

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2021-22(CRITERIA- 2)

2.6.1 Program outcomes, program specific outcomes and course outcomes

Department of Civil Engineering

Program Outcomes (PO's)

PO 1: To apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

PO 2: To identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO 3: To design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: To use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO 5: To create, select and apply appropriate techniques, resources, and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of limitations.

PO 6: To apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO 7: To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO 8: To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO 9: To function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: To communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: To demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: To recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's)

PSO1: Capable to study, plan, analyse and design the civil engineering structures required for the professional demands.

PSO2: Utilize the appropriate software and related modern tools to develop skills to plan, produce detailed drawings, write specifications, and prepare cost estimates of civil engineering structures.

PSO3: Offer engineering services with professional, environmental and ethical responsibility.

Coarse Code	CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES - 21MAT31
CO1	To solve ordinary differential equations using Laplace transform.
CO2	Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
CO3	To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
CO4	To solve mathematical models represented by initial or boundary value problems involving partial differential equations
CO5	Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
Coarse Code	GEODETTIC ENGINEERING - 21CV32
CO1	Execute survey using compass and plane table
CO2	Find the level of ground surface and Calculation of area and volumes
CO3	Operate theodolite for field execution
CO4	Estimate the capacity of reservoir
CO5	Interpret satellite imageries
Coarse Code	STRENGTH OF MATERIALS - 21CV33
CO1	Evaluate the behavior when a solid material is subjected to various types of forces (namely Compressive, Tensile, Thermal, Shear, flexure, Torque, internal fluid pressure) and estimate stresses and corresponding strain developed. (L3)
CO2	Estimate the forces developed and draw schematic diagram for stresses, forces, moments for simple beams with different types of support and are subjected to various types of loads (L3).
CO3	Evaluate the behavior when a solid material is subjected to Torque and internal fluid pressure and estimate stresses and corresponding strain developed. (L3)
CO4	. Distinguish the behavior of short and long column and calculate load at failure & explain the behavior of spring to estimate deflection and stiffness (L3)
CO5	Examine and Evaluate the mechanical properties of various materials under different loading conditions
Coarse Code	EARTH RESOURCES AND ENGINEERING - 21CV34
CO1	Apply geological knowledge in different civil engineering practice.
CO2	Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials.
CO3	Competent enough to provide services for the safety, stability, economy and life of the structures that they construct
CO4	Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems
CO5	Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction.
Coarse Code	COMPUTER-AIDED BUILDING PLANNING AND DRAWING - 21CV35
CO1	Prepare, read and interpret the drawings in a professional set up.
CO2	Know the procedures of submission of drawings and Develop working and submission drawings for building.
CO3	Plan and design of residential or public building as per the given requirements.

Coarse Code	SOCIAL CONNECT AND RESPONSIBILITY– 21SCR33
CO1	The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversational will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.
Coarse Code	FIRE SAFETY IN BUILDINGS - 21CV385
CO1	Understand types of fire, combustion process and fire resistance
CO2	Plan for fire safety and design of lifts
CO3	Design flow network in buildings
CO4	Design of electrical systems and maintenance
CO5	Perform health evaluation of buildings and suggest remedies
Coarse Code	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS- 21MAT41
CO1	Use the concepts of an analytic function and complex potential to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid visualization and image processing
CO2	Obtain series solution of ordinary differential equation.
CO3	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statically data.
CO4	Apply discrete and continues probability distribution in analyzing the probability model arising in the engineering field.
CO5	Construct joint probability distribution and demonstration the validity of testing the hypothesis
Coarse Code	FLUID MECHANICS AND HYDRAULICS - 21CV42
CO1	Understand fundamental properties of fluids and solve problems on Hydrostatics
CO2	Apply Principles of Mathematics to represent Kinematics and Bernoulli's principles
CO3	Compute discharge through pipes, notches and weirs
CO3	Design of open channels of various cross sections
CO3	Design of turbines for the given data and understand their operation characteristics
Coarse Code	PUBLIC HEALTH ENGINEERING – 21CV43
CO1	Estimate average and peak water demand for a community.
CO2	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
CO3	Design the different units of water treatment plant
CO4	Understand and design the various units of wastewater treatment plant
CO5	Acquire capability to conduct experiments and estimate the concentration of different parameters and compare the obtained results with the concerned guidelines and regulations.
Coarse Code	ANALYSIS OF STRUCTURES - 21CV44
CO1	Evaluate slope and deflections in beams using geometrical methods.
CO2	Determine deflections in trusses and frames using energy principles.
CO3	Analyse arches and cables for stress resultants.

