	Explain the functionality of file systems I/O systems
C202.5	Compare iOS and Android Operating Systems.

COURSE CODE: 21AD203 **YEAR/SEM: II/III**

COURSE NAME: Data Structure Design using Python

CO no.	Course Outcome
C203.1	Interpret the concepts of Object-Oriented Programming as used in Python.
C203.2	Implement Searching and sorting in Python.
C203.3	Identify the operation of Array and Linked list in Python.
C203.4	Demonstrate the applications of Stack and Queues in Python.
C203.5	Represent the searching algorithms in Graphs and Trees in Python.

COURSE CODE: 21AD205 **YEAR/SEM: II/III**

COURSE NAME: Principles of Artificial Intelligence

CO no.	Course Outcome
C204.1	Build artificial intelligence techniques to solve real-world problems.
C204.2	Make use of search algorithms to solve problems in a state-space.
C204.3	Select adversarial search techniques to make optimal decisions in games.
C204.4	Construct knowledge representation in propositional and predicate logic.
C204.5	Choose machine learning techniques to classify data and cluster data.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD206 **YEAR/SEM: II/III**

COURSE NAME: Software Engineering Principles and Design

CO no.	Course Outcome
C205.1	Apply software engineering principles for software development
C205.2	Use software requirement specification and design software according to the specification.
C205.3	Use UML diagram to design project deliverables.
C205.4	Apply different testing and manage the software.
C205.5	Implement Agile Scrum for software projects

COURSE CODE: 21AD202 **YEAR/SEM: II/III**

COURSE NAME: Operating System Principles Laboratory

CO no.	Course Outcome
C206.1	Define and implement UNIX Commands.
C206.2	Compare the performance of various CPU Scheduling Algorithms.
C206.3	Compare and contrast various Memory Allocation Methods.
C206.4	Define File Organization and File Allocation Strategies.
C206.5	Implement various Disk Scheduling Algorithms.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD204 **YEAR/SEM: II/III**

COURSE NAME: Data Structure Design using Python Laboratory

CO no.	Course Outcome
C207.1	Demonstrate the Oops Concepts.
C207.2	Interpret the data structure concepts.
C207.3	Implement Array and Linked list operations.
C207.4	Make use of Stack and Queue in real world applications.
C207.5	Understand the application of Trees and Graphs.

COURSE CODE: 21MA208 **YEAR/SEM: II/IV**

COURSE NAME: Probability and Statistics

CO no.	Course Outcome
C208.1	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
C208.2	Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
C208.3	Apply the concept of testing of hypothesis for small and large samples in real life problems.
C208.4	Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
C208.5	Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD207 **YEAR/SEM: II/IV**

COURSE NAME: Analysis of Algorithms

CO no.	Course Outcome
C209.1	Analyze the efficiency of algorithms using various frameworks
C209.2	Apply graph algorithms to solve problems and analyze their efficiency.
C209.3	Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems
C209.4	Use the state space tree method for solving problems.
C209.5	Solve problems using approximation algorithms and randomized algorithms

COURSE CODE: 21AD208 **YEAR/SEM: II/IV**

COURSE NAME: Database Design and Engineering

CO no.	Course Outcome
C210.1	Identify entities, attributes and their relationship, prepare ER model and use basics of SQL to write query.
C210.2	Use functional dependencies, normal forms to design and normalize a database.
C210.3	Summarize interleaved operations of transaction, file organization strategies, parsing and execution of SQL Statements.
C210.4	Understand and summarize basics of data engineering concepts.
C210.5	Analyze the principles governing Data Architecture and Storage in different applications.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD210 **YEAR/SEM: II/IV**

COURSE NAME: Computer Networking Principles

CO no.	Course Outcome
C211.1	Outline OSI model and the features of physical layer.
C211.2	Make use of data link layer features to calculate error codes and apply protocols for the given network.
C211.3	Compare congestion effects in a network and understand the concepts of application layer protocols.
C211.4	Illustrate examples for cryptography techniques.
C211.5	Apply security practices for real time applications.

COURSE CODE: 21AD212 **YEAR/SEM: II/IV**

COURSE NAME: Principles of Machine Learning

CO no.	Course Outcome
C212.1	Understand the functions of neural network and deep learning.
C212.2	Understand the functions of neural network and deep learning.
C212.3	Understand the functions of neural network and deep learning.
C212.4	Understand the functions of neural network and deep learning.
C212.5	Understand the functions of neural network and deep learning.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD209 **YEAR/SEM: II/IV**

COURSE NAME: Database Design and Engineering Laboratory

CO no.	Course Outcome
C213.1	Use DDL, DML & DCL commands to experiment the creation of database.
C213.2	Create an application to execute Views, Sequence and Synonyms.
C213.3	Test a database application using nested queries and join queries.
C213.4	Construct simple codes to execute functions and procedures.
C213.5	Design an application using ER diagram, normalization and create simple dataset.

COURSE CODE: 21AD211 **YEAR/SEM: II/IV**

COURSE NAME: Computer Networking Principles Laboratory

CO no.	Course Outcome
C214.1	Implement various networking commands
C214.2	Implement error correction codes
C214.3	Implement network and application layer protocols using sockets.
C214.4	Develop code for classical Encryption Techniques to solve the problems.
C214.5	Build cryptosystems by applying symmetric and public key encryption algorithms.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD213 **YEAR/SEM: II/IV**

COURSE NAME: Machine Learning Laboratory

CO no.	Course Outcome
C215.1	Identify and apply the appropriate machine learning algorithm for a given problem.
C215.2	Evaluate the Supervised learning models preprocessed through various feature engineering algorithms.
C215.3	Implement and apply dimensionality reduction techniques such as principal component analysis.
C215.4	Design and apply the Naive Bayes algorithm, maximum likelihood, and maximum a posteriori estimation.
C215.5	Understand the basic concepts of neural network model and design the same.

COURSE CODE: 21AD301 **YEAR/SEM: III/V**

COURSE NAME: Deep Learning Techniques

CO no.	Course Outcome
C301.1	Demonstrate the basic concepts, fundamental learning techniques and layers.
C301.2	Analyze and evaluate, in the context of a case study, the advantages and disadvantages of deep learning neural network architectures and other approaches.
C301.3	Design convolutional networks for handwriting and object classification from images or video.
C301.4	Design recurrent neural networks for sequence modeling.
C301.5	Build, train and apply fully connected deep neural networks.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD302 **YEAR/SEM: III/V**

COURSE NAME: Data Science and Analytics

CO no.	Course Outcome
C302.1	Apply the skills of data inspecting and cleansing.
C302.2	Classify data analytics techniques and compare with various applications.
C302.3	Understand how various libraries used for data visualization.
C302.4	Handle data using primary tools used for data science in Python.
C302.5	Apply analytics tools for data describing and visualization.

COURSE CODE: 21AD304 **YEAR/SEM: III/V**

COURSE NAME: Full Stack Development

CO no.	Course Outcome
C303.1	Design Interactive Web Pages using HTML and CSS.
C303.2	Develop server side coding with Node.js
C303.3	Design client side applications with React
C303.4	Use Typescript for web programming applications
C303.5	Develop the server and client for any applications and deploy using containers

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD303 **YEAR/SEM: III/V**

COURSE NAME: Data Science and Analytics Laboratory

CO no.	Course Outcome
C304.1	Develop relevant programming abilities.
C304.2	Demonstrate knowledge of statistical data analysis techniques
C304.3	Exhibit proficiency to build and assess data-based models.
C304.4	Demonstrate skill in Data management & processing tasks using Python.
C304.5	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

COURSE CODE: 21AD305 **YEAR/SEM: III/V**

COURSE NAME: Full Stack Development Laboratory

CO no.	Course Outcome
C305.1	Design Interactive Web Pages
C305.2	Develop server side coding with Node.js
C305.3	Develop application using Mango DB.
C305.4	Design client side applications with React and Typescript
C305.5	Develop web applications and deploy.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21EN301 **YEAR/SEM: III/V**

COURSE NAME: Professional Communication Laboratory

CO no.	Course Outcome
C306.1	Demonstrate effective communication skills through presentations.
C306.2	Utilize their knowledge of motivation in setting and achieving goals.
C306.3	Examine time and stress management.
C306.4	Formulate their ideas into an effective communication in formal contexts.
C306.5	Develop a well-composed resume and face interviews confidently.

COURSE CODE: 21AD306 **YEAR/SEM: III/VI**

COURSE NAME: Natural Language Processing

CO no.	Course Outcome
C307.1	Understand the concept of NLP and illustrate its real time application.
C307.2	Illustrate the methods of syntax analysis, such as probabilistic context-free grammars.
C307.3	Use semantics and discourse analysis methods to NLP and perform comparative study.
C307.4	Compare language modelling techniques based on the structure of the language.
C307.5	Demonstrate recent applications that use Natural Language Processing approaches.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD308 **YEAR/SEM: III/VI**

COURSE NAME: Computer Vision

CO no.	Course Outcome
C308.1	Summarize theories and methods of image processing and computer vision.
C308.2	Apply image processing techniques in Open CV.
C308.3	Apply feature-based image alignment, segmentation and motion estimation for 2D image.
C308.4	Implement 3D reconstruction techniques.
C308.5	Design real time applications for image processing and computer vision.

COURSE CODE: 21AD307 **YEAR/SEM: III/VI**

COURSE NAME: Natural Language Processing Laboratory

CO no.	Course Outcome
C309.1	Implement NLP concepts using python
C309.2	Create NLP applications for other languages
C309.3	Illustrate detection models
C309.4	Develop applications using sentiment analysis
C309.5	Implement whatsapp chat analysis

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD401 **YEAR/SEM: IV/VII**

COURSE NAME: Data Visualization

CO no.	Course Outcome
C401.1	Discover various data types and ways to visualize them for better understanding.
C401.2	Identify visualizations techniques to specific problems using datasets.
C401.3	Understand the different techniques for arranging networks and trees structured approach for visual analytics.
C401.4	Show how to analyze extensive datasets using different visualization methods and tools.
C401.5	Create dashboards with visualizations to help make decisions on large dataset.

COURSE CODE: 21AD402 **YEAR/SEM: IV/VII**

COURSE NAME: Data Visualization Laboratory

CO no.	Course Outcome
C402.1	Explain the concepts of data abstraction and task abstraction in data visualization.
C402.2	Identify and apply the different types of visualization techniques to data.
C402.3	Use visual analytics techniques to explore and analyze data.
C402.4	Use visualization tools to perform diverse types of visual analysis.
C402.5	Create dashboard using visualization tools for different use cases.

Velammal College of Engineering & Technology, Madurai
(Autonomous)
Department of Artificial Intelligence and Data Science
Regulation 2021 – COURSE OUTCOMES

COURSE CODE: 21AD403 **YEAR/SEM: IV/VII**

COURSE NAME: Project Work-I

CO no.	Course Outcome
C403.1	
C403.2	
C403.3	
C403.4	
C403.5	

COURSE CODE: 21AD404 **YEAR/SEM: IV/VII**

COURSE NAME: Project Work-II

CO no.	Course Outcome
C404.1	Gain Domain knowledge and technical skill set required for solving industry / research problems
C404.2	Provide solution architecture, module level designs, algorithms
C404.3	Implement, test and deploy the solution for the target platform
C404.4	Prepare detailed technical report, demonstrate and present the work

Velammal College of Engineering and Technology (Autonomous), Madurai – 625 009
Department of Electrical and Electronics Engineering
VCET R2021-Curriculum

CO-PO Mapping for I year to IV year (Odd Semester)

I YEAR (First Semester)															
		Course outcomes		Program outcomes											
				1	2	3	4	5	6	7	8	9	10	11	12
				K3	K4	K5	K5	K6	K3	K2	K3	K3	K2	K3	K3
1	**21EN101/ Professional English-I**	C101.1	Describe the listening and comprehending complex academic texts	0	0	0	0	0	0	0	0	1	3	0	0
		C101.2	Discuss on reading & inferring the denotative and connotative meanings of technical text	0	0	0	0	0	0	0	0	2	3	0	0
		C101.3	Construct definitions, descriptions, narrations and essays on various topics	0	0	0	0	0	0	0	0	0	3	0	0
		C101.4	Develop speaking fluently and accurately in formal and informal communicative context	0	0	0	0	0	0	0	0	0	3	0	0
		C101.5	Organize opinions to express effectively in both oral and written medium of communication	0	0	0	0	0	0	0	0	0	3	0	0
		Course contribution		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**
2	**21MA101/ Matrices and Calculus**	C102.1	Apply eigen values to compute the inverse and positive powers of square matrix and use to diagonalise the given matrix by the concept of orthogonal reduction	3	2	1	-	-	-	-	-	-	-	-	-
		C102.2	Apply differential calculus tools in solving various application problems	3	2	1	-	-	-	-	-	-	-	-	-
		C102.3	Apply to use differential calculus ideas on several variable functions	3	2	1	-	-	-	-	-	-	-	-	-

		C102.4	Demonstrate and apply the techniques of integration	3	2	1	-	-	-	-	-	-	-	-	-
		C102.5	Apply integrals of multivariable to find areas enclosed between two curves and volume enclosed between surfaces	3	2	1	-	-	-	-	-	-	-	-	-
		Course contribution		**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**21PH101 Engineering Physics**	C103.1	Understand the importance of mechanics	2	1	-	-	-	-	-	-	-	1	-	-
		C103.2	Express their knowledge in electromagnetic waves	2	1	-	-	-	-	-	-	-	1	-	-
		C103.3	Demonstrate a strong foundational knowledge in oscillations, optics and Lasers	2	1	-	-	-	-	-	-	-	1	-	-
		C103.4	Understand the importance of quantum physics	2	1	-	-	-	-	-	-	-	1	-	-
		C103.5	Comprehend and apply quantum mechanical principles towards the formation of energy bonds	2	1	-	-	-	-	-	-	-	1	-	-
		C103.6	Illustrate the applications of fibre optic sensor with applications	2	1	-	-	-	-	-	-	-	1	-	-
		Course contribution		**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
4	**21CH101 Engineering Chemistry**	C104.1	Infer the water from quality parameter data and propose suitable treatment methodologies to treat water	2	1	-	-	-	-	-	-	-	1	-	-
		C104.2	Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications	2	1	-	-	-	-	-	-	-	1	-	-
		C104.3	Apply the knowledge of phase rule and composite for material selection requirements	2	1	-	-	-	-	-	-	-	1	-	-