CO4	Apply slope deflection method in analysing indeterminate structures and construct bending moment diagram
CO5	Analyse continuous beams, frames and trusses using stiffness matrix method of analysis.
Coarse Code	EARTH RESOURCES AND ENGINEERING LABORATORY – 21BE45
CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies
CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3	Corroborate the concepts of biomimetics for specific requirements.
CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems
Coarse Code	EARTH RESOURCES AND ENGINEERING LABORATORY - 21CVL46
CO1	Comprehend the relations between minerals and rocks based on their physical properties
CO2	Assess the suitability of materials used in building construction
CO3	Differentiate geological investigations necessary for the construction of dams, bridges, and tunnels
CO4	Describe the groundwater investigation using resistivity methods
CO5	Understand the applications of Geospatial technology in Civil Engineering
Coarse Code	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS (CIP) - 21CIP47
CO1	Have constitutional knowledge and legal literacy.
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers.
Coarse Code	GREEN BUILDINGS - 21CV485
CO1	
Coarse Code	UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT- 21UHV49
CO1	Holistic vision of life
CO2	Socially responsible behaviour
CO3	Environmentally responsible work
CO4	Ethical human conduct
CO5	Having Competence and Capabilities for Maintaining Health and Hygiene
CO6	Appreciation and aspiration for excellence (merit) and gratitude for all
Coarse Code	HYDROLOGY AND WATER RESOURCE ENGINEERING- 21CV51
CO1	Provide a background in the theory of hydrological processes and their measurement
CO2	Estimate runoff and develop unit hydrographs.
CO3	Find the water requirement and frequency of irrigation for various crops.
CO4	Find the canal capacity and compute the reservoir capacity.
CO5	Analyse floods and droughts. Emphasise on the importance of conservation of water and water bodies.
Coarse Code	TRANSPORTATION ENGINEERING- 21CV52
CO1	Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.

CO2	Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction
CO3	Design road geometrics, structural components of pavement and drainage.
CO4	Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.
Coarse Code	DESIGN OF RC STRUCTURAL ELEMENTS- 21CV53
CO1	Understand the design philosophy and principles.
CO2	Solve engineering problems of RC elements subjected to flexure, shear and torsion.
CO3	Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
CO4	Owens professional and ethical responsibility.
Coarse Code	GEOTECHNICAL ENGINEERING– 21CV54
CO1	Determine the index properties of soil and hence classify the soil
CO2	Assess the compaction and consolidation characteristics of soil
CO3	Determine the permeability of soils and assess the seepage in hydraulic structures
CO4	Evaluate shear parameters of the soil using shear tests
CO5	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
Coarse Code	GEOTECHNICAL ENGINEERING LABORATORY- 21CVL55
CO1	Physical and index properties of the soil
CO2	Classify based on index properties and field identification
CO3	To determine OMC and MDD, plan and assess field compaction program
CO4	Shear strength and consolidation parameters to assess strength and deformation characteristics
CO5	In-situ shear strength characteristics(SPT-Demonstration)
Coarse Code	RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS– 21CV56
CO1	To know the meaning of engineering research.
CO2	To know the procedure of Literature Review and Technical Reading.
CO3	To know the fundamentals of patent laws and drafting procedure.
CO4	Understanding the copyright laws and subject matters of copyrights and designs
CO5	Understanding the basic principal of desiring Rights.
Coarse Code	ENVIRONMENTAL STUDIES – 21CIV57
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
Coarse Code	GENDER SENSITISATION - 21CV583

CO1	Appreciate gender issues prevalent in the society
CO2	Value the role of each gender in family, society and state.
CO3	Analyse the gender sensitivity at work place and evolve proper perception of the other gender
CO4	Sensitise oneself towards gender equality
Coarse Code	CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP – 21CV61
CO1	Understand various management principles of construction industry (L2)
CO2	Use planning, organizing, scheduling, monitoring and controlling techniques for managing construction activity (L4)
CO3	Understand importance of quality control and safety in construction.(L2)
CO4	Understand managing data pertaining to construction project. (L4)
CO5	Evaluate alternatives and develop capital budget for different scenarios.
Coarse Code	CONCRETE TECHNOLOGY – 21CV62
CO1	Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications (L2)
CO2	Design the concrete mix for the given materials as per IS:10262-2019 provisions (L4)
CO3	Understand the manufacturing process and assess the quality of green (L2)
CO4	Describe the properties of fresh and hardened concrete – Strength and Durability aspects (L3)
CO5	Examine and Evaluate properties of Cement and Concrete
Coarse Code	DESIGN OF STEEL STRUCTURAL ELEMENTS – 21CV63
CO1	Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
CO2	Understand the Concept of Bolted and Welded connections
CO3	Understand the Concept of Design of compression members, built-up columns and columns splices
CO4	Understand the Concept of Design of tension members, simple slab base and gusseted base.
CO5	Understand the Concept of Design of laterally supported and un-supported steel beams.
Coarse Code	DESIGN OF PRE-STRESSED CONCRETE STRUCTURES – 21CV641
CO1	Understand the requirement of PSC members for present scenario.
CO2	Analyse the stresses encountered in PSC element during transfer and at working.
CO3	Understand the effectiveness of the design of PSC after studying losses
CO4	Capable of analyzing the PSC element and finding its efficiency.
CO5	Design PSC beam for different requirements.
Coarse Code	APPLIED GEOTECHNICAL ENGINEERING - 21CV642
CO1	Ability to plan and execute geotechnical site investigation program for different civil engineering projects.
CO2	Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils.
CO3	Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures.
CO4	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure.