		C104.4	Recommend suitable fuels for engineering processes and applications	2	1	-	-	-	-	-	-	-	1	-	-
		C104.5	Recognize different forms of energy sources and apply them for suitable applications in energy sectors	2	1	-	-	-	-	-	-	-	1	-	-
		C104.6	Capacitate themselves for higher level cognizance	2	1	-	-	-	-	-	-	-	1	-	-
		Course contribution		2	1	-	-	-	-	-	-	-	1	-	-
5	**21CS101 Problem Solving and Python Programming**	C105.1	Develop algorithmic solutions to simple computational problems	3	2	1	1	1	-	-	1	-	1	-	1
		C105.2	Develop and execute simple Python programs	2	-	-	-	3	-	-	-	-	1	-	1
		C105.3	Write simple Python programs using conditionals and loops for solving problems	3	1	-	-	-	-	-	-	-	1	-	1
		C105.4	Decompose a Python program into functions	3	3	-	-	-	-	-	-	-	1	-	1
		C105.5	Represent compound data using Python lists, tuples, dictionaries	2	1	-	-	-	-	-	-	-	1	-	1
		C105.6	Read and write data from/to files in Python programs	3	1	-	-	-	-	-	-	-	1	-	1
		C105.7	Demonstrate a mini project by applying and analyzing the concepts learnt in the course for the given requirements.	3	3	1	1	3	-	-	-	-	1	3	1
		Course contribution		**3**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**1**	**1**	**1**
6	**21CS102 Problem Solving and Python Programming Laboratory**	C106.1	Develop algorithmic solutions to simple computational problems	3	3	1	1	3	-	-	1	-	1	-	-
		C106.2	Develop and execute simple Python programs.	3	3	1	-	3	-	-	1	-	1	-	1
		C106.3	Implement programs in Python using conditionals and loops for solving problems.	3	2	1	-	-	-	-	1	-	1	-	1
		C106.4	Deploy functions to decompose a Python	3	3	1	-	3	-	-	1	-	1	-	1

			program.												
		C106.5	Process compound data using Python data structures	2	2	1	-	-	-	-	1	-	1	-	1
		C106.6	Utilize Python packages in developing software applications	3	2	1	-	-	-	-	1	-	1	-	1
		Course contribution		**3**	**3**	**1**	**1**	**2**	-	-	**1**	-	**1**	-	**1**
7	**21PC101 Physics and Chemistry Laboratory**	C107.1	Demonstrate the stress-strain behavior by uniform bending method	2	1	-	-	-	-	-	-	1	-	-	-
		C107.2	Illustrate Young's modulus of the material of cantilever using simple harmonic oscillations	2	1	-	-	-	-	-	-	1	-	-	-
		C107.3	Demonstrate the wavelength of the given Laser source of light using grating	2	1	-	-	-	-	-	-	1	-	-	-
		C107.4	Analyze the thickness of a thin wire testing using air wedge arrangement	2	1	-	-	-	-	-	-	1	-	-	-
		C107.5	Illustrate inertia of moment and inertia of rest and the modulus behind torsional pendulum	2	1	-	-	-	-	-	-	1	-	-	-
		C107.6	Analyze the wheatstone bridge to null deflection and determine the band gap of thermistor	2	1	-	-	-	-	-	-	1	-	-	-
		C107.6	Demonstrate the stress-strain behavior by non-uniform bending method	2	1	-	-	-	-	-	-	1	-	-	-
		Course contribution		**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
I YEAR (Second Semester)															
1	**21EN102 English –II**	C108.1	Read and interpret information critically in technical texts	-	-	-	-	-	-	-	-	-	3	-	1
		C108.2	Construct convincing job applications, resume and effective reports	-	-	-	-	-	-	-	-	-	3	-	1
		C108.3	Make use of the technical ideas effectively in spoken and written forms	-	-	-	-	-	-	-	-	-	3	-	1
		C108.4	Infer spoken language in lectures and talks	-	-	-	-	-	-	-	-	-	3	-	1
		C108.5	Utilize basic soft skills ideas in life	-	-	-	-	-	-	-	-	1	3	-	1

		C108.6	Summarize the extensive reading contents	-	-	-	-	-	-	-	-	-	3	-	1
		Course contribution		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**1**
2	**21MA102/ Vector calculus and Complex Variables**	C109.1	Apply the concept of vector calculus in engineering problems	3	2	1	1	-	-	-	-	-	-	-	-
		C109.2	Solve the partial differentials equations by using various techniques	3	2	1	1	-	-	-	-	-	-	-	-
		C109.3	Construct an analytic function using their properties and discuss the transformations	3	2	1	1	-	-	-	-	-	-	-	-
		C109.4	Apply Cauchy theorem and Cauchy's integral formula to evaluate the given integral over the closed curve	3	2	1	1	-	-	-	-	-	-	-	-
		C109.5	Choose the suitable method to solve the given differential equation to first and second order	3	2	1	1	-	-	-	-	-	-	-	-
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
3	**21PH105/ Physics for Electrical Engineering**	C110.1	Compare the basics of dielectric materials & insulation.	2	1	-	-	-	-	-	-	-	1	-	-
		C110.2	Infer the electrical & magnetic properties of materials & their applications in devices	2	1	-	-	-	-	-	-	-	1	-	-
		C110.3	Interpret the semiconductor physics & functioning of semiconductor device	2	1	-	-	-	-	-	-	-	1	-	-
		C110.4	Summarize the optical properties of optoelectronic materials	2	1	-	-	-	-	-	-	-	1	-	-
		C110.5	Explain the basics of nanotechnology and nano devices	2	1	-	-	-	-	-	-	-	1	-	-
		C110.6	Develop a model characterizing optical effects	2	1	-	-	-	-	-	-	-	1	-	-
		Course contribution		**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

4	**21ME101/ Engineering Graphics**	C111.1	Construct the orthographic projections of points, straight lines and plane surfaces.	3	2	2	2	2	2	2	2	2	2	2	2
		C111.2	Sketch the orthographic projections of solids.	3	2	2	2	2	2	2	2	2	2	2	2
		C111.3	Sketch the orthographic projections of sectioned solids and development of lateralsurfaces of the solids.	3	2	2	2	2	2	2	2	2	2	2	2
		C111.4	Construct the isometric and perspective projections of simple solids.	3	2	2	2	2	2	2	2	2	2	2	2
		C111.5	Sketch the orthographic projection of objects using free hand.	3	2	2	2	2	2	2	2	2	2	2	2
		Course contribution		**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
5	**21EE101/ Electric Circuit Analysis**	C112.1	Develop nodal equations and loop equation for electric circuits.	3	2	1	1	-	-	-	-	-	-	-	1
		C112.2	Apply network reduction techniques for linear and nonlinear circuits.	3	2	1	1	-	-	-	-	-	-	-	1
		C112.3	Solve network parameters and transient response for DC and AC circuits.	3	2	1	1	1	-	-	-	-	-	-	1
		C112.4	Make use of three phase balanced and unbalanced circuit connections for calculation of power and power factor.	3	2	1	1	-	-	-	-	-	-	-	1
		C112.5	Solve the frequency response of RLC circuits and coupled networks.	3	2	1	1	1	-	-	-	-	-	-	1
		Course contribution		**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
6	**21CH103/ Environmental Science**	C113.1	Explain the concept, structure and function of an ecosystem	2	1	-	-	-	-	3	-	-	-	-	-
		C113.2	Demonstrate the environmental impacts of energy sources.	2	1	-	-	-	2	3	-	-	-	-	-
		C113.3	Select the suitable management method for solid wastes	2	1	-	-	-	3	3	-	-	-	-	-

		C113.4	Practice the suitable management method during disaster episode	2	1	-	-	-	3	3	-	-	-	-	-
		C113.5	Describe the Traditional values and Impact of modernization on Environment	2	1	-	-	-	2	3	2	2	2	-	-
		C113.6	Industrial Visit and report submission	2	1	-	-	-	-	3	-	-	-	-	-
		Course contribution		**2**	1	**-**	**-**	**-**	**3**	**3**	**2**	2	2	**-**	**-**
7	**21MC101 Basic Civil and Mechanical Engineering**	C114.1	Understanding profession of Civil Engineering	3	-	-	1	-	2	-	-	-	-	-	-
		C114.2	Summarize the planning of materials used for construction of building and its process	3	2	2	1	1	2	-	-	-	-	-	-
		C114.3	Understanding the Manufacturing processes	3	-	-	-	1	2	-	-	-	-	-	-
		C114.4	Demonstrate the working principle of Power Plant and IC Engine	3	2	-	-	1	2	-	-	-	-	-	-
		C114.5	Elaborate the components of refrigeration and air conditioning cycle	3	2	-	-	1	2	-	-	-	-	-	-
		Course contribution		**3**	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**
8	**21EM101 Engineering Practices Laboratory**	C115.1	Construct the basic switch board wiring, fluorescent lamp wiring and staircase wiring using various electrical components	3	2	1	1	-	-	-	-	1	1	-	1
		C115.2	Make use of energy meter to measure energy and with electrical equipment to measure resistance	3	2	1	1	-	-	-	-	1	1	-	1
		C115.3	Identify the concepts of iron box wiring and fan regulator to study its construction, operation and repair	3	2	1	1	-	-	-	-	1	1	-	1
		C115.4	Develop the electronic circuit for soldering and testing using PCB board	3	2	1	1	-	-	-	-	1	1	-	1
		C115.5	Experiment with the study of Smartphone and assemble and dismantle	3	2	1	1	-	-	-	-	1	1	-	1

			of computer/laptop												
		C115.6	Demonstrate the measurement of AC signal parameters using CRO	3	2	1	1	-	-	-	-	1	1	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
	21EE102 Electric Circuits Laboratory	C116.1	Apply the circuit concepts using fundamental laws of electric circuits	3	2	1	1	1	-	-	-	1	1	-	1
		C116.2	Identify equivalent circuit parameters using network theorems	3	2	1	1	1	-	-	-	1	1	-	1
		C116.3	Solve for power and energy in AC circuits	3	2	1	1	1	-	-	-	1	1	-	1
		C116.4	Utilize the concept of resonance in electric circuits	3	2	1	1	1	-	-	-	1	1	-	1
		C116.5	Construct the electric circuit simulation using software packages	3	2	1	1	1	-	-	-	1	1	-	1
II YEAR (Third Semester)															
1	**21MA202/ Transform Techniques and its Applications**	C201.1	Evaluate the Laplace transform and inverse Laplace transform of differential functions	3	3	3	2	1	-	-	-	-	-	-	-
		C201.2	Apply Laplace transform technique to solve second order differential equations with elementary functions	3	3	3	2	1	-	-	-	-	-	-	-
		C201.3	Solve the given differential equations using Z transform	3	3	3	2	1	-	-	-	-	-	-	-
		C201.4	Evaluate the given integral using Fourier Transform Technique	3	3	3	2	1	-	-	-	-	-	-	-
		C201.5	Choose suitable fourier transform techniques to evaluate the given integral in wide variety of situations in Electrical Engineering	3	3	3	2	1	-	-	-	-	-	-	-
		Course contribution		**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**21EE201/**	C202.1	Outline the basic mathematical concepts related to electromagnetic waves	3	2	1	1	-	-	-	-	-	-	-	1

	Field Theory	C202.2	Summarize the basic concepts of electrostatic fields, electrical potential, energy density capacitance and their applications	3	2	1	1	-	-	-	-	-	-	-	1
		C202.3	Infer the knowledge in magneto static fields, magnetic flux density, vector potential, inductance and its applications	3	2	1	1	-	-	-	-	-	-	-	1
		C202.4	Classify methods of EMF generation and Maxwell's equations of electrodynamic fields	3	2	1	1	-	-	-	-	-	-	-	1
		C202.5	Illustrate the basic concepts of electromagnetic waves and characterizing parameters	3	2	1	1	-	-	-	-	-	-	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
3	**21EE202/ DC Machines and Transformers**	C203.1	Explain the magnetic-circuits	2	1	1	1	-	-	-	-	-	-	-	1
		C203.2	Build the knowledge in constructional details of transformers.	3	2	1	1	-	-	-	-	-	-	-	1
		C203.3	Develop the concepts of electromechanical energy conversion.	3	1	1	1	-	-	-	-	-	-	-	1
		C203.4	Show the working principle of DC Generator.	3	2	1	1	-	-	-	-	-	-	-	1
		C203.5	Illustrate the working principle of DC Motor.	3	2	1	1	-	-	-	-	-	-	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
4	**21EE203/ Transmission and Distribution**														
		C204.1	Outline the importance and the functioning of transmission line parameters.	2	2	1	1	-	-	-	-	-	-	-	1
		C204.2	Identify the performance of transmission lines based on the length and environmental aspects.	3	2	1	1	-	-	-	-	-	-	-	1
		C204.3	Explain the mechanical design of transmission lines and formation of corona.	2	2	1	1	-	-	-	-	-	-	-	1
		C204.4	Illustrate about the insulators and cables based on the transmission voltage capacity.	2	2	1	1	-	-	-	-	-	-	-	1
		C204.5	Compare the concepts of electric distribution system such as EHVAC, HVDC and FACTS	2	2	1	1	-	-	-	-	-	-	-	1

		Course contribution		**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
5	**21EE204/ Electronic Devices and Circuits**	C205.1	Outline the structure, operation and V- I characteristics of various PN diodes.	2	1	1	1	-	-	-	-	-	-	-	-
		C205.2	Develop V-I characteristics of Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET).	3	2	1	1	-	-	-	-	-	-	-	-
		C205.3	Identify the transistor application as amplifiers	3	2	1	1	-	-	-	-	-	-	-	-
		C205.4	Infer the operation and characteristics and gain of multistage and differential amplifiers.	2	1	1	1	-	-	-	-	-	-	-	-
		C205.5	Summarize the operation of feedback amplifiers and oscillators with their applications.	2	1	1	1	-	-	-	-	-	-	-	-
		Course contribution		**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6	**21EE205/ Digital Logic Circuits**	C206.1	Outline the various number systems and different logic families.	2	1	1	1	-	-	-	-	-	-	1	1
		C206.2	Build combinational logic circuits using basic gates and simplification using Karnaugh maps.	3	2	1	1	-	-	-	-	-	-	1	1
		C206.3	Model synchronous sequential circuits using flip flops.	3	2	1	1	-	-	-	-	-	-	1	1
		C206.4	Develop asynchronous sequential circuits using flip flops.	3	2	1	1	-	-	-	-	-	-	1	1
		C206.5	Explain the hardware functionality at system level using Programmable Logic device (PLD) and Hardware Description Language (HDL).	3	2	1	1	1	-	-	-	-	-	1	1
		Course contribution		**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
7	**21EE206/ DC Machines and Transformers Laboratory**	C207.1	Identify the performance characteristics of DC Generator.	3	2	1	1	-	-	-	-	1	1	-	1
		C207.2	Develop the performance characteristics of DC motor.	3	2	1	1	-	-	-	-	1	1	-	1
		C207.3	Experiment with DC machines to predetermine their performance.	3	2	1	1	-	-	-	-	1	1	-	1
		C207.4	Make use of speed control techniques in DC motors.	3	2	1	1	-	-	-	-	1	1	-	1

		C207.5	Build the performance characteristics of Transformers.	3	2	1	1	-	-	-	-	1	1	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
8	**21EE207/ Electronic Devices and Digital Laboratory**	C208.1	Identify the VI characteristics of semiconductor diodes on and packing	3	2	1	1	-	-	-	-	1	-	1	-
		C208.2	Develop the VI characteristics of bipolar and unipolar devices.	3	2	1	1	-	-	-	-	1	-	1	-
		C208.3	Construct combinational circuits using basic gates.	3	2	1	1	-	-	-	-	1	-	1	-
		C208.4	Model synchronous and asynchronous counters using JK flip flop.	3	2	1	1	-	-	-	-	1	-	1	-
		C208.5	Build shift registers using delay flip flop.	3	2	1	1	-	-	-	-	1	-	1	-
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**-**
II YEAR (Fourth Semester)																
1	**21MA202/ Transform techniques And Its Applications**	C209.1	Evaluate the Laplace Transform and Inverse Laplace Transform of differential functions	3	3	3	2	1	-	-	-	-	-	-	-
		C209.2	Apply Laplace transform technique to solve second order differential equations with elementary functions	3	3	3	2	1	-	-	-	-	-	-	-
		C209.3	Solve the given difference equations using Z transform	3	3	3	2	1	-	-	-	-	-	-	-
		C209.4	Evaluate the given integral using Fourier Transform techniques	3	3	3	2	1	-	-	-	-	-	-	-
		C209.5	Choose suitable Fourier Transform techniques to evaluate the give integral in wide variety of situations in Electrical Engineering	3	3	3	2	1	-	-	-	-	-	-	-
		Course contribution		**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**21EE208 / Measurement and Instrumentation**	C210.1	Outline the basic concepts about measurement of analog and digital meters.	2	1	1	1	-	-	-	-	-	-	-	1
		C210.2	Illustrate the fundamentals of electrical and electronic instruments.	2	1	1	1	-	-	-	-	-	-	-	1
		C210.3	Compare the various measurement techniques for resistance, inductance and capacitance measurement using bridges.	2	1	1	1	-	-	-	-	-	-	-	1