CO5	Capable of estimating load carrying capacity of single and group of piles.
Coarse Code	RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS - 21CV643
CO1	Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway
CO2	Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive
CO3	Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same
CO4	Apply the knowledge gained to conduct surveying, understand the tunnelling activities
Coarse Code	DESIGN CONCEPTS IN BUILDING SERVICES - 21CV644
CO1	Describe the basics of house plumbing and waste water collection and disposal.
CO2	Discuss the safety and guidelines with respect to fire safety.
CO3	Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
CO4	Understand and implement the requirements of thermal comfort in buildings
Coarse Code	GROUNDWATER HYDRAULICS(Elective) - 21CV645
CO1	Explain the importance of Groundwater
CO2	Paraphrasing the Characteristics of aquifers
CO3	Estimate the quantity of groundwater by various methods
CO4	Analyse the zones of groundwater resource
CO5	Analyse the quality of groundwater and understand Techniques of modeling
Coarse Code	ALTERNATE BUILDING MATERIALS - 21CV646
CO1	Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
CO2	Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
CO3	Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
CO4	Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.
Coarse Code	OCCUPATIONAL HEALTH AND SAFETY (Elective) - 21CV651
CO1	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
CO2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard
CO3	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
CO4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
CO5	Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.
Coarse Code	QUANTITY SURVEY AND CONTRACT MANAGEMENT - 21CV71
CO1	Develop the quantity estimates for different Civil Engineering structures, works & also communicate the cost abstract in a simple form to the stake holders.

CO2	Prepare specifications of various Civil Engineering Structures/works, also will be able to analyse the requirement of a structure /work to arrive at a specific cost for completion of the same.
CO3	Make use of minimum basic knowledge gained in this course to take up entrepreneurship/employment as a contractor.
Coarse Code	CONSTRUCTION TECHNOLOGY FOR SUBSTRUCTURE & SUPERSTRUCTURES– 21CV72
CO1	Select Appropriate technology for underground constructions.
CO2	Able to select appropriate pile construction method and testing of piles.
CO3	Able to select appropriate concreting practices for different constructions
CO4	Able to select appropriate underwater construction technology
Coarse Code	ADVANCED DESIGN OF RCC AND STEEL STRUCTURES (Elective) - 21CV731
CO1	Students will acquire the basic knowledge in design of RCC and Steel Structures.
CO2	Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.
Coarse Code	ADVANCED GEOTECHNICAL ENGINEERING (Elective) - 21CV732
CO1	Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria
CO2	Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles.
CO3	Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
CO4	Understand basics of analysis and design principles of machine foundations.
Coarse Code	PAVEMENT MATERIALS AND CONSTRUCTION (Elective) - 21CV733
CO1	Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS, IRC specifications
CO2	Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
CO3	Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
CO4	Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.
Coarse Code	SOLID WASTE MANAGEMENT (Elective) - 21CV734
CO1	Identify improper practices of solid waste disposal and their environmental implications. Know the basic engineering principles of solid waste management
CO2	Describe the need for economics in collection and transportation of solid waste and clearly discuss various types of collection systems and analyse system dynamics
CO3	Understand the management concepts, define 4 R approach, apply PPP model and community involvement for effective management of solid waste
CO4	Develop a concise idea on various conventional and advanced treatment options for solid waste

CO5	Conceive the design aspects of engineered disposal options and apply the gained knowledge
Coarse Code	GROUND IMPROVEMENT TECHNIQUES- 21CVL742
CO1	Give solutions to solve various problems associated with soil formations having less strength.
CO2	Use effectively the various methods of ground improvement techniques depending upon the requirements.
CO3	Utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures
Coarse Code	ENVIRONMENTAL PROTECTION AND MANAGEMENT- 21CV753
CO1	Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
CO2	Lead pollution prevention assessment team and implement waste minimization options
CO3	Develop, Implement, maintain and Audit Environmental Management systems for Organisations