		C210.4	Summarize the concept of digital storage & display devices.	2	1	1	1	-	-	-	-	-	-	-	1
		C210.5	Illustrate the operation of transducers and data acquisition system.	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
3	**21EE209 / Induction and Synchronous Machines**	C211.1	Experiment with 3 phase alternators to find voltage regulation by EMF, MMF, ZPF and ASA methods.	3	2	1	1	-	-	-	-	-	-	-	1
		C211.2	Solve for direct axis reactance of salient pole alternator using slip test.	3	2	1	1	-	-	-	-	-	-	-	1
		C211.3	Develop the characteristics of V and Inverted V curves in synchronous motors	2	2	1	1	-	-	-	-	-	-	-	1
		C211.4	Identify the performance characteristics of single phase and three phase induction motor	3	2	1	1	-	-	-	-	-	-	-	1
		C211.5	Construct the characteristics of single phase and three phase induction motor	2	2	1	1	-	-	-	-	-	-	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
4	**21EE210 Control Systems**	C212.1	Develop transfer function of systems based on the knowledge of Mathematics, Science and Engineering fundamentals.	3	2	1	1	-	-	-	-	-	-	-	1
		C212.2	Apply the various time domain and frequency domain techniques to assess the system performance.	3	2	1	1	-	-	-	-	-	-	-	1
		C212.3	Identify the effect of various compensation in frequency domain.	3	2	1	1	-	-	-	-	-	-	-	1
		C212.4	Make use of knowledge about various stability techniques to different applications	3	2	1	1	-	-	-	-	-	-	-	1
		C212.5	Solve Controllability and Observability using state space representation	3	2	1	1	-	-	-	-	-	-	-	1
		C212.6	Develop transfer function of systems based on the knowledge of Mathematics, Science and Engineering fundamentals.	3	2	1	1	-	-	-	-	-	-	-	1

		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
5	**21EE211/ Integrated Circuits**	C213.1	Explain the steps involved in IC fabrication and characterization of Op-Amp	2	1	1	1	-	-	-	-	-	-	-	-
		C213.2	Outline the basic applications of Op-Amp.	2	2	1	1	-	-	-	-	-	-	-	-
		C213.3	Summarize the role of Op-Amp in wave generator, comparator and converter circuit.	2	2	1	1	-	-	-	-	-	-	-	-
		C213.4	Classify special ICs namely Timers, PLL circuits, regulator Circuits with their applications	2	1	1	1	-	-	-	-	-	-	-	-
		C213.5	Interpret the role of ICs in voltage regulator circuit.	2	1	1	1	-	-	-	-	-	-	-	-
		Course contribution		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6	**21EE212/ Microprocessors, Microcontrollers and Interfacing**	C214.1	Illustrate the Pin diagram & Architecture of 8086 microprocessor.	2	1	1	1	-	-	-	-	1	1	-	1
		C214.2	Interpret 8086 processor with interfacing devices.	2	1	1	1	-	-	-	-	1	1	-	1
		C214.3	Explain the Pin diagram & Architecture of 8051 microcontroller.	2	1	1	1	-	-	-	-	1	1	-	1
		C214.4	Outline the interfacing concepts of 8051 microcontroller.	2	1	1	1	-	-	-	-	1	1	-	1
		C214.5	Demonstrate the applications of 8051 microcontroller.	2	2	1	1	-	-	-	-	1	1	-	1
		Course contribution		**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	1	1	-	1
7	**21EE213/ Induction and Synchronous Machines Laboratory**	C215.1	Experiment with 3 phase alternators to find voltage regulation by EMF, MMF, ZPF and ASA methods.	3	2	1	1	-	-	-	-	1	1	-	1
		C215.2	Solve for direct axis reactance of salient pole alternator using slip test.	3	2	1	1	-	-	-	-	1	1	-	1
		C215.3	Develop the characteristics of V and Inverted V curves in synchronous motors	3	2	1	1	-	-	-	-	1	1	-	1
		C215.4	Identify the performance characteristics of single phase and three phase induction motor	3	2	1	1	-	-	-	-	1	1	-	1
		C215.5	Construct the characteristics of single phase	3	2	1	1	-	-	-	-	1	1	-	1

			and three phase induction motor													
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
8	**21EE214/ Integrated Circuits and Instrumentation Laboratory**	C216.1	Model adder, comparator, differentiator and integrator using IC 741.	3	2	1	1	1	-	-	-	1	1	-	1
		C216.2	Make use of linear ICs for verifying the function of voltage regulator, astable and mono-stable multivibrators	3	2	1	1	1	-	-	-	1	1	-	1
		C216.3	Build P, PI, PID controllers and compensators.	3	2	1	1	1	-	-	-	1	1	-	1
		C216.4	Solve for unknown passive elements using D.C and A.C Bridges.	3	2	1	1	1	-	-	-	1	1	-	1
		C216.5	Develop the characteristics of energy meter, transducers and converters.	3	2	1	1	1	-	-	-	1	1	-	1
		Course contribution		**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	1
III YEAR (Fifth semester)																
1	**21EE301 /Power System Analysis**	C301.1	Construct admittance matrix of the power system under steady state condition.	3	2	1	1	-	-	-	-	-	-	-	-
		C301.2	Apply Gauss-Seidel and Newton Raphson techniques for power flow analysis	3	2	1	1	-	-	-	-	-	-	-	-
		C301.3	Utilize Thevenin's theorem for symmetrical fault analysis	3	2	1	1	-	-	-	-	-	-	-	-
		C301.4	Solve Line to ground fault, Line to line fault and double line to ground faults using sequence networks	3	2	1	1	-	-	-	-	-	-	-	-
		C301.5	Make use of equal area criterion for stability problem in power system.	3	2	1	1	-	-	-	-	-	-	-	-
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2	**21EE302/ Power Electronics**	C302.1	Outline the characteristics of various power electronic switching devices.	2	1	1	1	-	-	-	-	-	-	1	1
		C302.2	Identify the performance parameters of phase controlled converters.	3	2	1	1	-	-	-	-	-	-	1	1

		C302.3	Explain the performance parameters for DC-DC converters and Switching regulator.	2	1	1	1	-	-	-	-	1	-	1	1
		C302.4	Develop the various PWM techniques applied to the inverters.	3	2	1	1	-	-	-	-	1	-	1	1
		C302.5	Model the single phase and three phase AC voltage controllers and cyclo converter.	3	2	1	1	-	-	-	-	-	-	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	-	-	-	1	-	**1**	**1**
3	**21EE303 / Digital Signal Processing**	C303.1	Explain the importance of Fourier transform, digital filters and DS Processors.	2	1	1	1	-	-	-	-	-	-	-	1
		C303.2	Summarize the knowledge on Signals and systems & their mathematical representation.	2	1	1	1	-	-	-	-	-	-	-	1
		C303.3	Illustrate the transformation techniques and their computation	2	1	1	1	-	-	-	-	-	-	-	1
		C303.4	Compare the types of filters and their design for digital implementation	2	1	1	1	-	-	-	-	-	-	-	1
		C303.5	Outline the various applications of digital signal processing	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		**2**	**1**	**1**	**1**	**-**	-	-	-	-	-	-	**1**
4	**21EE304 / Embedded Systems(Theory With Practical Course)**	C304.1	Explain the building blocks of embedded system.	2	1	1	-	1	-	-	-	2	-	-	-
		C304.2	Illustrate the interfacing of embedded network.	2	1	1	-	1	-	-	-	2	-	-	-
		C304.3	Summarize the various embedded development strategies	2	1	1	-	1	-	-	-	2	-	-	-
		C304.4	Develop the programs to interface memory, I/Os with processor.	2	1	1	-	1	-	-	-	2	-	-	-
		C304.5	Build the embedded system blocks for simple applications	2	1	1	-	1	-	-	-	2	-	-	-
		Course contribution		**2**	**1**	**1**	**-**	**1**	-	-	-	**2**	-	-	-
5	**21CS308/ C and Data**	C305.1	Develop C programs for simple applications using basic constructs and	3	2	1	1	1	-	-	-	-	-	-	1

	Structures		arrays.													
		C305.2	Construct C programs involving functions, recursion, pointers & structures.	3	2	1	1	1	-	-	-	-	-	-	1
		C305.3	Build abstract data types for linear data structures.	3	2	1	1	1	-	-	-	-	-	-	1
		C305.4	Categorize the different non-linear data structures to resolve problems.	3	3	2	2	1	-	-	-	-	-	-	1
		C305.5	Solve the problems using various sorting algorithms and hashing techniques.	3	3	2	2	1	-	-	-	-	-	-	1
		Course contribution		**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
5	**21PEE01/ Energy Utilization and Conservation**	CV101.1	Compare different illumination schemes.	2	1	1	1	-	-	-	-	-	-	-	1
		CV101.2	Outline the concepts of Refrigeration and Air conditioning	2	1	1	1	-	-	-	-	-	-	-	1
		CV101.3	Summarize various modes of heating and Welding with its applications	2	1	1	1	1	-	-	-	-	-	-	1
		CV101.4	Illustrate the choice of electric drives and the different characteristics of motor for traction	2	1	1	1	-	-	-	-	-	-	-	1
		CV101.5	Explain the various energy conservation methods	2	1	1	1	1	-	-	-	-	-	-	1
		Course contribution		**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**1**
6	**21PEE12/Special Electrical Machines**	CV204.1	Explain the performance of stepper motors.	2	1	1	1	-	-	-	-	-	-	-	1
		CV204.2	Illustrate characteristics and performance of synchronous reluctance motors.	2	1	1	1	-	-	-	-	-	-	-	1
		CV204.3	Demonstrate the controllers for switched reluctance motors.	2	1	1	1	-	-	-	-	-	-	-	1
		CV204.4	Summarize the performance and applications of permanent magnet brushless DC motors.	2	1	1	1	-	-	-	-	-	-	-	1
		CV204.5	Outline the performance and characteristics of permanent magnet synchronous motors	2	1	1	1	-	-	1	-	-	-	1	1

		Course contribution		**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**1**
7	**21PEE03 / Power Quality**	CV103.1	Explain the concepts of transients, sags and swells.	3	2	2	1	-	-	-	-	-	-	1	1
		CV103.2	Illustrate the voltage sag performance and its mitigation techniques.	3	2	2	1	-	-	-	-	-	-	1	1
		CV103.3	Summarize the effects of harmonics and distortions.	3	2	2	1	-	-	-	-	-	-	1	1
		CV103.4	Demonstrate the passive shunt compensators design.	3	2	2	1	-	-	-	-	-	-	1	1
		CV103.5	Outline the concepts of monitoring and diagnostic techniques of power quality problems.	3	2	2	1	-	-	-	-	-	-	1	1
		Course contribution		**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
8	**21EE305/ Power Electronics laboratory**	C306.1	Develop the characteristics curve of different switching devices.	3	2	1	1	-	-	-	-	1	1	-	1
		C306.1	Organize the operation of AC/DC fully and half controlled converters.	3	2	1	1	-	-	-	-	1	1	-	1
		C306.1	Solve the operation of switching devices in chopper circuits.	3	2	1	1	-	-	-	-	1	1	-	1
		C306.1	Make use of the output of inverters for different duty cycle.	3	2	1	1	-	-	-	-	1	1	-	1
		C306.1	Apply the power electronic circuits using suitable simulation tool.	3	2	1	1	-	-	-	-	1	1	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
III YEAR (Sixth semester)															
1	**21EE306 / Protection and Switchgear**	C308.1	Summarize Electromagnetic and Static Relays	2	1	1	1	-	-	-	-	-	-	-	1
		C308.2	Explain the causes of abnormal operating conditions of the apparatus and system	2	1	1	1	-	-	-	-	-	-	-	1
		C308.3	Outline the characteristics and functions of relays and protection schemes	2	1	1	1	-	-	-	-	-	-	-	1

		C308.4	Illustrate the apparatus protection, static and numerical relays	2	1	1	1	-	-	-	-	-	-	-	1
		C308.5	Interpret the knowledge on functioning and suitability of circuit breaker	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		**2**	**1**	**1**	**1**	-	-	-	-	-	-	-	**1**
2	**21EE307/ Renewable Energy Systems (TwP)**	C309.1	Summarize the different types of renewable energy sources	2	1	1	1	-	-	-	-	-	-	-	1
		C309.2	Explain the components and working principle of wind power plants	2	1	1	1	-	-	-	-	-	-	-	1
		C309.3	Illustrate the various types of solar thermal and solar PV systems	2	1	1	1	-	-	-	-	-	-	-	1
		C309.4	Classify the different types of hydro power plant and biomass plant	2	1	1	1	-	-	-	-	-	-	-	1
		C309.5	Outline the construction and working principle of renewable energy, storage system and hybrid energy sources.	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		2	1	1	1	-	-	-	-	-	-	-	1
3	**21EE308 / Control Systems and Electrical Drives**	C310.1	Build the characteristics of controllers.	3	2	1	1	-	-	-	-	1	1	-	1
		C310.2	Analyze the modeling of systems	3	2	1	1	-	-	-	-	1	1	-	1
		C310.3	Solve the characteristics of Compensators.	3	2	1	1	-	-	-	-	1	1	-	1
		C310.4	Experiment with the output of BLDC Motor drive using digital simulation.	3	2	1	1	-	-	-	-	1	1	-	1
		C310.5	Make use of speed control of the three phase induction motor drive using simulation.	3	2	1	1	1	-	-	-	1	1	-	1

		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
4	**21PEE04/ Restructured Power Systems**	CV104.1	Illustrate the restructuring of power industry.	2	1	1	1	-	1	1	1	-	-	1	1
		CV104.2	Outline the basics of various market models.	2	1	1	1	-	-	-	-	-	-	1	1
		CV104.3	Illustrate about fundamentals of economics in Restructured Power System.	2	1	1	1	-	1	1	-	-	-	1	1
		CV104.4	Explain the significance of pricing methods of transmission network.	2	1	1	1	-	1	1	1	-	-	1	1
		CV104.5	Compare the various power sectors in India and Ancillary System.	2	1	1	1	-	1	1	1	-	-	1	1
		Course contribution		2	1	1	1	-	1	1	1	-	-	1	1
5	**21PEE05/ Power System Transients**	CV105.1	Summarize the causes of transients in power system	2	1	1	1	-	-	-	-	-	-	-	1
		CV105.2	Outline the over voltages due to switching transients	2	1	1	1	-	-	-	-	-	-	-	1
		CV105.3	Explain the effect of lightning strokes in power system	2	1	1	1	-	-	-	-	-	-	-	1
		CV105.4	Interpret the concept of travelling waves in distributed lines	2	1	1	1	-	-	-	-	-	-	-	1
		CV105.5	Illustrate the transient performance of integrated power system with EMTP software	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
6	**21PEE09 / Modern Power Converters**	CV603.1	Interpret switched mode DC power supply for various industrial applications	2	1	1	1	-	-	-	-	-	-	-	-

		CV603.2	Explain the characteristics of Switched mode AC-DC converters with and without isolation.	3	2	1	1	-	-	-	-	-	-	-	-
		CV603.3	Summarize the different types of multilevel inverters.	2	1	1	1	-	-	-	-	-	-	-	-
		CV603.4	Outline the bidirectional switch with and without DC link.	3	2	1	1	-	-	-	-	-	-	-	-
		CV603.5	Illustrate the soft switching power converters with resonant DC link.	2	2	1	1	-	-	-	-	-	-	-	-
		Course contribution		**3**	**2**	**1**	**1**	**-**	-	-	-	-	-	-	-
7	**21PEE40 / Industrial Instrumentations**	CV201.1	Show the various methods used for measurement of force, torque and speed	2	1	1	1	-	-	-	-	-	-	-	-
		CV201.2	Summarize the operating principle of vibration, acceleration and density measurement.	2	1	1	1	-	-	-	-	-	-	-	-
		CV201.3	Outline working of viscosity, moisture and humidity measurement instrument	2	1	1	1	-	-	-	-	-	-	-	-
		CV201.4	Classify the devices used for temperature sensing.	2	1	1	1	-	-	-	-	-	-	-	-
		CV201.5	Explain the various methods used for pressure and vacuum measurement	2	1	1	1	-	-	-	-	-	-	-	-
		Course contribution		**2**	**1**	**1**	**1**	**-**	-	-	-	-	-	-	-
	21PEE07 / Energy Management	CV107.1	Demonstrate the need for energy management and auditing process	2	1	1	1	-	-	-	-	-	-	-	1
		CV107.2	Explain the load management and economic analysis performed in a system	2	1	1	1	-	-	-	-	-	-	-	1
		CV107.3	Outline the energy management concepts for electrical equipment and metering	2	1	1	1	-	-	-	-	-	-	-	1

			system													
		CV107.4	Classify various lighting systems and energy standards	2	1	1	1	-	-	-	-	-	-	-	1
		CV107.5	Interpret the performance assessment made on various utility systems	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		2	1	1	1	-	-	-	-	-	-	-	1
8	**21OAD01-Artificial Intelligence And Machine Learning (OE)**	CO1	Explain the fundamental concepts of intelligent agents, including their definition, nature, structure, and problem-solving capabilities.	3	2	3	3	-	-	-	-	1	3	3	3
		CO2	Apply uninformed and informed search techniques to solve various types of problems.	1	1	1	3	1	-	-	-	1	2	1	3
		CO3	Analyze the different approaches to machine learning, including classification, regression.	2	1	2	1	1	-	-	-	2	1	1	3
		CO4	**I**mplement supervised learning algorithms, such as neural networks, decision trees, and support vector machines	3	1	3	1	-	-	-	-	2	1	2	1
		CO5	Evaluate unsupervised learning algorithms, such as self-organizing maps and clustering algorithms, for their effectiveness in data analysis.	3	1	1	2	2	-	-	-	3	1	2	3
		Course contribution		**2**	**1**	**2**	**2**	**1**	-	-	-	**2**	**2**	**2**	**3**
IV year / VII semester																
1	**21EE401 /Power System Operation and Control**	C401.1	Build the various power system operation problems for different loading conditions.	3	2	1	1	-	1	1	1	-	-	1	1
		C401.2	Illustrate the need and importance of load frequency control.	2	1	1	1	-	-	-	-	-	-	1	1
		C401.3	Explain the various control actions for maintaining the voltage profile under dynamic loading conditions.	2	1	1	1	-	-	-	-	-	-	1	1
		C401.4	Solve the optimum scheduling and cost of generators using economic dispatch and unit commitment concepts.	3	2	1	1	-	1	1	-	-	-	1	1

		C401.5	Explain the various control actions for monitoring the Power system security.	2	1	1	1	-	-	1	-	-	-	1	1
		Course contribution		**2**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**-**	**-**	**1**	**1**
2	**21EE402 / Power System Simulation Lab**	C402.1	Model transmission line parameters	3	2	1	1	-	-	-	-	1	1	-	1
		C402.2	Develop the network matrices for the load flow and fault analysis	3	2	1	1	-	-	-	-	1	1	-	1
		C402.3	Solve for power flow using GS and NR method	3	2	1	1	-	-	-	-	1	1	-	1
		C402.4	Solve the small signal and transient stability problems during fault from the network matrix	3	2	1	1	-	-	-	-	1	1	-	1
		C402.5	Solve the load frequency dynamics and electromagnetic transient problems.	3	2	1	1	-	-	-	-	1	1	-	1
		Course contribution		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
3	**21EE403 / Project Phase I**	C403.1	Outline the problem identified in industries.	2	1	1	1	1	2	1	1	1	1	1	1
		C403.2	Experiment with the innovative techniques.	3	2	2	2	1	2	1	1	3	2	3	1
		C403.3	Make use of advanced tools for the solution.	3	2	2	2	1	2	1	1	3	2	3	1
		C403.4	Select a suitable method for implementation.	3	2	2	2	1	2	1	1	3	2	3	1
		C403.5	Analyze the developed prototype for future scope.	3	2	2	2	1	2	1	1	3	2	3	1
		Course contribution		**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**3**	**2**	**3**	**1**
4	**21PEE02/ Smart Grid (Honors)**	CV102.1	Illustrate the concepts of smart grid and its challenges	2	1	1	1	-	-	-	-	-	-	-	1
		CV102.2	Outline the various types of smart grid technologies.	2	1	1	1	-	-	-	-	-	-	-	1
		CV102.3	Compare the smart meters and	2	1	1	1	-	-	-	-	-	-	-	1

			advanced metering infrastructure													
		CV102.4	Explain about power quality management in smart grid.	2	1	1	1	-	-	-	-	-	-	-	1
		CV102.5	Develop the knowledge on LAN, WAN and cloud computing for smart grid applications	2	1	1	1	-	-	-	-	-	-	-	1
		Course contribution		**2**	**1**	**1**	**1**	-	-	-	-	-	-	-	**1**
5	**21PEE03 / Power Quality**	CV103.1	Explain the concepts of transients, sags and swells.	3	1	1	1	-	-	-	-	-	-	1	1
		CV103.2	Illustrate the voltage sag performance and its mitigation techniques.	3	1	1	1	-	-	-	-	-	-	1	1
		CV103.3	Summarize the effects of harmonics and distortions.	3	1	1	1	-	-	-	-	-	-	1	1
		CV103.4	Demonstrate the passive shunt compensators design.	3	1	1	1	-	-	-	-	-	-	1	1
		CV103.5	Outline the concepts of monitoring and diagnostic techniques of power quality problems.	3	1	1	1	-	-	-	-	-	-	1	1
		Course contribution		**3**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
6	**21PEE16/ Flexible AC Transmission System**	CV208.1	Outline the need for Flexible AC Transmission System (FACTS)controllers	2	1	1	1	-	-	-	-	-	-	-	1
		CV208.2	Summarize the applications of Static VAR Compensator (SVC) &Static Compensator (STATCOM).	2	1	1	1	-	-	-	-	-	-	-	1
		CV208.3	Illustrate the applications of Thyristor Controlled Series Capacitor (TCSC) and ThyristorSwitched Series Capacitor (TSSC).	2	1	1	1	-	-	-	-	-	-	-	1
		CV208.4	Interpret the operational characteristics of UPFC and Interline Power Flow Controllers	2	1	1	1	-	-	-	-	-	-	-	1
		CV208.5	Explain the special purpose FACTS controllers in power system	2	1	1	1	-	-	-	-	-	-	-	1

		Course contribution		**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	
7	**21PEE43/ SOFT COMPUTING**	CV606.1	Interpret the difference between supervised and unsupervised learning network	2	1	1	1	-	-	-	-	-	-	-	1	
		CV606.2	Outline the applications of artificial neural network	2	1	1	1	-	-	-	-	-	-	-	1	
		CV606.3	Explain fuzzy rule and membership functions	2	1	1	1	-	-	-	-	-	-	-	1	
		CV606.4	Summarize the fuzzy logic control made in various applications	2	1	1	1	-	-	-	-	-	-	-	1	
		CV606.5	Show the various applications of genetic algorithm	2	1	1	1	-	-	-	-	-	-	-	1	
		Course contribution		2	1	1	1	-	-	-	-	-	-	-	1	

3.1.2 (b) CO-PSO Matrices of courses selected in 3.1.1

The same procedures of giving weightage to POs are followed for PSOs. Table 3.1.2.1(b) provides the sample CO-PSO mapping for the same subjects described in section 3.1.1.

Table: 3.1.2.1(b) Sample CO-PSO Mapping for I year to IV year

I Year-Course Outcomes (odd semester)			Program specific outcomes	
			1	2
21EN101 Professional English	C101.1	Describe the listening and comprehending complex academic texts	-	-
	C101.2	Discuss on reading & inferring the denotative and connotative meanings of technical text	-	-
	C101.3	Construct definitions, descriptions, narrations and essays on various topics	-	-
	C101.4	Develop speaking fluently and accurately in formal and informal communicative context	-	-
	C101.5	Organize opinions to express effectively in both oral and written medium of communication	-	-
21MA101/ Matrices and calculus	C102.1	Apply eigen values to compute the inverse and positive powers of square matrix and use to diagonalise the given matrix by the concept of	3	-
	C102.2	Apply differential calculus tools in solving various application problems	3	-
	C102.3	Apply to use differential calculus ideas on several variable functions	3	-
	C102.4	Demonstrate and apply the techniques of integration	3	-
	C102.5	Apply integrals of multivariable to find areas enclosed between two curves and volume enclosed between surfaces	3	-
21PH101/ Engineering Physics	C103.1	Understand the importance of mechanics	-	-
	C103.2	Express their knowledge in electromagnetic waves	-	-
	C103.3	Demonstrate a strong foundational knowledge in oscillations, optics and Lasers	-	-
	C103.4	Understand the importance of quantum physics	-	-
	C103.5	Comprehend and apply quantum mechanical principles towards the formation of energy bonds	-	-
	C103.6	Illustrate the applications of fibre optic sensor with applications	-	-
21CH101/ Engineering Chemistry	C104.1	Infer the water from quality parameter data and propose suitable treatment methodologies to treat water	-	-
	C104.2	Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications	-	-
	C104.3	Apply the knowledge of phase rule and composite for material selection requirements	-	-

	C104.4	Recommend suitable fuels for engineering processes and applications	-	-
	C104.5	Recognize different forms of energy sources and apply them for suitable applications in energy sectors	-	-
	C104.6	Capacitate themselves for higher level cognizance	-	-
21CS101/ Problem Solving and Python Programming	C105.1	Develop algorithmic solutions to simple computational problems	-	-
	C105.2	Develop and execute simple Python programs	-	-
	C105.3	Write simple Python programs using conditionals and loops for solving	-	-
	C105.4	Decompose a Python program into functions	-	-
	C105.5	Represent compound data using Python lists, tuples, dictionaries	-	-
	C105.6	Read and write data from/to files in Python programs	-	-
	C105.7	Demonstrate a mini project by applying and analyzing the concepts learnt in the course for the given requirements.	-	-
21CS102/ Problem Solving and Python Programming Laboratory	C106.1	Develop algorithmic solutions to simple computational problems	-	-
	C106.2	Develop and execute simple Python programs.	-	-
	C106.3	Implement programs in Python using conditionals and loops for solving problems.	-	-
	C106.4	Deploy functions to decompose a Python program.	-	-
	C106.5	Process compound data using Python data structures	-	-
	C106.6	Utilize Python packages in developing software applications	-	-
21PC101/ Physics and Chemistry Laboratory	C107.1	Demonstrate the stress-strain behavior by uniform bending method	-	-
	C107.2	Illustrate Young's modulus of the material of cantilever using simple harmonic oscillations	-	-
	C107.3	Demonstrate the wavelength of the given Laser source of light using grating	-	-
	C107.4	Analyze the thickness of a thin wire testing using air wedge arrangement	-	-
	C107.5	Illustrate inertia of moment and inertia of rest and the modulus behind torsional pendulum	-	-
	C107.6	Analyze the wheatstone bridge to null deflection and determine the band gap of thermistor	-	-
	C107.7	Demonstrate the stress-strain behavior by non-uniform bending method		
I Year-Course Outcomes (second semester)				
21EN102/ English-II	C108.1	Read and interpret information critically in technical texts	-	-
	C108.2	Construct convincing job applications, resume and effective reports	-	-
	C108.3	Make use of the technical ideas effectively in spoken and written forms	-	-

	C108.4	Infer spoken language in lectures and talks	-	-
	C108.5	Utilize basic soft skills ideas in life	-	-
	C108.6	Summarize the extensive reading contents	-	-
21MA102/ Vector Calculus and Complex Variables	C109.1	Apply the concept of vector calculus in Engineering problems	-	-
	C109.2	Solve the Partial Differential Equations by using various techniques.	-	-
	C109.3	Construct an analytic function using their properties and discuss the transformations	-	-
	C109.4	Apply Cauchy theorem and Cauchy's integral formula to evaluate the given integral over the closed curve	-	-
	C109.5	Choose the suitable method to solve the given differential equation of first and second order.	-	-
21PH105/ Physics for Electrical Engineering	C110.1	Compare the basics of dielectric materials & insulation.	-	-
	C110.2	Infer the electrical & magnetic properties of materials & their applications in devices	-	-
	C110.3	Interpret the semiconductor physics & functioning of semiconductor devices	-	-
	C110.4	Summarize the optical properties of optoelectronic materials	-	-
	C110.5	Explain the basics of nanotechnology and nano devices	-	-
	C110.6	Develop a model characterizing optical effects	-	-
21ME101 / Engineering Graphics	C111.1	Construct the orthographic projections of points, straight lines and plane	3	2
	C111.2	Sketch the orthographic projections of solids.	3	2
	C111.3	Sketch the orthographic projections of sectioned solids and development	3	2
	C111.4	Construct the isometric and perspective projections of simple solids.	3	2
	C111.5	Sketch the orthographic projection of objects using free hand.	3	2
21EE101/ Electric Circuit Analysis	C113.1	Develop nodal equations and loop equation for electric circuits.	2	2
	C113.2	Apply network reduction techniques for linear and nonlinear circuits.	2	2
	C113.3	Solve network parameters and transient response for DC and AC	2	2
	C113.4	Make use of three phase balanced and unbalanced circuit connections for	2	2
	C113.5	Solve the frequency response of RLC circuits and coupled networks.	2	2
21CH102/ Environmental science	C113.1	Explain the concept, structure and function of an ecosystem	-	-
	C113.2	Demonstrate the environmental impacts of energy sources.	-	-
	C113.3	Select the suitable management method for solid wastes	-	-
	C113.4	Practice the suitable management method during disaster episode	-	-
	C113.5	Describe the Traditional values and Impact of modernization on Environment	-	-

	C113.6	Industrial Visit and report submission	-	-
21MC101/ Basic Civil and Mechanical engineering	C114.1	Understanding profession of Civil Engineering	-	-
	C114.2	Summarize the planning of materials used for construction of building and its process	-	-
	C114.3	Understanding the Manufacturing processes	-	-
	C114.4	Demonstrate the working principle of Power Plant and IC Engine	-	-
	C114.5	Elaborate the components of refrigeration and air conditioning cycle	-	-
21EM101 / Engineering Practices laboratory	C115.1	Construct the basic switch board wiring, fluorescent lamp wiring and staircase wiring using various electrical components	2	1
	C115.2	Make use of energy meter to measure energy and with electrical equipment to measure resistance	2	1
	C115.3	Identify the concepts of iron box wiring and fan regulator to study its construction, operation and repair	2	1
	C115.4	Develop the electronic circuit for soldering and testing using PCB board	2	1
	C115.5	Experiment with the study of Smartphone and assemble and dismantle of computer/laptop	2	1
	C115.6	Demonstrate the measurement of AC signal parameters using CRO	2	1
21EE102/ Electric Circuits Laboratory	C116.1	Apply basic circuit concepts using fundamental laws of electric circuits	1	1
	C116.2	Identify equivalent circuit parameters using network theorems	1	1
	C116.3	Solve for power and energy in AC circuits	1	1
	C116.4	Utilize the concept of resonance in electric circuits	1	1
	C116.5	Construct the electric circuit simulation using software packages	1	1
II Year-Course Outcomes (third semester)				
21MA202/ Transform Techniques and its Applications	C201.1	Evaluate the Laplace transform and inverse Laplace transform of differential functions	3	2
	C201.2	Apply Laplace transform technique to solve second order differential equations with elementary functions	3	2
	C201.3	Solve the given differential equations using Z transform	3	2
	C201.4	Evaluate the given integral using Fourier Transform Technique	3	2
	C201.5	Choose suitable fourier transform techniques to evaluate the given integral in wide variety of situations in Electrical Engineering	3	2
	Course contribution		3	2
21EE201 Field Theory	C202.1	Outline the basic mathematical concepts related to electromagnetic waves	2	1
	C202.2	Summarize the basic concepts of electrostatic fields, electrical potential, energy density capacitance and their applications	2	1