Course Outcomes	ADVANCED STRUCTURAL ANALYSIS- 20CSE11
CO1	Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members
CO2	Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation
CO3	Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamental.
CO4	Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending
CO5	Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column
Course Outcomes	MATRIX METHODS OF STRUCTURAL ANALYSIS- 20CSE12
CO1	Formulate force displacement relation by flexibility and stiffness method
CO2	Analyze the plane trusses, continuous beams and portal frames by transformation approach
CO3	Analyse the structures by direct stiffness method
Course Outcomes	Advanced design of RCC structures - 20CSE13
CO1	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the principles of Structural Design
CO3	Design and develop analytical skills.
CO4	Summarize the principles of Structural Design and detailing
CO5	Understands the structural performance.
Course Outcomes	MECHANICS OF DEFORMABLE BODIES - 20CSE14
CO1	Achieve Knowledge of design and development of problem solving skills
CO2	Understand the principles of stress-strain behaviour of continuum
CO3	Design and develop analytical skills
CO4	Describe the continuum in 2 and 3- dimensions
CO5	Understand the concepts of elasticity and plasticity.
Course Outcomes	STRUCTURAL DYNAMICS – 20CSE15
CO1	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the principles of Structural Dynamics
CO3	Design and develop analytical skills.
CO4	Summarize the Solution techniques for dynamics of Multi-degree freedom systems
CO5	Understand the concepts of damping in structures.
Course Outcomes	Structural engineering lab 1 -20CSEL16
CO1	Achieve Knowledge of design and development of experimenting skills.
CO2	Understand the principles of design of experiments
CO3	Design and develop analytical skills.
CO4	Summarize the testing methods and equipments.
Course Outcomes	RESEARCH METHODOLOGY AND IPR -20RMI17
CO1	Discuss research methodology and the technique of defining a research problem

CO2	Explain the functions of the literature review in research, carrying out a literature search, developing
CO3	Explain various research designs and their characteristics.
CO4	Explain the art of interpretation and the art of writing research reports
CO5	Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR
Course Outcomes	ADVANCED DESIGN OF STEEL STRUCTURES - 20CSE21
CO1	Able to understand behavior of Light gauge steel members
CO2	Able to understand design concepts of cold formed/unrestrained beams
CO3	Able to understand Fire resistance concept required for present days.
CO4	Able to analyze beam column behavior
Course Outcomes	FINITE ELEMENT METHOD OF ANALYSIS - 20CSE22
CO1	Explain the basic theory behind the finite element method.
CO2	Formulate force-displacements relations for 2-D elements
CO3	Use the finite element method to analyze real structures.
CO4	Use a Finite Element based program for structural analysis
Course Outcomes	EARTHQUAKE RESISTANT STRUCTURES - 20CSE23
CO1	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the principles of engineering seismology and concepts of earthquake resistance of reinforced concrete buildings.
CO3	Design and develop analytical skills.
CO2	Understand the concepts of earthquake resistance of reinforced concrete buildings.
CO4	Summarize the Seismic evaluation and retrofitting of structures.
Course Outcomes	ADVANCED DESIGN OF PRE- STRESSED CONCRETE STRUCTURES (Elective 1) - 20CSE242
CO1	Analyse , Design and detail PSC elements
Course Outcomes	ADVANCED STRUCTURAL ANALYSIS (Elective 2) - 18CSE251
CO1	Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members
CO2	Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation
CO3	Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamental
CO4	Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending
CO5	Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column
Course Outcomes	DESIGN OF TALL STRUCTURES (Elective 2) - 20CSE252
CO1	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the principles of strength and stability
CO3	Design and develop analytical skills.
CO4	Summarize the behavior of various structural systems.
CO5	Understand the concepts of P-Delta analysis

Course Outcomes	STRUCTURAL ENGINEERING LAB-2 -20CSEL26
CO1	Achieve Knowledge of design and development of programming skills.
CO2	Understand the principles of structural analysis and design
CO3	Design and develop analytical skills
CO4	Summarize the performance of structures for static and dynamic forces.
Course Outcomes	DESIGN OF BRIDGES - 20CSE31
CO1	Describe historical growth, select ideal site and bridge, calculate values of design parameters of slab culvert at critical section as per IRC, design and detailing required for the execution of the project.
CO2	Carry out analysis of box culvert as per IRC to obtain the values of design parameters and to design and detail the components following IS code procedure.
CO3	Demonstrate the use of Pigeauds Method and Courbon's Method in the analysis of T beam bridge as per IRC, design to obtain the safe dimensions various components, optimum reinforcement required following IS code procedure.
CO4	Display the use of Courbon's Method in the analysis of PSC bridge as per IRC, design to obtain the safe value of pre stressing force, obtain the dimensions of various components to keep the stresses within codal provisions following IS code procedure.
CO 5	Analysis a balanced cantilever bridge as per IRC and to obtain the safe values of design parameters and to design and detail the components as per IS code procedure
Course Outcomes	DESIGN CONCEPTS OF SUBSTRUCTURES (Elective- 1) - 20CSE321
CO1	Achieve Knowledge of design and development of problem solving skills
CO2	Understand the principles of subsoil exploration
CO3	Design and develop analytical skills.
CO4	Understand the concepts of Settlement analysis.
Course Outcomes	FRACTURE MECHANICS APPLIED TO CONCRETE (Elective 2) - 20CSE331
CO1	Apply principles of fracture mechanics.
CO2	Design concrete structures using fracture mechanics approach.
CO3	Explain the importance of fracture mechanics.
CO4	Take special care of very large sized structures
Course Outcomes	PROJECT WORK PHASE -2 - 20CSE41