	C202.3	Infer the knowledge in magneto static fields, magnetic flux density, vector potential, inductance and its applications	2	1
	C202.4	Classify methods of EMF generation and Maxwell's equations of electrodynamic fields	2	1
	C202.5	Illustrate the basic concepts of electromagnetic waves and characterizing parameters	2	1
	Course contribution		2	1
21EE202 / DC Machines & Transformers	C203.1	Explain the magnetic-circuits	2	1
	C203.2	Build the knowledge in constructional details of transformers.	2	1
	C203.3	Develop the concepts of electromechanical energy conversion.	2	1
	C203.4	Show the working principle of DC Generator.	2	1
	C203.5	Illustrate the working principle of DC Motor.	2	1
	Course contribution		**2**	**1**
21EE203 Transmission and Distribution	C204.1	Outline the importance and the functioning of transmission line parameters.	2	1
	C204.2	Identify the performance of transmission lines based on the length and environmental aspects.	2	1
	C204.3	Explain the mechanical design of transmission lines and formation of corona.	2	1
	C204.4	Illustrate about the insulators and cables based on the transmission voltage capacity.	2	1
	C204.5	Compare the concepts of electric distribution system such as EHVAC, HVDC and FACTS.	2	1
	Course contribution		**2**	**1**
21EE204 Electronic Devices and Circuits	C205.1	Outline the structure, operation and V- I characteristics of various PN diodes.	2	1
	C205.2	Develop V-I characteristics of Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET).	2	1
	C205.3	Identify the transistor application as amplifiers	2	1
	C205.4	Infer the operation and characteristics and gain of multistage and differential amplifiers.	2	1
	C205.5	Summarize the operation of feedback amplifiers and oscillators with their applications.	2	1
	Course contribution		**2**	**1**
21EE205 Digital Logic Circuits	C206.1	Outline the various number systems and different logic families.	1	1
	C206.2	Build combinational logic circuits using basic gates and simplification using Karnaugh maps.	1	1
	C206.3	Model synchronous sequential circuits using flip flops.	1	1
	C206.4	Develop asynchronous sequential circuits using flip flops.	1	1
	C206.5	Explain the hardware functionality at system level using Programmable Logic device (PLD) and Hardware Description Language (HDL).	1	1
	Course contribution		**1**	**1**

21EE206 DC Machines and Transformers Laboratory	C207.1	Identify the performance characteristics of DC Generator.	2	1
	C207.2	Develop the performance characteristics of DC motor.	2	1
	C207.3	Experiment with DC machines to predetermine their performance.	2	1
	C207.4	Make use of speed control techniques in DC motors.	2	1
	C207.5	Build the performance characteristics of Transformers.	2	1
	Course contribution		**2**	**1**
21EE207 Electronic Devices and Digital Laboratory	C208.1	Identify the VI characteristics of semiconductor diodes. on and packing	2	1
	C208.2	Develop the VI characteristics of bipolar and unipolar devices.	2	1
	C208.3	Construct combinational circuits using basic gates.	2	1
	C208.4	Model synchronous and asynchronous counters using JK flip flop.	2	1
	C208.5	Build shift registers using delay flip flop.	2	1
	Course contribution		**2**	**1**
II Year-Course Outcomes (Fourth semester)				
21MA202/ Transform techniques And Its Applications	C209.1	Evaluate the Laplace Transform and Inverse Laplace Transform of differential functions	3	2
	C209.2	Apply Laplace transform technique to solve second order differential equations with elementary functions	3	2
	C209.3	Solve the given difference equations using Z transform	3	2
	C209.4	Evaluate the given integral using Fourier Transform techniques	3	2
	C209.5	Choose suitable Fourier Transform techniques to evaluate the give integral in wide variety of situations in Electrical Engineering	3	2
	Course contribution		**3**	**2**
21EE208 / Measurement and Instrumentation	C210.1	Outline the basic concepts about measurement of analog and digital meters.	2	1
	C210.2	Illustrate the fundamentals of electrical and electronic instruments.	2	1
	C210.3	Compare the various measurement techniques for resistance, inductance and capacitance measurement using bridges.	2	1
	C210.4	Summarize the concept of digital storage & display devices.	2	1
	C210.5	Illustrate the operation of transducers and data acquisition system.	2	1
	Course contribution		**2**	**1**
21EE209/ Induction and Synchronous Machines	C211.1	Build the performance characteristics of 3 phase induction motors.	3	1
	C211.2	Identify the method of starting, speed control and braking of 3 phase induction motors.	3	1
	C211.3	Explain the performance characteristics of single phase induction motors and basic characteristics of special machines.	2	1
	C211.4	Develop the performance characteristics of various types of alternators.	3	1

	C211.5	Show the performance characteristics of synchronous motors.	2	1
	Course contribution		**3**	**1**
21EE210/ Control Systems	C212.1	Develop transfer function of systems based on the knowledge of Mathematics, Science and Engineering fundamentals.	2	1
	C212.2	Apply the various time domain and frequency domain techniques to assess the system performance.	2	1
	C212.3	Identify the effect of various compensation in frequency domain.	2	1
	C212.4	Make use of knowledge about various stability techniques to different applications	2	1
	C212.5	Solve Controllability and Observability using state space representation	2	1
	Course contribution		**2**	**1**
21EE211/ Integrated Circuits	C211.1	Explain the steps involved in IC fabrication and characterization of Op-Amp	2	1
	C211.2	Outline the basic applications of Op-Amp.	2	1
	C211.3	Summarize the role of Op-Amp in wave generator, comparator and converter circuit.	2	1
	C211.4	Classify special ICs namely Timers, PLL circuits, regulator Circuits with their applications	2	1
	C211.5	Interpret the role of ICs in voltage regulator circuit.	2	1
	Course contribution		**2**	**1**
21EE212/ Microprocessors, Microcontrollers and Interfacing	C214.1	Illustrate the Pin diagram & Architecture of 8086 microprocessor.	2	1
	C214.2	Illustrate the Pin diagram & Architecture of 8086 microprocessor.	2	1
	C214.3	Interpret 8086processor with interfacing devices.	2	1
	C214.4	Explain the Pin diagram & Architecture of 8051 microcontroller.	2	1
	C214.5	Outline the interfacing concepts of 8051 microcontroller.	2	1
	Course contribution		**2**	**1**
21EE213/ Induction and Synchronous Machines Laboratory	C215.1	Experiment with 3 phase alternators to find voltage regulation by EMF, MMF, ZPF and ASA methods.	3	1
	C215.2	Solve for direct axis reactance of salient pole alternator using slip test.	3	1
	C215.3	Develop the characteristics of V and Inverted V curves in synchronous motors	3	1
	C215.4	Identify the performance characteristics of single phase and three phase induction motor	3	1
	C215.5	Construct the characteristics of single phase and three phase induction motor	3	1
	Course contribution		**3**	**1**
21EE214/ Integrated Circuits and	C214.1	Model adder, comparator, differentiator and integrator using IC 741.	2	1
	C214.2	Make use of linear ICs for verifying the function of voltage regulator, astable and mono-stable multivibrators.	2	1

Instrumentation Laboratory	C214.3	Build P, PI, PID controllers and compensators.	2	1
	C214.4	Solve for unknown passive elements using D.C and A.C Bridges.	2	1
	C214.5	Develop the characteristics of energy meter, transducers and converters.	2	1
	Course contribution		**2**	**1**
III Year-Course Outcomes (Fifth semester)				
21EE301 / Power System Analysis	C301.1	Construct admittance matrix of the power system under steady state condition.	2	1
	C301.2	Apply Gauss-Siedel and Newton Raphson techniques for power flow analysis .	2	1
	C301.3	Utilize Thevenin's theorem for symmetrical fault analysis .	2	1
	C301.4	Solve Line to ground fault, Line to line fault and double line to ground faults using sequence networks	2	1
	C301.5	Make use of equal area criterion for stability problem in power system.	2	1
	Course contribution		**2**	**1**
21EE302/ Power Electronics	C302.1	Outline the characteristics of various power electronic switching devices.	1	2
	C302.2	Identify the performance parameters of phase controlled converters.	1	2
	C302.3	Explain the performance parameters for DC-DC converters and Switching regulator.	1	2
	C302.4	Develop the various PWM techniques applied to the inverters.	1	2
	C302.5	Model the single phase and three phase AC voltage controllers and cyclo converter.	1	2
	Course contribution		**1**	**2**
21EE303 / Digital Signal Processing	C303.1	Explain the importance of Fourier transform, digital filters and DS Processors.	2	1
	C303.2	Summarize the knowledge on Signals and systems & their mathematical representation.	2	1
	C303.3	Illustrate the transformation techniques and their computation	2	1
	C303.4	Compare the types of filters and their design for digital implementation	2	1
	C303.5	Outline the various applications of digital signal processing	2	1
	Course contribution		**2**	**1**
21EE304/ Embedded Systems	C304.1	Explain the building blocks of embedded system.	2	2
	C304.2	Illustrate the interfacing of embedded network.	2	2
	C304.3	Summarize the various embedded development strategies	2	2
	C304.4	Develop the programs to interface memory, I/Os with processor.	3	3
	C304.5	Build the embedded system blocks for simple applications	3	3
	Course contribution		**2**	**2**

21CS308 C and Data Structures	C305.1	Develop C programs for simple applications using basic constructs and	-	-
	C305.2	Construct C programs involving functions, recursion, pointers &	-	-
	C305.3	Build abstract data types for linear data structures.	-	-
	C305.4	Categorize the different non-linear data structures to resolve problems.	-	-
	C305.5	Solve the problems using various sorting algorithms and hashing techniques.	-	-
	Course contribution		-	-
21PEE01/ Energy Utilization and Conservation	CV101.1	Compare different illumination schemes.	2	1
	CV101.2	Outline the concepts of Refrigeration and Air conditioning	2	1
	CV101.3	Summarize various modes of heating and Welding with its applications	2	1
	CV101.4	Illustrate the choice of electric drives and the different characteristics of motor for traction	2	1
	CV101.5	Explain the various energy conservation methods	2	1
	Course contribution		**2**	**1**
21PEE12/ Special Electrical Machines	CV204.1	Explain the performance of stepper motors.	2	1
	CV204.2	Illustrate characteristics and performance of synchronous reluctance motors.	2	1
	CV204.3	Demonstrate the controllers for switched reluctance motors.	2	1
	CV204.4	Summarize the performance and applications of permanent magnet brushless DC motors.	2	1
	CV204.5	Outline the performance and characteristics of permanent magnet synchronous motors	2	1
	Course contribution		2	1
21PEE03 / Power Quality	K2	Explain the concepts of transients, sags and swells.	1	1
	K2	Illustrate the voltage sag performance and its mitigation techniques.	1	1
	K2	Summarize the effects of harmonics and distortions.	1	1
	K2	Demonstrate the passive shunt compensators design.	1	1
	K2	Outline the concepts of monitoring and diagnostic techniques of power quality problems.	1	1
	Course contribution		**1**	**1**
21EE305/ Power Electronics Laboratory	K3	Develop the characteristics curve of different switching devices.	2	2
	K3	Organize the operation of AC/DC fully and half controlled converters.	2	2
	K3	Solve the operation of switching devices in chopper circuits.	2	2
	K3	Make use of the output of inverters for different duty cycle.	2	2

	K3	Apply the power electronic circuits using suitable simulation tool.	2	2
	Course contribution		**2**	**2**
III Year-Course Outcomes (Sixth semester)				
21EE306 / Protection and Switchgear	**K2**	Summarize Electromagnetic and Static Relays	2	1
	K2	Explain the causes of abnormal operating conditions of the apparatus and system	2	1
	K2	Outline the characteristics and functions of relays and protection schemes	2	1
	K2	Illustrate the apparatus protection, static and numerical relays	2	1
	K2	Interpret the knowledge on functioning and suitability of circuit breaker	2	1
	Course contribution		**2**	**1**
21EE307/ Renewable Energy Systems (TwP)	K2	Summarize the different types of renewable energy sources	1	1
	K2	Explain the components and working principle of wind power plants	1	1
	K2	Illustrate the various types of solar thermal and solar PV systems	1	1
	K2	Classify the different types of hydro power plant and biomass plant	1	1
	K2	Outline the construction and working principle of renewable energy storage system and hybrid energy sources.	1	1
	Course contribution		1	1
21EE308 / Control Systems and Electrical Drives	K3	Build the characteristics of controllers.	2	2
	K3	Analyze the modeling of systems	2	2
	K3	Solve the characteristics of Compensators.	2	2
	K3	Experiment with the output of BLDC Motor drive using digital simulation	2	2
	K3	Make use of speed control of the three phase induction motor drive using simulation.	2	2
	Course contribution		**2**	**2**
21PEE04/ Restructured Power Systems	K2	Illustrate the restructuring of power industry.	2	1
	K2	Outline the basics of various market models.	2	1
	K2	Illustrate about fundamentals of economics in Restructured Power System.	2	1
	K2	Explain the significance of pricing methods of transmission network.	2	1
	K2	Compare the various power sectors in India and Ancillary System.	2	1
	Course contribution		2	1
21PEE09 / Modern Power	**K2**	Interpret switched mode DC power supply for various industrial applications	1	2

Converters	**K3**	Explain the characteristics of Switched mode AC-DC converters with and without isolation.	1	2
	K2	Summarize the different types of multilevel inverters.	1	2
	K3	Outline the bidirectional switch with and without DC link.	1	2
	K2	Illustrate the soft switching power converters with resonant DC link.	1	2
	Course contribution		**1**	**2**
21PEE40 – Industrial Instrumentations	**K2**	Show the various methods used for measurement of force, torque and speed	1	2
	K2	Summarize the operating principle of vibration, acceleration and density measurement.	1	2
	K2	Outline working of viscosity, moisture and humidity measurement instrument	1	2
	K2	Classify the devices used for temperature sensing.	1	2
	K2	Explain the various methods used for pressure and vacuum measurement	1	2
	Course contribution		**1**	**2**
21PEE07 / Energy Management and Auditing	**K2**	Demonstrate the need for energy management and auditing process	2	1
	K2	Explain the load management and economic analysis performed in a system	2	1
	K2	Outline the energy management concepts for electrical equipment and metering system	2	1
	K2	Classify various lighting systems and energy standards	2	1
	K2	Interpret the performance assessment made on various utility systems	2	1
	Course contribution		**2**	**1**
21OAD01- Artificial Intelligence And Machine Learning (OE)	CO1	Explain the fundamental concepts of intelligent agents, including their definition, nature, structure, and problem-solving capabilities.	1	2
	CO2	Apply uninformed and informed search techniques to solve various types of problems.	2	3
	CO3	Analyze the different approaches to machine learning, including classification, regression.	1	1
	CO4	**I**mplement supervised learning algorithms, such as neural networks, decision trees, and support vector machines	2	2
	CO5	Evaluate unsupervised learning algorithms, such as self-organizing maps and clustering algorithms, for their effectiveness in data analysis.	2	1
	Course contribution		**2**	**2**
IV Year-Course Outcomes (Seventh semester)				

21EE401 /Power System Operation and Control	C401.1	Build the various power system operation problems for different loading conditions.	2	1
	C401.2	Illustrate the need and importance of load frequency control.	2	1
	C401.3	Explain the various control actions for maintaining the voltage profile under dynamic loading conditions.	2	1
	C401.4	Solve the optimum scheduling and cost of generators using economic dispatch and unit commitment concepts.	2	1
	C401.5	Explain the various control actions for monitoring the Power system security.	2	1
	Course contribution		**2**	**1**
21EE402 / Power System Simulation Lab	C402.1	Model transmission line parameters	2	2
	C402.2	Develop the network matrices for the load flow and fault analysis	2	2
	C402.3	Solve for power flow using GS and NR method	2	2
	C402.4	Solve the small signal and transient stability problems during fault from the network matrix	2	2
	C402.5	Solve the load frequency dynamics and electromagnetic transient problems.	2	2
	Course contribution		2	2
21EE403 / Project Phase I	C403.1	Outline the problem identified in industries.	2	1
	C403.2	Experiment with the innovative techniques.	3	1
	C403.3	Make use of advanced tools for the solution.	3	1
	C403.4	Select a suitable method for implementation.	3	1
	C403.5	Analyze the developed prototype for future scope.	3	1
	Course contribution		**3**	**1**
21PEE02/ Smart Grid (Honors)	CV102.1	Illustrate the concepts of smart grid and its challenges	2	1
	CV102.2	Outline the various types of smart grid technologies.	2	1
	CV102.3	Compare the smart meters and advanced metering infrastructure	2	1
	CV102.4	Explain about power quality management in smart grid.	2	1
	CV102.5	Develop the knowledge on LAN, WAN and cloud computing for smart grid applications	2	1
	Course contribution		**2**	**1**
21PEE03/ Power Quality	CV103.1	Explain the concepts of transients, sags and swells.	2	1
	CV103.2	Illustrate the voltage sag performance and its mitigation techniques.	2	1

	CV103.3	Summarize the effects of harmonics and distortions.	2	1
	CV103.4	Demonstrate the passive shunt compensators design.	2	1
	CV103.5	Outline the concepts of monitoring and diagnostic techniques of power quality problems.	2	1
	Course contribution		**2**	**1**
21PEE16/ Flexible AC Transmission System	CV208.1	Outline the need for Flexible AC Transmission System (FACTS) controllers	2	1
	CV208.2	Summarize the applications of Static VAR Compensator (SVC) & Static Compensator (STATCOM).	2	1
	CV208.3	Illustrate the applications of Thyristor Controlled Series Capacitor TCSC) and Thyristor Switched Series Capacitor (TSSC).	2	1
	CV208.4	Interpret the operational characteristics of UPFC and Interline Power Flow Controllers	2	1
	CV208.5	Explain the special purpose FACTS controllers in power system	2	1
	Course contribution		2	1
21PEE43/ Soft Computing Techniques and Applications	CV606.1	Interpret the difference between supervised and unsupervised learning network	2	1
	CV606.2	Outline the applications of artificial neural network	2	1
	CV606.3	Explain fuzzy rule and membership functions	2	1
	CV606.4	Summarize the fuzzy logic control made in various applications	2	1
	CV606.5	Show the various applications of genetic algorithm	2	1
	Course contribution		2	1

3.1.3 (a) Program Level Course-PO matrix of all courses including first year courses (10)

Table 3.1.3.1 (a) provides Course-PO Mappings for all courses of Autonomous Regulation 2021.

Table: 3.1.3.1(a) Course- PO Mapping for all Courses

S. No	Course code / Course Name	Course outcome	Program outcome											
			1	2	3	4	5	6	7	8	9	10	11	12
I YEAR-First semester														
1.	21EN101/ Professional English-I	C101	0	0	0	0	0	0	0	0	0	3	0	0
2.	21MA101/ Matrices and Calculus	C102	3	2	1	-	-	-	-	-	-	-	-	-
3.	21PH101/ Engineering Physics	C103	2	1	-	-	-	-	-	-	-	1	-	-
4.	21CH101/ Engineering Chemistry	C104	2	1	-	-	-	-	-	-	-	1	-	-
5.	21CS101/ Problem Solving and Python Programming	C105	3	2	1	1	1	-	-	1	-	1	1	1
6.	21CS102/ Problem Solving and Python Programming Laboratory	C106	3	3	1	1	2	-	-	1	-	1	-	1
7.	21PC101/ Physics and Chemistry Laboratory	C107	2	1	-	-	-	-	-	-	1	-	-	-
I YEAR-Second semester														
1.	21EN102/ English –II	C108	-	-	-	-	-	-	-	-	1	3	-	1
2.	21MA102/ Vector calculus and Complex Variables	C109	3	2	1	1	-	-	-	-	-	-	-	-
3.	21PH105/ Physics for Electrical Engineering	C110	2	1	-	-	-	-	-	-	-	1	-	-
4.	21ME101/ Engineering Graphics	C111	3	2	2	2	2	2	2	2	2	2	2	2
5.	21EE101/ Electric Circuit Analysis	C112	3	2	1	1	1	-	-	-	-	-	-	1
6.	21CH103/ Environmental Science	C113	2	1	-	-	-	3	3	2	2	2	-	-
7.	21MC101/ Basic Civil and Mechanical Engineering	C114	3	2	2	1	1	2	-	-	-	-	-	-

8.	21EM101/ Engineering Practices Laboratory	C115	3	2	1	1	-	-	-	-	1	1	-	1
9.	21EE102/ Electric Circuits Laboratory	C116	3	2	1	1	1	-	-	-	1	1	-	1
II YEAR- Third semester														
1.	21MA202/ Transform Techniques and its Applications	C201	3	3	3	2	1	-	-	-	-	-	-	-
2.	21EE201/ Field Theory	C202	3	2	1	1	-	-	-	-	-	-	-	1
3.	21EE202/ DC Machines and Transformers	C203	3	2	1	1	-	-	-	-	-	-	-	1
4.	21EE203/ Transmission and Distribution	C204	2	2	2	1	1	-	-	-	-	-	-	-
5.	21EE204/ Electronic Devices and Circuits	C205	2	1	1	1	-	-	-	-	-	-	-	-
6.	21EE205/ Digital Logic Circuits	C206	3	2	1	1	1	-	-	-	-	-	1	1
7.	21EE206/ DC Machines and Transformers Laboratory	C207	3	2	1	1	-	-	-	-	1	1	-	1
8.	21EE207/ Electronic Devices and Digital Laboratory	C208	3	2	1	1	-	-	-	-	1	-	1	-
II YEAR- Fourth semester														
1.	21MA207 / Statistics and Numerical Methods	C209	3	3	3	2	1	-	-	-	-	-	-	-
2.	21EE208/ Measurements and Instrumentation	C210	2	1	1	1	-	-	-	-	-	-	-	1
3.	21EE209/ Induction and Synchronous Machines	C211	3	2	1	1	-	-	-	-	-	-	-	1
4.	21EE210/ Control Systems	C212	3	2	1	1	-	-	-	-	-	-	-	1
5.	21EE211/ Integrated Circuits	C213	2	2	1	1	-	-	-	-	-	-	-	-
6.	21EE212/ Microprocessors, Microcontrollers and Interfacing	C214	2	2	1	1	1	-	-	-	1	1	-	1
7.	21EE213/ Induction and Synchronous Machines Laboratory	C215	3	2	1	1	-	-	-	-	1	1	-	1
8.	21EE214/ Integrated Circuits and Instrumentation Laboratory	C216	3	2	1	1	1	-	-	-	1	1	-	1
III YEAR- Fifth semester														
1.	21EE301/ Power System Analysis	C301	3	2	1	1	-	-	-	-	-	-	-	-
2.	21EE302/ Power Electronics	C302	3	2	1	1	-	-	-	-	1	-	1	1
3.	21EE303/ Digital Signal Processing	C303	2	1	1	1	-	-	-	-	-	-	-	1
4.	21EE304/ Embedded Systems	C304	2	1	1	-	1	-	-	-	2	-	-	-
5.	21CS308/ C and Data Structures	C305	3	3	2	2	1	-	-	-	-	-	-	1
6.	21PEE01/ Energy Utilization & Conservation	CV101	2	1	1	1	-	-	1	-	-	-	1	1
7.	21PEE12/ Special Electrical Machines	CV204	2	1	1	1	-	-	1	-	-	-	1	1
8.	21PEE03/ Power Quality	CV103	3	2	2	1	-	-	-	-	-	-	1	1
9.	21EE305/ Power Electronics Laboratory	C306	3	2	1	1	-	-	-	-	1	1	-	1
10.	21EN301/ Professional Communication Laboratory	C307												

III YEAR- Sixth semester														
1.	21EE306 / Protection and Switchgear	C308	2	1	1	1								1
2.	21EE307/Renewable Energy Systems (TwP)	C309	2	1	1	1	-	-	-	-	-	-	-	1
3.	21EE308 / Control Systems and Electrical Drives Laboratory	C310	3	2	1	1	-	-	-	-	1	1	-	1
4.	21PEE04/Restructured Power System	CV104	2	1	1	1	-	1	1	1	-	-	1	1
5.	21PEE05/ Power System Transients	CV105	2	1	1	1	-	-	-	-	-	-	-	1
6.	21PEE07 Energy Management and Auditing	CV107	2	1	1	1	-	-	-	-	-	-	-	1
7.	21PEE09 / Modern Power Converters	CV201	3	2	1	1	-	-	-	-	-	-	-	1
	21OAD01-Artificial Intelligence and Machine Learning (OE)		2	1	2	2	1	-	-	-	2	2	2	3
8.	21PEE40 / Industrial Instrumentations	CV603	2	1	1	1	-	-	-	-	-	-	-	2
IV YEAER – Seventh Semester														
1.	21EE401/ Power System Operation and Control	C401	2	1	1	1	-	1	1	1	-	-	1	1
2.	21EE402/ Power System Laboratory	C402	3	2	1	1	-	-	-	-	1	1	-	1
3.	21EE403/ Project Work I	C403	3	2	2	2	1	2	1	1	3	2	3	1
4.	21PEE02/ Smart Grid	CV102	2	1	1	1	-	-	-	-	-	-	-	1
5.	21PEE03/ Power Quality	CV103	3	1	1	1	-	-	-	-	-	-	1	1
6.	21PEE16/ Flexible AC Transmission System	CV208	2	1	1	1	-	-	-	-	-	-	-	1
7.	21PEE43 / Soct Computing Techniques and Applications	CV606	2	1	1	1	-	-	-	-	-	-	-	1

3.1.3 (b) Program level Course-PSO matrix of all courses including first year Courses (10)

Table 3.1.3.1(b) provides Course-PSO mapping for all courses ofAutonomous Regulation R2021

Table: 3.1.3.1 (b) Course PSO mapping for all Courses

I YEAR-First semester				
S.No.	**Course code / Course Name**	**Course outcome**	**Program Specific Outcomes (PSOs)**	
			1	2
1.	21EN101/ Professional English-I	C101	0	0
2.	21MA101/ Matrices and Calculus	C102	3	-
3.	21PH101/ Engineering Physics	C103	-	-
4.	21CH101/ Engineering Chemistry	C104	-	-
5.	21CS101/ Problem Solving and Python Programming	C105	-	-
6.	21CS102/ Problem Solving and Python Programming Laboratory	C106	-	-
7.	21PC101/ Physics and Chemistry Laboratory	C107	-	-

I YEAR- Second semester				
1.	21EN102/ English –II	C108	-	-
2.	21MA102/ Vector calculus and Complex Variables	C109	-	-
3.	21PH105/ Physics for Electrical Engineering	C110	-	-
4.	21ME101/ Engineering Graphics	C111	3	2
5.	21EE101/ Electric Circuit Analysis	C112	2	2
6.	21CH103/ Environmental Science	C113	-	-
7.	21MC101/ Basic Civil and Mechanical Engineering	C114	-	-
8.	21EM101/ Engineering Practices Laboratory	C115	2	1
9.	21EE102/ Electric Circuits Laboratory	C116	1	1
II YEAR-Third semester				
1.	21MA202/ Transform Techniques and its Applications	C201	3	2
2.	21EE201/ Field Theory	C202	3	2
3.	21EE202/ DC Machines and Transformers	C203	2	1
4.	21EE203/ Transmission and Distribution	C204	2	1
5.	21EE204/ Electronic Devices and Circuits	C205	2	1
6.	21EE205/ Digital Logic Circuits	C206	1	1
7.	21EE206/ DC Machines and Transformers Laboratory	C207	2	1
8.	21EE207/ Electronic Devices and Digital Laboratory	C208	2	1
II YEAR- Fourth semester				
1.	21MA207 / Statistics and Numerical Methods	C209	3	2
2.	21EE208/ Measurements and Instrumentation	C210	2	1
3.	21EE209/ Induction and Synchronous Machines	C211	3	1
4.	21EE210/ Control Systems	C212	2	1
5.	21EE211/ Integrated Circuits	C213	2	1
6.	21EE212/ Microprocessors, Microcontrollers and Interfacing	C214	2	1
7.	21EE213/ Induction and Synchronous Machines Laboratory	C215	3	1
8.	21EE214/ Integrated Circuits and Instrumentation Laboratory	C216	2	1
III YEAR- Fifth semester				
1.	21EE301/ Power System Analysis	C301	2	1
2.	21EE302/ Power Electronics	C302	1	2
3.	21EE303/ Digital Signal Processing	C303	2	1
4.	21EE304/ Embedded Systems	C304	2	2
5.	21CS308/ C and Data Structures	C305	-	-
6.	21PEE01/ Energy Utilization & Conservation	CV101	2	1
7.	21PEE12/ Special Electrical Machines	CV204	2	1
8.	21PEE03/ Power Quality	CV103	1	1
9.	21EE305/ Power Electronics Laboratory	C306	2	2
10	21EN301/ Professional Communication Laboratory	C307		
III YEAR- Sixth semester				
1.	21EE306 / Protection and Switchgear	C308	2	1

2.	21EE307/Renewable Energy Systems (TwP)	C309	1	1
3.	21EE308 / Control Systems and Electrical Drives Laboratory	C310	2	2
4.	21PEE05 / Power System Transients	CV105	2	1
5.	21PEE04/ Restructured Power System	CV104	2	1
6.	21PEE07/ Energy Management and Auditing	CV107	2	1
7.	21PEE40 / Industrial Instrumentations	CV201	1	2
8.	21OAD01-Artificial Intelligence and Machine Learning (OE)		2	2
9.	21PEE09 / Modern Power Converters	CV603	1	2
IV YEAER – Seventh Semester				
1.	21EE401/ Power System Operation and Control	C401	2	1
2.	21EE402/ Power System Laboratory	C402	2	2
3.	21EE403/ Project Work I	C403	3	1
4.	21PEE02 / Smart Grid	CV102	2	1
5.	21PEE03/ Power Quality	CV103	2	1
6.	21PEE16/ Flexible AC Transmission System CV208	CV208	2	1
7.	21PEE43 / Soct Computing Techniques and Applications	CV606	2	1

Velammal College of Engineering and Technology (Autonomous), Madurai – 625 009
Department of Electronics and Communication Engineering
VCET R2021-Curriculum

Programme Outcomes for all the courses offered in the department:

PO Number	List of Courses
PO1:	21MA101- Matrices & Calculus
	21PH101- Engineering Physics
	21CH101-Engineering Chemistry
	21CS101- Problem Solving and Python Programming
	21CS102- Problem Solving and Python Programming Lab
	21MA103- Sampling techniques and Numerical Methods
	21PH104- Physics for Electronics Engineering
	21ME101- Engineering Graphics
	21EC101- Electronic Devices
	21EC102- Circuit Analysis
	21CS105- C Programming
	21EM101-EngineeringPracticesLab
	21EC103- Electronic Devices & Circuits Lab
	21MA201- Transforms and Partial Differential Equations
	21EC201- Digital Principles and System design
	21EC202- Electronic Circuits-I
	21EC203- Signals & Systems
	21CS214- Object Oriented Programming and Data Structures
	21EC204- Linear Integrated Circuits(TwP)
	21EC205- Analog and Digital Circuits Lab
	21CS215-Object Oriented Programming and Data Structures Lab
	21MA206- Probability and Random Processes
	21CH103- Environmental Science
	21EC206- Electronic Circuits-II
	21EC207- Electromagnetic Fields
	21EC208- Microprocessors & Microcontrollers
	21EC209- Analog Communication (TwP)
	21EC210- Circuits Design and Simulation Lab
	21EC211- Microprocessors & Microcontrollers Lab
	21EC301- Digital Communication
	21EC302- Transmission Lines & RF Systems
	21EC303- Digital Signal Processing (TwP)
	21PEC50- Artificial Intelligence
	21PEC53- Machine Learning
	21PEC25- IOT Based System Design

	21PEC26- Control System for IOT Applications,
	21PEC27- Industrial and Industry 4.O
	21PEC34- Unmanned Aerial Vehicle and Drones
	21PEC07- Signal Integrity
	21PEC09- Digital Image Processing,
	21PEC43- Wide Band Gap Devices
	21MCC01- Constitution of India
	21EC304- Antennas & Wave Propagation
	21EC305- VLSI & Chip design
	21PCS21- Information Storage and Management
	21PCE20- Disaster Management
	21PME40- Entrepreneurship Development
	21PEE30- Renewable Energy
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC08- Stochastic Digital Signal Processing
	21PEC28-IoT for Smart Systems
	21PEC33- Remote Sensing
	21PEC44- ASIC Design
	21PEC52- Soft Computing Techniques
	21PEC02- RF MEMS
	21PEC10- Speech Processing
	21PEC23- MEMS Design
	21PEC30- Avionics
	21PEC51- Pattern Recognition
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC307- VLSI Design Lab
	21EC401- Microwave & Optical Engineering
	21PEC36- Wireless Communication
	21PEC29- Satellite Communication
	21PCE07- Green Building
	21PCE17- Solid Hazardous Waste Management
	21PME23- Enterprise Resource Planning
	21PIT16- Strategies Digital Marketing
	21PEC01- RF Transceiver
	21PEC55- Digital Forensics
	21PEC03- RF Test and Measurement
	21PEC22- Wireless Sensor Networks
	21PEC46- Design for Testability of VLSI Circuits
	21PEC06- Modern Antenna Design
	21PEC06- Modern Antenna Design
	21PEC14- Multimedia Compression Techniques
	21PEC47- Mixed Signal IC Design