**COs of All Programs**

CIVIL ENGINEERING	
Course Code	TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES - 18MAT31
C01	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
C02	Demonstrate Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
C03	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
C04	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
C05	Determine the external of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
Course Code	STRENGTH OF MATERIALS - 18CV32
C01	To evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements.
C02	To evaluate the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
C03	To analyse different internal forces and stresses induced due to representative loads on structural elements.
C04	To evaluate slope and deflections of beams.
C05	To evaluate the behaviour of torsion members, columns and struts.
Course Code	FLUIDS MECHANICS - 18CV33
C01	Possess a sound knowledge of fundamental properties of fluids and fluid continuum
C02	Compute and solve problems on hydrostatics, including practical applications
C03	Apply principles of mathematics to represent kinematic concepts related to fluid flow
C04	Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
C05	Compute the discharge through pipes and over notches and weirs
Course Code	SBUILDING MATERIALS AND CONSTRUCTION - 18CV34
C01	Select suitable materials for buildings and adopt suitable construction techniques.
C02	Decide suitable type of foundation based on soil parameters
C03	Supervise the construction of different building elements based on suitability
C04	Exhibit the knowledge of building finishes and form work requirements
Course Code	BUILDING MATERIALS AND CONSTRUCTION - 18CV34

CO1	Select suitable materials for buildings and adopt suitable construction techniques.
CO2	Decide suitable type of foundation based on soil parameters
CO3	Supervise the construction of different building elements based on suitability
CO4	Exhibit the knowledge of building finishes and form work requirements
Course Code	BASIC SURVEYING - 18CV35
CO1	Posses a sound knowledge of fundamental principles Geodetics
CO2	Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
CO3	Capture geodetic data to process and perform analysis for survey problems
CO4	Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours
Course Code	ENGINEERING GEOLOGY - 18CV36
CO1	Apply geological knowledge in different civil engineering practice.
CO2	Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials.
CO3	Civil Engineers are competent enough for the safety, stability, economy and life of the structures that they construct.
CO4	Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems.
CO5	Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering construction.
Course Code	COMPUTER AIDED BUILDING PLANNING AND DRAWING - 18CVL37
CO1	Prepare, read and interpret the drawings in a professional set up.
CO2	Know the procedures of submission of drawings and Develop working and submission drawings for building.
CO3	Plan and design aresidential or public building as per the given requirements.
Course Code	BUILDING MATERIALS TESTING LABORATORY - 18CVL38
CO1	Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
CO2	Identify, formulate and solve engineering problems of structural elements subjected to flexure.
CO3	Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.
Course Code	ADDITIONAL MATHEMATICS – I 18MATDIP31
CO1	Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
CO2	Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
CO3	Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
CO4	Learn techniques of integration including the evaluation of double and triple integrals.
CO5	Identify and solve first order ordinary differential equations.
Course Code	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHOD 18CV41
CO1	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.

CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
CO4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.
Course Code	ANALYSIS OF DETERMINATE STRUCTURES - 18CV42
C01	Identify different forms of structural systems.
CO2	Construct ILD and analyse the beams and trusses subjected to moving loads
CO3	Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and beams.
CO4	Determine the stress resultants in arches and cables.
Course Code	APPLIED HYDRAULICS - 18CV43
C01	Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
CO2	Design the open channels of various cross sections including economical channel sections
CO3	Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
CO4	Compute water surface profiles at different conditions
CO5	Design turbines for the given data, and to know their operation characteristics under different operating conditions
Course Code	CONCRETE TECHNOLOGY - 18CV44
C01	Relate material characteristics and their influence on microstructure of concrete.
C02	Distinguish concrete behavior based on its fresh and hardened properties.
C03	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
C04	Adopt suitable concreting methods to place the concrete based on requirement.
C05	Select a suitable type of concrete based on specific application.
Course Code	ADVANCED SURVEYING - 18CV45
C01	Apply the knowledge of geometric principles to arrive at surveying problems
CO2	Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
CO3	Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments
CO4	Design and implement the different types of curves for deviating type of alignments.
Course Code	WATER SUPPLY AND TREATMENT ENGINEERING - 18CV46
C01	Estimate average and peak water demand for a community.
C02	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
C03	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
C04	Design a comprehensive water treatment and distribution system to purify and distribute water The required quality standards.