	21EC403- Microwave & Optical Engineering Lab
	21PEC57- Mobile Communication
	21PEC24- Embedded and Real time Systems
PO2:	21MA101- Matrices & Calculus
	21PH101- Engineering Physics
	21CH101-Engineering Chemistry
	21CS101- Problem Solving and Python Programming
	21MA103- Sampling techniques and Numerical Methods
	21PH104- Physics for Electronics Engineering
	21ME101- Engineering Graphics
	21EC101- Electronic Devices
	21EC102- Circuit Analysis
	21CS105- C Programming
	21EM101- Engineering Practices Lab
	21EC103- Electronic Devices & Circuits Lab
	21MA201- Transforms and Partial Differential Equations
	21EC201- Digital Principles and System design
	21EC202- Electronic Circuits-I
	21EC203- Signals & Systems
	21CS214- Object Oriented Programming and Data Structures
	21EC204- Linear Integrated Circuits(TwP)
	21EC205- Analog and Digital Circuits Lab
	21CS215-Object Oriented Programming and Data Structures Lab
	21MA206- Probability and Random Processes
	21CH103- Environmental Science
	21EC206- Electronic Circuits-II
	21EC207- Electromagnetic Fields
	21EC208- Microprocessors & Microcontrollers
	21EC209- Analog Communication (TwP)
	21EC210- Circuits & Design Lab
	21EC211- Microprocessors & Microcontrollers Lab
	21EC301- Digital Communication
	21EC302- Transmission Lines & RF Systems
	21EC303- Digital Signal Processing (TwP)
	21PEC50- Artificial Intelligence

	21PEC53- Machine Learning
	21PEC25- IOT Based System Design
	21PEC26- Control System for IOT Applications
	21PEC27- Industrial and Industry 4.O
	21PEC34- Unmanned Aerial Vehicle and Drones
	21PEC07- Signal Integrity
	21PEC09- Digital Image Processing
	21PEC43- Wide Band Gap Devices
	21MCC01- Constitution of India
	21EC304- Antennas & Wave Propagation
	21EC305- VLSI & Chip design
	21PCS21- Information Storage and Management
	21PCE20- Disaster Management
	21PME40- Entrepreneurship Development
	21PEE30- Renewable Energy
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC08- Stochastic Digital Signal Processing
	21PEC28-IoT for Smart Systems
	21PEC33- Remote Sensing
	21PEC44- ASIC Design
	21PEC52- Soft Computing Techniques
	21PEC02- RF MEMS
	21PEC10- Speech Processing
	21PEC23- MEMS Design
	21PEC30- Avionics
	21PEC51- Pattern Recognition
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC307- VLSI Design Lab
	21EC401- Microwave & Optical Engineering
	21PEC36- Wireless Communication
	21PEC29- Satellite Communication
	21PCE07- Green Building
	21PCE17- Solid Hazardous Waste Management
	21PME23- Enterprise Resource Planning

	21PIT16- Strategies Digital Marketing
	21PEC01- RF Transceiver
	21PEC55- Digital Forensics
	21PEC03- RF Test and Measurement
	21PEC22- Wireless Sensor Networks
	21PEC46- Design for Testability of VLSI Circuits
	21PEC06- Modern Antenna Design
	21PEC14- Multimedia Compression Techniques
	21PEC47- Mixed Signal IC Design
	21EC403- Microwave & Optical Engineering Lab
	21PEC57- Mobile Communication
	21PEC24- Embedded and Real time Systems
PO3:	21CS101- Problem Solving and Python Programming
	21CS102- Problem Solving and Python Programming Lab
	21EC103- Electronic Devices & Circuits Lab
	21EC201- Digital Principles and System design
	21EC202- Electronic Circuits-I
	21EC203- Signals & Systems
	21CS214- Object Oriented Programming and Data Structures
	21EC204- Linear Integrated Circuits(TwP)
	21EC205- Analog and Digital Circuits Lab
	21CS215- Object Oriented Programming and Data Structures Lab
	21EC206- Electronic Circuits-II
	21EC207- Electromagnetic Fields
	21EC208- Microprocessors & Microcontrollers
	21EC209- Analog Communication (TwP)
	21EC210- Circuits & Design Lab
	21EC211- Microprocessors & Microcontrollers Lab
	21EC301- Digital Communication
	21EC302- Transmission Lines & RF Systems
	21EC303- Digital Signal Processing (TwP)
	21PEC50- Artificial Intelligence
	21PEC53- Machine Learning
	21PEC25- IOT Based System Design
	21PEC26- Control System for IOT Applications
	21PEC34- Unmanned Aerial Vehicle and Drones
	21PEC07- Signal Integrity
	21PEC09- Digital Image Processing
	21PEC43- Wide Band Gap Devices
	21EC304- Antennas & Wave Propagation

	21EC305- VLSI & Chip design
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC08- Stochastic Digital Signal Processing
	21PEC28-IoT for Smart Systems
	21PEC44- ASIC Design
	21PEC10- Speech Processing
	21PEC30- Avionics
	21PEC51- Pattern Recognition
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC307- VLSI Design Lab
	21EC401- Microwave & Optical Engineering
	21PEC36- Wireless Communication
	21PEC29- Satellite Communication
	21PEC55- Digital Forensics
	21PEC03- RF Test and Measurement
	21PEC22- Wireless Sensor Networks
	21PEC46- Design for Testability of VLSI Circuits
	21PEC06- Modern Antenna Design
	21EC401- Microwave & Optical Engineering
	21CS101- Problem Solving and Python Programming
	21CS102- Problem Solving and Python Programming Lab
	21EC102- Circuit Analysis
	21CS105- C Programming
	21EC103- Electronic Devices & Circuits Lab
	21EC202- Electronic Circuits-I
	21EC203- Signals & Systems
	21CS214- Object Oriented Programming and Data Structures
	21EC205- Analog and Digital Circuits Lab
	21CS215- Object Oriented Programming and Data Structures Lab
	21EC206- Electronic Circuits-II
	21EC208- Microprocessors & Microcontrollers
	21EC210- Circuits Design and Simulation Lab
	21EC211- Microprocessors & Microcontrollers Lab
	21EC301- Digital Communication
	21EC302- Transmission Lines & RF Systems
	21EC303- Digital Signal Processing (TwP)
	21PEC53- Machine Learning

PO4:	21PEC25- IOT Based System Design
	21PEC26- Control System for IOT Applications
	21PEC09- Digital Image Processing
	21PEC43- Wide Band Gap Devices
	21EC304- Antennas & Wave Propagation
	21EC305- VLSI & Chip design
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC08- Stochastic Digital Signal Processing
	21PEC28-IoT for Smart Systems
	21PEC10- Speech Processing
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC307- VLSI Design Lab
	21EC401- Microwave & Optical Engineering
	21PEC36- Wireless Communication
	21PEC29- Satellite Communication
	21PEC55- Digital Forensics
	21PEC03- RF Test and Measurement
	21PEC06- Modern Antenna Design
	21EC403- Microwave & Optical Engineering Lab
PO5:	21CS101- Problem Solving and Python Programming
	21CS102- Problem Solving and Python Programming Lab
	21CS105- C Programming
	21EC201- Digital Principles and System design
	21EC202- Electronic Circuits-I
	21CS214- Object Oriented Programming and Data Structures
	21EC205- Analog and Digital Circuits Lab
	21CS215- Object Oriented Programming and Data Structures Lab
	21EC208- Microprocessors & Microcontrollers
	21EC210- Circuits Design and Simulation Lab
	21EC211- Microprocessors & Microcontrollers Lab
	21EC301- Digital Communication
	21EC303- Digital Signal Processing (TwP)
	21PEC25- IOT Based System Design
	21PEC26- Control System for IOT Applications

	21PEC09- Digital Image Processing
	21EC304- Antennas & Wave Propagation
	21EC305- VLSI & Chip design
	21PEC28-IoT for Smart Systems
	21PEC52- Soft Computing Techniques
	21PEC30- Avionics
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC307- VLSI Design Lab
	21PEC29- Satellite Communication
	21PEC22- Wireless Sensor Networks
	21PEC06- Modern Antenna Design
PO6:	21EC101-Electronic devices
	21PEC50-Artificial Intelligence
	21PEC51-Pattern Recognition
	21PEC30-Avionics
	21PEC14-Multimedia compression techniques
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC03- RF Test and Measurement
PO7:	21EC101-Electronic devices
	21EC209-Analog Communication
	21PEC50-Artificial Intelligence
	21PEC26-Control System for IoT applications
	21PEC27-Industrial and Industry 4.0
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC52- Soft Computing Techniques
	21PEC51-Pattern Recognition
	21PEC29-Satellite Communication
	21PEC14-Multimedia compression techniques
	21PEC54- Deep Learning Techniques
PO8:	21CS215-Object Oriented Programming Lab
	21EC102-Circuit Analysis
	21CS101-Problem Solving and Python Programming
	21CS102-Problem Solving Python Programming Lab
	21EC204- Linear Integrated Circuits(TwP)

PO9:	21CS101- Problem Solving and Python Programming
	21CS102- Problem Solving and Python Programming Lab
	21EN101- Professional Communication Lab
	21EC102- Circuit Analysis
	21CS105- C Programming
	21EC103- Electronic Devices & Circuits Lab
	21EC201- Digital Principles and System design
	21EC202- Electronic Circuits-I
	21EC203- Signals & Systems
	21CS214- Object Oriented Programming and Data Structures
	21EC204- Linear Integrated Circuits(TwP)
	21EC205- Analog and Digital Circuits Lab
	21CS215- Object Oriented Programming and Data Structures Lab
	21EC206- Electronic Circuits-II
	21EC207- Electromagnetic Fields
	21EC208- Microprocessors & Microcontrollers
	21EC209- Analog Communication (TwP)
	21EC210- Circuits & Design Lab
	21EC211- Microprocessors & Microcontrollers Lab
	21EC302- Transmission Lines & RF Systems
	21EC303- Digital Signal Processing (TwP)
	21PEC50- Artificial Intelligence
	21PEC53- Machine Learning
	21PEC25- IOT Based System Design
	21PEC09- Digital Image Processing
	21PEC43- Wide Band Gap Devices
	21PEC34- Unmanned Aerial Vehicle and Drones
	21EC304- Antennas & Wave Propagation
	21EC305- VLSI & Chip design
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC08- Stochastic Digital Signal Processing
	21PEC44- ASIC Design
	21PEC10- Speech Processing
	21PEC30- Avionics
	21PEC51- Pattern Recognition

	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC307- VLSI Design Lab
	21EC401- Microwave & Optical Engineering
	21PEC36- Wireless Communication
	21PEC29- Satellite Communication
	21PEC03- RF Test and Measurement
	21PEC22- Wireless Sensor Networks
	21PEC06- Modern Antenna Design
	21EC403- Microwave & Optical Engineering Lab
	21PEC57-Mobile Communication
PO10:	21EN101- Professional Communication Lab
	21EN101- Professional English I
	21EN102- English-II
	21PH104- Physics for Electronics Engineering
	21PH101- Engineering Physics
	21CS101-Problem Solving and Python Programming
	21CS102-Problem Solving Python Programming Lab
	21CS105-C Programming
	21EC103- Electronic Devices & Circuits Lab
	21EC202- Electronic Circuits-I
	21EC203- Signals & Systems
	21CS214- Object Oriented Programming and Data Structures
	21CS215- Object Oriented Programming and Data Structures Lab
	21EC206- Electronic Circuits-II
	21EC207- Electromagnetic Fields
	21EC208- Microprocessors & Microcontrollers
	21EC209- Analog Communication (TwP)
	21EC210- Circuits & Design Lab
	21EC302- Transmission Lines & RF Systems
	21EC303- Digital Signal Processing (TwP)
	21PEC53- Machine Learning
	21PEC50-Artificial Intelligence
	21PEC09- Digital Image Processing
	21PEC34- Unmanned Aerial Vehicle and Drones

	21EC305- VLSI & Chip design
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC08- Stochastic Digital Signal Processing
	21PEC28-IoT for Smart Systems
	21PEC44- ASIC Design
	21PEC52-Soft Computing Techniques
	21PEC10-Speech Processing
	21PEC23- MEMS Design
	21PEC30- Avionics
	21PEC51- Pattern Recognition
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC401- Microwave & Optical Engineering
	21PEC36- Wireless Communication
	21PEC29- Satellite Communication
	21PEC03- RF Test and Measurement
	21PEC22- Wireless Sensor Networks
	21PEC06- Modern Antenna Design
	21PEC57-Mobile Communication
PO11:	21CS101-Problem Solving and Python Programming
	21CS102-Problem Solving Python Programming Lab
	21EC101-Electronic Devices
	21CS105-C Programming
	21PEC25-IoT Based System Design
	21PEC55-Digital Forensics
	21EC306-Communication Networks
	21EN102- English-II
	21CS101-Problem Solving and Python Programming
	21CS101-Problem Solving and Python Programming Lab
	21EC101-Electronic Devices
	21EC102- Circuit Analysis
	21CS105- C Programming
	21EC103- Electronic Devices & Circuits Lab
	21EC201- Digital Principles and System design
	21EC202- Electronic Circuits-I

PO12:	21EC203- Signals & Systems
	21EC204- Linear Integrated Circuits(TwP)
	21CS215-Object Oriented Programming and Data Structures Lab
	21EC302- Transmission Lines & RF Systems
	21PEC27- Industrial and Industry 4.O
	21PEC09- Digital Image Processing
	21PEC43- Wide Band Gap Devices
	21EC304- Antennas & Wave Propagation
	21EC305- VLSI & Chip design
	21PEC04- Electromagnetic Interference and Compatibility
	21PEC44- ASIC Design
	21PEC52-Soft Computing Techniques
	21PEC23- MEMS Design
	21PEC54- Deep Learning Techniques
	21EC306- Communication Networks(TwP)
	21EC401- Microwave & Optical Engineering
	21PEC29- Satellite Communication
	21PEC03- RF Test and Measurement
	21PEC22- Wireless Sensor Networks
	21PEC06- Modern Antenna Design
	21PEC14-Multimedia Compression Techniques

Programme outcomes and Course Outcomes for all the courses

Program Articulation Matrix															
Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
21IP101	IP	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21EN101	Professional English I	--	--	--	--	--	--	--	--	--	3	--	--	--	--
21MA101	Matrices & Calculus	3	2	--	--	--	--	--	--	--	--	--	--	--	--
21PH101	Engineering Physics	2	1	--	--	--	--	--	--	--	2	--	--	--	--
21CH101	Engineering Chemistry	2	1	--	--	--	--	1	1	--	1	--	1	--	--
21CS101	Problem Solving and Python Programming	3	2	1	1	1	--	--	2	3	3	1	1	--	--
21XXXX	Cambridge Course	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21CS102	Problem Solving and Python Programming Lab	3	2	1	1	1	--	--	2	2	2	1	1	--	--
21PC101	Physics & Chemistry Lab	2	1	--	--	--	--	--	--	1	--	--	--	--	--
21EN102	English-II	--	--	--	--	--	---	--	--	--	3	--	1	--	--
21MA103	Sampling techniques and Numerical Methods	3	2	--	--	---	---	---	---	--	--	---	--	--	--