Course Code	ENGINEERING GEOLOGY LABORATORY - 18CVL47
C01	The students able to identify the minerals, rocks and utilize them effectively in civil engineering practices.
C02	The students will interpret and understand the geological conditions of the area for implementation of civil engineering projects.
C03	The students will interpret subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
C04	The students will learn the techniques in the interpretation of LANDSAT Imageries to find out the lineaments and other structural features for the given area.
C05	The students will be able to identify the different structures in the field.
Course Code	FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY - 18CVL48
C01	Properties of fluids and the use of various instruments for fluid flow measurement.
C02	Working of hydraulic machines under various conditions of working and their characteristics.
Course Code	ADDITIONAL MATHEMATICS – II 18MATDIP41
C01	Solve systems of linear equations using matrix algebra.
C02	Apply the knowledge of numerical methods in modelling and solving of engineering problems.
C03	Apply the knowledge of numerical methods in modelling and solving of engineering problems.
C04	Classify partial differential equations and solve them by exact methods.
C05	Apply elementary probability theory and solve related problems.
Course Code	CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP - 18CV51
C01	Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.
CO2	Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.
CO3	Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
CO4	Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.
Course Code	ANALYSIS OF INDETERMINATE STRUCTURES - 18CV52
C01	Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope deflection method
CO2	Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
CO3	Construct the bending moment diagram for beams and frames by Kani's method.
	Construct the bending moment diagram for beams and frames using flexibility method
CO4	Analyze the beams and indeterminate frames by system stiffness method.
Course Code	DESIGN OF RC STRUCTURAL ELEMENTS - 18CV53
C01	Understand the design philosophy and principles.
CO2	Solve engineering problems of RC elements subjected to flexure, shear and torsion.
CO3	Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
CO4	Owns professional and ethical responsibility.

Course Code	BASIC GEOTECHNICAL ENGINEERING - 18CV54
CO1	Ability to plan and execute geotechnical site investigation program for different civil engineering projects
CO2	Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
CO3	Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
CO4	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
CO5	Capable of estimating load carrying capacity of single and group of piles
Course Code	MUNICIPAL WASTEWATER ENGINEERING - 18CV55
CO1	Select the appropriate sewer appurtenances and materials in sewer network.
CO2	Design the sewers network and understand the self purification process in flowing water.
CO3	Design the various physico-chemical treatment units
CO4	Design the various biological treatment units
CO5	Design various AOPs and low cost treatment units.
Course Code	HIGHWAY ENGINEERING - 18CV56
CO1	Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
CO2	Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
CO3	Design road geometrics, structural components of pavement and drainage.
CO4	Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.
Course Code	SURVEYING PRACTICE - 18CVL57
CO1	Apply the basic principles of engineering surveying and for linear and angular measurements.
CO2	Comprehend effectively field procedures required for a professional surveyor.
CO3	Use techniques, skills and conventional surveying instruments necessary for engineering practice.
Course Code	CONCRETE AND HIGHWAY MATERIALS LABORATORY - 18CVL58
CO1	Able to interpret the experimental results of concrete and highway materials based on laboratory tests.
CO2	Determine the quality and suitability of cement.
CO3	Design appropriate concrete mix Using Professional codes.
CO4	Determine strength and quality of concrete.
CO5	Evaluate the strength of structural elements using NDT techniques.
CO6	Test the soil for its suitability as sub grade soil for pavements.
Course Code	DESIGN OF STEEL STRUCTURAL ELEMENTS - 18CV61
CO1	Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
CO2	Understand the Concept of Bolted and Welded connections.
CO3	Understand the Concept of Design of compression members, built-up columns and column splices.

C04	Understand the Concept of Design of tension members, simple slab base and gusseted base.
C05	Understand the Concept of Design of laterally supported and un-supported steel beams.
Course Code	APPLIED GEOTECHNICAL ENGINEERING - 18CV62
C01	Ability to plan and execute geotechnical site investigation program for different civil engineering projects
C02	Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
C03	Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
C04	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
C05	Capable of estimating load carrying capacity of single and group of piles
Course Code	HYDROLOGY AND IRRIGATION ENGINEERING - 18CV63
C01	Understand the importance of hydrology and its components.
C02	Measure precipitation and analyze the data and analyze the losses in precipitation.
C03	Estimate runoff and develop unit hydrographs.
C04	Find the benefits and ill-effects of irrigation.
C05	Find the quantity of irrigation water and frequency of irrigation for various crops.
C06	Find the canal capacity, design the canal and compute the reservoir capacity.
Course Code	MATRIX METHOD OF STRUCTURAL ANALYSIS (Elective) - 18CV641
C01	Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
C02	Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
C03	Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
C04	Evaluate secondary stresses.
Course Code	SOLID WASTE MANAGEMENT (Elective) - 18CV642
C01	Analyse existing solid waste management system and to identify their drawbacks.
CO2	Evaluate different elements of solid waste management system.
CO3	Suggest suitable scientific methods for solid waste management elements.
CO4	Design suitable processing system and evaluate disposal sites.
Course Code	ALTERNATE BUILDING MATERIALS (Elective) - 18CV643
C01	Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
C02	Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
C03	Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
C04	Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.
Course Code	GROUND IMPROVEMENT TECHNIQUES (Elective) - 18CV644
CO1	Give solutions to solve various problems associated with soil formations having less strength.