21PH104	Physics for Electronics Engineering	2	1	--	--	--	---	--	--	--	1	--	--	--	--
21ME101	Engineering Graphics	3	2	2	2	1	-	-	-	-	2	-	-	2	1
21EC101	Electronic Devices	2	1	-	-	--	1	1	--	--	--	1	1	2	-
21EC102	Circuit Analysis	3	3	2	2	--	--	--	1	1	--	--	1	3	--
21CS105	C Programming	3	2	1	1	2	--	--	--	1	1	1	1	2	1
21EM101	Engineering Practices Lab	3	2	1	1	-	-	-	-	1	1	-	1	2	1
21EC103	Electronic Devices & Circuits Lab	3	2	1	1	---	---	---	---	2	1	---	1	3	1
21MA201	Transforms and Partial Differential Equations	3	2	--	--	---	---	---	---	--	--	---	--	--	--
21EC201	Digital Principles and System design	3	2	1	-	2	-	-	-	1	-	-	2	2	1
21EC202	Electronic Circuits-I	3	2	1	2	1	---	---	---	1	1	---	1	3	1
21EC203	Signals & Systems	3	2	1	1	--	---	---	---	1	1	---	1	3	--
21CS214	Object Oriented Programming and Data Structures	3	2	2	1	1	-	-	-	1	1	-	-	1	1
21XXXX	Microsoft Office Fundamentals	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21EC204	Linear Integrated Circuits(TwP)	2	1	1	--	--	--	--	1	1	--	--	1	2	2

21EC205	Analog and Digital Circuits Lab	3	2	1	1	2	---	---	---	2	---	---	---	--	--
21CS215	Object Oriented Programming and Data Structures Lab	3	2	1	1	1	--	-	1	2	2	-	1	1	1
21MA206	Probability and Random Processes	3	2	1	--	--	--	--	--	--	--	--	--	1	--
21CH103	Environmental Science	2	1	-	-	-	2	3	1	-	-	-	-	-	-
21EC206	Electronic Circuits-II	3	2	1	1	-	-	-	-	1	1	-	-	--	--
21EC207	Electromagnetic Fields	3	2	1	-	-	-	-	-	1	1	-	-	3	1
21EC208	Microprocessors & Microcontrollers	3	2	1	1	2	--	--	--	1	1	--	--	3	1
21EC209	Analog Communication (TwP)	3	2	1	-	1	-	1	-	1	1	-	-	--	--
21EC210	Circuits Design and simulation Lab	3	2	2	1	1	---	---	---	2	1	---	---	3	1
21EC211	Microprocessors & Microcontrollers Lab	3	2	1	1	1	-	---	-	2	-	-	-	3	1
21EC301	Digital Communication	2	1	1	1	1	---	---	---	-	-	---	-	2	--
21EC302	Transmission Lines & RF Systems	3	2	1	1	---	---	---	---	1	1	---	1	3	--
21EC303	Digital Signal	3	2	1	1	1	---	---	---	1	1	---	---	3	1

	Processing (TwP)														
21PEC50	Artificial Intelligence	3	2	1	---	---	1	1	---	1	1	---	----	2	--
21PEC53	Machine Learning	3	2	1	1	1	-	-	-	1	1	-	-		
21PEC25	IOT Based System Design	3	2	1	1	1	-	-	-	1	-	1	-	3	1
21PEC26	Control System for IOT Applications	3	2	1	1	-	-	1	-	-	-	-	1	2	1
21PEC27	Industrial and Industry 4.O	2	1	1	-	1	1	-	-	-	-	-	1	1	-
21PEC34	Unmanned Aerial Vehicle and Drones	3	2	1	-	-	-	-	-	1	1	-	-	1	1
21PEC07	Signal Integrity	3	2	1	-	-	-	-	-	1	1	-	-	1	1
21PEC09	Digital Image Processing	3	2	1	1	1	-	-	-	1	1	-	1	2	1
21PEC43	Wide Band Gap Devices	3	2	1	1	-	-	-	-	1	-	-	1	3	-
21MCC01	Constitution of India	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21EN101	Professional Communication Lab	--	--	--	--	--	--	--	--	1	3	--	--	--	--
21EC304	Antennas & Wave Propagation	3	2	2	2	1	--	--	--	1	--	--	1	3	1
21EC305	VLSI & Chip design	3	2	1	1	1	-	-	-	1	1	-	1	3	1

21PCS21	Information Storage and Management (OE)	3	2	1	--	--	--	--	--	--	--	--	--	1	--
21PCE20	Disaster Management (OE)	2	2	2	2	1	1	1	1	-	-	-	-	1	-
21PME40	Entrepreneurship Development (OE)	3	2	1	--	--	--	--	--	--	--	--	--	1	--
21PEE30	Renewable Energy (OE)	3	2	1	--	--	--	--	--	--	--	--	--	1	--
21PEC04	Electromagnetic Interference and Compatibility (Hons2)	2	1	1	1	-	1	1	-	1	1	-	1	3	1
21PEC08	Stochastic Digital Signal Processing (Hons2)	3	2	1	1	-	-	-	-	1	1	-	-	3	1
21PEC28	IoT for Smart Systems (Hons2)	3	2	1	1	1				1	1			2	2
21PEC33	Remote Sensing (Hons2)	3	2	1	--	--	--	--	--	--	--	--	--	1	--
21PEC44	ASIC Design (Hons2)	3	2	1	--	--	--	--	--	1	1	--	1	3	--
21PEC52	Soft Computing Techniques (Hons2)	3	1	-	--	1	--	1	--	1	1	--	2	1	2
21PEC02	RF MEMS (Hons3)	3	2	1	--	--	--	--	--	--	--	--	--	1	--
21PEC10	Speech Processing (Hons3)	2	1	1	1	-	-	-	-	1	1	-	-	2	--

21PEC23	MEMS Design (Hons3)	2	2	1	1	-	2	-	-	1	1	1	2	2	2
21PEC30	Avionics (Hons3)	2	1	1	-	1	1	-	-	1	1	-	-	--	--
21PEC51	Pattern Recognition (Hons3)	3	2	1	---	---	1	1	---	1	1	---	----	2	--
21PEC54	Deep Learning Techniques (Hons3)	3	2	1	1	1	--	1	--	1	1	--	2	2	1
21MCC02	Essence of Indian Traditional Knowledge	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21EC306	Communication Networks(TwP)	3	1	1	1	2	--	--	--	1	1	1	1	3	2
21EC307	VLSI Design Lab	3	3	2	1	2	-	--	--	1	-	--	-	3	2
21EC401	Microwave & Optical Engineering	3	2	1	1	--	--	--	--	1	1	--	1	2	1
21PEC36	Wireless Communication	2	1	1	1	--	--	--	--	1	1	--	--	2	--
21PEC29	Satellite Communication	2	1	1	1	2	---	1	---	1	1	---	1	2	-
21PCE07	Green Building	3	3	3	2	2	3	2	2	2	3	2	2	3	3
21PCE17	Solid Hazardous Waste Management	---	2	2	2	---	3	3	3	3	2	---	2	2	2
21PME23	Enterprise Resource Planning	3	2	2	2	2	--	--	--	--	--	--	--	2	--

21PIT16	Strategies Digital Marketing	3	2	2	2	2	--	--	--	--	--	--	--	2	--
21PEC01	RF Transceivers	3	2	1	1	--	--	--	--	--	--	1	--	3	-
21PEC55	Digital Forensics	3	2	1	1	--	--	--	--	--	--	1	--	3	-
21PEC03	RF Test and Measurement	3	2	1	1	--	1	-	-	1	1	-	1	2	1
21PEC22	Wireless Sensor Networks	3	1	2	---	1	-	-	-	1	1	-	1	2	1
21PEC46	Design for Testability of VLSI Circuits	2	1	1	---	--	--	--	--	--	--	--	--	2	--
21PEC06	Modern Antenna Design	3	2	1	1	1	-	-	---	1	1	--	1	2	1
21PEC14	Multimedia Compression Techniques	2	1	--	---	---	2	1	---	--	---	--	1	2	1
21PEC47	Mixed Signal IC Design	2	1	--	---	---	2	1	---	--	---	--	1	2	1
21EC403	Microwave & Optical Engineering Lab	3	2	1	1	-	-	-	-	1	-	-	-	3	1
21EC404	Project Work-I	--	--	--	---	---	---	---	---	--	--	---	---	--	---
21PEC57	Mobile Communication	2	1	--	---	---	---	---	---	1	1	---	---	2	---
21PEC24	Embedded and Real time Systems	3	2	1	1	1	--	--	--	1	1	1	1	3	1
21EC405	Project Work-II	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Programme outcomes and Course Outcomes for Individual Subjects

Course Name: Problem Solving and Python Programming
Course Code: 21CS101

Course Outcomes (COs) Code & Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	2	1	---	---	2	3	3	2	-	1	1
CO-2	3	2	1	2	1	---	---	2	3	3	2	-	1	1
CO-3	3	2	1	2	1	---	---	2	3	3	2	-	1	1
CO-4	3	2	1	3	1	---	---	2	3	3	2	1	1	1
CO-5	3	2	1	3	1	---	---	2	3	3	2	1	1	1
Course Contribution	3	2	1	1	1	---	---	2	3	3	1	1	1	1

Course Name: Problem solving and Python Programming Lab
Course Code: 21CS102

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	1	1	--	--	--	--	--	1	1	1	1
CO-2	2	1	--	--	1	--	--	--	--	--	1	1	3	2
CO-3	3	2	1	1	1	--	--	--	1	--	1	1	1	1
CO-4	3	2	1	1	1	--	--	--	2	--	1	1	1	1
CO-5	3	2	1	1	1	--	--	--	2	2	1	1	1	2
Course Contribution	3	2	1	1	1	--	--	--	1	1	1	1	2	2

Course Name: Electronic Devices **Course Code: 21EC101**

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	--	--	--	--	--	--	--	--	--	--	2	---
CO-2	2	1	--	--	--	--	--	--	--	--	--	--	2	--
CO-3	2	1	--	--	--	--	--	--	--	--	--	--	2	--
CO-4	2	1	--	--	--	1	1	--	--	--	1	1	2	--
CO-5	2	1	--	--	--	1	1	--	--	--	1	1	2	--
Course Contribution	2	1	--	--	--	1	1	--	--	--	1	1	2	--

.

Course Name: Circuit Analysis
CourseCode:21EC102

Course Outcomes(COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	---	---	---	---	---	---	---	---	3	--
CO-2	3	3	2	2	---	---	---	---	---	---	---	---	3	--
CO-3	3	3	2	2	---	---	---	---	---	---	---	---	3	--
CO-4	3	3	2	2	---	---	---	---	---	---	---	---	3	--
CO-5	2	3	2	2	---	---	---	---	---	---	---	---	2	1
Course Contribution	3	2	1	1	1	---	---	---	1	1	---	1	3	1

Course Name: Digital Principles and System Design
Course Code: 21EC201

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	-	-	-	-	-	1	-	-	2	3	-
CO-2	3	2	1	-	2	-	-	-	1	-	-	-	3	1
CO-3	3	2	1	-	2	-	-	-	1	-	-	2	3	1
CO-4	3	2	1	-	2	-	-	-	1	-	-	2	3	1
CO-5	3	2	1	-	2	-	-	-	1	-	-	2	3	1
Course Contribution	3	2	1	-	2	-	-	-	1	-	-	2	3	2

Course Name: Electronic Circuits-I
CourseCode:21EC202

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	--	--	--	--	1	1	--	--	3	--
CO-2	3	2	1	-	--	--	--	--	1	1	--	--	3	--
CO-3	3	2	1	--	--	--	--	--	1	1	--	--	3	--
CO-4	2	1	1	--	--	--	--	--	1	1	--	--	2	--
CO-5	3	3	2	2	1	--	--	--	--	--	--	1	3	1
Course Contribution	3	2	1	2	1	--	--	--	1	1	--	--	3	1

Course Name: Electromagnetic Fields Course Code: 21EC207

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	---	---	---	---	---	1	1	---	---	3	---
CO-2	3	2	1	---	---	---	---	---	1	1	---	---	3	1
CO-3	3	2	1	---	---	---	---	---	1	1	---	---	3	1
CO-4	3	1	---	---	---	---	---	---	---	---	---	---	3	---
CO-5	3	1	---	---	---	---	---	---	---	---	---	---	3	---
Course Contribution	3	2	1	---	---	---	---	---	1	1	---	---	3	1

Course Name: Microprocessor & Microcontroller
Course Code :21EC208

Course Outcomes (COs) code & Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-2	3	2	1	1	---	---	---	---	1	1	---	---	3	---
CO-3	3	2	1	1	2	---	---	---	1	1	---	---	3	---
CO-4	2	1	---	---	---	---	---	---	---	---	---	---	2	---
CO-5	3	2	1	1	2	---	---	---	---	---	---	---	3	2
Course Contribution	3	2	1	1	2	---	---	---	1	1	---	---	3	1

Course Name: Digital Communication
CourseCode:21EC301

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-2	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-3	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-4	2	1	---	---	1	---	---	---	1	1	---	---	2	---
CO-5	3	2	1	1	---	---	---	---	1	1	---	---	3	---
Course Contribution	2	1	1	1	1	---	---	---	1	1	---	---	2	---

Course Name: Transmission Lines and RF Systems
Course Code:21EC302

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	1	---	---	---	---	---	---	---	---	2	---
CO-2	2	1	1	1	---	---	---	---	---	---	---	---	2	---
CO-3	3	2	1	1	---	---	---	---	1	1	---	---	3	---
CO-4	3	2	1	1	---	---	---	---	1	1	---	1	3	---
CO-5	3	2	1	1	---	---	---	---	1	1	---	1	3	---
Course Contribution	3	2	1	1	---	---	---	---	1	1	---	1	3	---

Course Name: Antennas and Wave Propagation
Course Code :21EC304

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	2	2	---	---	---	---	---	---	---	---	2	---
CO-2	3	2	2	2	---	---	---	---	1	1	---	---	2	---
CO-3	3	2	2	2	1	---	---	---	1	1	---	---	3	1
CO-4	3	2	2	1	1	---	---	---	---	---	---	2	3	1
CO-5	3	2	---	1	---	---	---	---	---	---	---	2	3	---
Course Contribution	3	2	2	2	1	---	---	---	---	---	---	1	3	1

Course Name: VLSI and Chip Design
Course Code:21EC305

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	1	---	---	---	---	1	1	---	1	2	---
CO-2	3	2	1	1	2	---	---	---	1	1	---	1	3	2
CO-3	2	1	---	---	---	---	---	---	---	---	---	---	2	---
CO-4	3	2	1	1	---	---	---	---	1	1	---	1	3	1
CO-5	2	1	---	---	---	---	---	---	---	---	---	---	2	---
Course Contribution	3	2	1	1	1	---	---	---	1	1	---	1	3	1

Course Name: Microwave and Optical Engineering
CourseCode:21EC401

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	1	---	---	---	---	1	1	---	1	3	---
CO-2	2	1	1	1	---	---	---	---	---	---	---	1	2	---
CO-3	2	1	1	1	---	---	---	---	---	---	---	1	3	---
CO-4	3	2	1	1	---	---	---	---	---	---	---	1	3	---
CO-5	3	2	1	1	---	---	---	---	---	---	---	1	3	---
Course Contribution	3	2	1	1	---	---	---	---	1	1	---	1	3	---

Course Name: Wireless Communication
Course Code:21PEC36

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	1	---	---	---	---	1	1	---	---	2	---
CO-2	2	1	1	1	---	---	---	---	1	1	---	---	2	---
CO-3	2	1	1	1	---	---	---	---	1	1	---	---	2	---
CO-4	2	1	1	1	---	---	---	---	---	---	---	---	2	---
CO-5	2	1	1	1	---	---	---	---	---	---	---	---	2	---
Course Contribution	2	1	1	1	---	---	---	---	1	1	---	---	2	---

Course Name: Mobile Communication
Course Code:21EC402

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-2	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-3	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-4	2	1	---	---	---	---	---	---	1	1	---	---	2	---
CO-5	2	1	---	---	---	---	---	---	1	1	---	---	2	---
Course Contribution	2	1	---	---	---	---	---	---	1	1	---	---	2	---

Course Name: Embedded and Real time Systems
Course Code:21PEC24

Course Outcomes (COs) code& Statement	Program Outcomes(POs)												Program Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	-	-	-	-	-	-	-	-	-	2	---
CO-2	2	1	1	-	-	-	-	-	-	-	-	-	2	---
CO-3	2	1	1	-	-	-	-	-	-	-	-	-	2	---
CO-4	3	2	1	1	1	-	-	-	-	-	-	-	3	---
CO-5	3	2	1	1	1	-	-	-	1	1	1	1	3	1
Course Contribution	3	2	1	1	1	-	-	-	1	1	1	1	3	1