CO2	Use effectively the various methods of ground improvement techniques depending upon the requirements.
CO3	utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures
Course Code	RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS (Elective) - 18CV645
CO1	Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
CO2	Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
CO3	Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
CO4	Apply the knowledge gained to conduct surveying, understand the tunneling activities.
Course Code	REMOTE SENSING AND GIS (Elective) -18CV651
CO1	Collect data and delineate various elements from the satellite imagery using their spectral signature.
CO2	Analyze different features of ground information to create raster or vector data.
CO3	Perform digital classification and create different the maticmaps for solving specific problems
CO4	Make decision based on the GIS analysis on thematic maps.
Course Code	TRAFFIC ENGINEERING(Elective) - 18CV652
CO1	Understand the human factors and vehicular factors in traffic engineering design.
CO2	Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
CO3	Use anappropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
CO4	Understand the basic knowledge of Intelligent Transportation System.
Course Code	OCCUPATIONAL HEALTH AND SAFETY (Elective) - 18CV653
CO1	Identify hazards in the work place that poseadangeror threat to their safety or health, orthatofothers.
CO2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
CO3	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
CO4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
CO5	Identify the decisions required to maintain protection of the environment, workplace as well as personal
Course Code	SUSTAINABILITY CONCEPTS IN CIVIL ENGINEERING (Elective) - 18CV654
CO1	Learn the sustainability concepts; understand the role and responsibility of engineers in Sustainable Development.
CO2	Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits.
CO3	Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines.

CO4	Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society.
Course Code	SOFTWARE APPLICATION LABORATORY - 18CVL66
C01	Use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work
Course Code	ENVIRONMENTAL ENGINEERING LABORATORY - 18CVL67
C01	Acquire capability to conduct experiments and estimate the concentration of different parameters.
CO2	Compare the result with standards and discuss based on the purpose of analysis.
CO3	Determine type of treatment, degree of treatment for water and waste water.
CO4	Identify the parameter to be analyzed for the student project work in environmental stream.
Course Code	EXTENSIVE SURVEY PROJECT - 18CVP68
C01	Apply Surveying knowledge and tools effectively for the projects
CO2	Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
CO3	Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
CO4	Professional etiquettes at workplace, meeting and general
CO5	Establishing trust based relationships in teams & organizational environment
CO6	Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques
Course Code	QUANTITY SURVEYING AND CONTRACT MANAGEMENT - 18CV71
C01	Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.
CO2	Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works.
CO3	Prepare the specifications and analyze the rates for various items of work.
CO4	Assess contract and tender documents for various construction works.
CO5	Determine the externals of functional and solve the simple problem of the calculus of variations.
Course Code	DESIGN OF RCC AND STEEL STRUCTURES - 18CV72
C01	Students will acquire the basic knowledge in design of RCC and Steel Structures.
CO2	Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.
Course Code	THEORY OF ELASTICITY (Elective-1) - 18CV731
C01	Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum.
CO2	Ability to formulate boundary value problems; and calculate stresses and strains.
CO3	Ability to comprehend constitutive relations for elastic solids and compatibility constraints.
CO4	Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function
Course Code	AIR POLLUTION AND CONTROL (Elective-1) - 18CV732
C01	Identify the major sources of air pollution and understand their effects on health and environment.

CO2	Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
CO3	Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
CO4	Choose and design control techniques for particulate and gaseous emissions.
Course Code	PAVEMENT MATERIALS AND CONSTRUCTION (Elective-1) - 18CV733
CO1	Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
CO2	Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
CO3	Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
CO4	Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.
Course Code	GROUND WATER HYDRAULICS (Elective-1) - 18CV734
CO1	Find the characteristics of aquifers
CO2	Estimate the quantity of ground water by various methods.
CO3	Locate the zones of ground water resources.
CO4	Select particular type of well and augment the ground water storage.
Course Code	MASONRY STRUCTURES (Elective-1) - 18CV735
CO1	Select suitable material for masonry construction by understanding engineering properties.
CO2	Compute loads, load combinations and analyze the stresses in masonry.
CO3	Design masonry under compression (Axial load) for various requirements and conditions.
CO4	Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
CO5	Assess the behavior of shear wall and reinforced masonry.
Course Code	EARTHQUAKE ENGINEERING (Elective-2) -18CV741
CO1	Acquire basic knowledge of engineering seismology.
CO2	Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
CO3	Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
CO4	Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
CO5	Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry structures thorough exposure to different IS-codes of practices.
Course Code	DESIGN CONCEPT OF BUILDING SERVICES (Elective-2) - 18CV742
CO1	Describe the basics of house plumbing and waste water collection and disposal.
CO2	Discuss the safety and guidelines with respect to fire safety.
CO3	Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
CO4	Understand and implement the requirements of thermal comfort in buildings.
Course Code	REINFORCED EARTH STRUCTURES (Elective-2) - 18CV743
CO1	Identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;

CO2	Understand the laboratory testing concepts of Geo synthetics
CO3	Design RE retaining structures and Soil Nailing concepts
CO4	Determine the load carrying capacity of Foundations resting on RE soil bed.
Course Code	DESIGN OF HYDRAULIC STRUCTURES (Elective-2) - 18CV744
C01	Check the stability of gravity dams and design the dam.
CO2	Estimate the quantity of seepage through earth dams.
CO3	Design spillways and aprons for various diversion works.
CO4	Select particular type of canal regulation work for canal network.
Course Code	URBAN TRANSPORT PLANNING (Elective-2) - 18CV745
C01	Design, conduct and administer surveys to provide the data required for transportation planning.
CO2	Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
CO3	Develop and calibrate modal split, trip generation rates for specific types of land use developments.
CO4	Adopt the steps that are necessary to complete a long-term transportation plan.
Course Code	FINITE ELEMENT METHOD (Elective-3) -18CV751
C01	The student will have the knowledge on advanced methods of analysis of structures.
Course Code	NUMERICAL METHODS AND APPLICATIONS (Elective-3) - 18CV752
C01	The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.
Course Code	ENVIRONMENTAL PROTECTION AND MANAGEMENT - (Elective-3)
C01	Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards.
CO2	Lead pollution prevention assessment team and implement waste minimization options.
CO3	Develop, Implement, maintain and Audit Environmental Management systems for Organizations.
Course Code	COMPUTER AIDED DETAILING OF STRUCTURES - 18CVL76
C01	Prepare detailed working drawings of Steel Structures
CO2	Prepare detailed working drawings of RCC Structures
Course Code	GEOTECHNICAL ENGINEERING LABORATORY -18CVL77
C01	Physical and index properties of the soil
CO2	Classify based on index properties and field identification
CO3	To determine OMC and MDD, plan and assess field compaction program
CO4	Shear strength and consolidation parameters to assess strength and deformation characteristics
Course Code	DESIGN OF PRE- STRESSECONCRETE - 18CV81
C01	Understand the requirement of PSC members for present scenario.
CO2	Analyse the stresses encountered in PSC element during transfer and at working.
CO3	Understand the effectiveness of the design of PSC after studying losses
CO4	Capable of analyzing the PSC element and finding its efficiency
CO5	Design PSC beam for different requirements.

Course Code	BRIDGE ENGINEERING (Elective-2) -18CV821
C01	Understand the load distribution and IRC standards.
CO2	Design the slab and T beam bridges.
CO3	Design Box culvert, pipe culvert
CO4	Use bearings, hinges and expansion joints
CO5	Design Piers and abutments.
Course Code	PREFABRICATED STRUCTURES (Elective-2) -18CV822
C01	Use modular construction, industrialized construction
CO2	Design prefabricated elements
CO3	Design some of the prefabricated elements
CO4	Use the knowledge of the construction methods and prefabricated elements in buildings
Course Code	ADVANCED FOUNDATION ENGINEERING (Elective-2) - 18CV823
C01	Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
CO2	Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles.
CO3	Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
CO4	Understand basics of analysis and design principles of machine foundations.
Course Code	REHABILITATION AND RETROFITTING (Elective-2) - 18CV824
C01	Identify the causes for structural (Concrete) deterioration.
CO2	Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
CO3	Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
Course Code	PAVEMENT DESIGN (Elective-2) - 18CV825
C01	Systematically generate and compile required data's for design of pavement (Highway & Airfield).
CO2	Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
CO3	Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001
CO4	Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements
Course Code	PROJECT WORK PHASE-2 - 18CVP83
C01	Describe the project and be able to defend it.
CO2	Develop critical thinking and problem solving skills.
CO3	Learn to use modern tools and techniques.
CO4	Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
C05	Develop skills to work in a team to achieve common goal.
CO6	Develop skills of project management and finance.
CO7	Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
CO8	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Course Code	TECHNICAL SEMINAR - 18CVS84
CO1	Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study
CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology.
CO3	Develop written and oral communication skills.
CO4	Explore concepts in larger diverse social and academic contexts.
CO5	Apply principles of ethics and respect in interaction with others.
CO6	Develop the skills to enable life-long learning.
Course Code	INTERNSHIP /PROFESSIONAL PRACTICE - 18CVI85
CO1	Students will get the field exposure and experience

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2021-22(CRITERIA- 2)

2.6.1 Program outcomes, program specific outcomes and course outcomes

Department of Computer Science & Engineering

Program Outcomes (PO's)

PO 1: Apply the knowledge of Mathematics, Science and Computer Engineering to identify, formulate and solve any engineering problems with varied complexity.

PO 2: Design and develop a system, component or process to meet the desired needs within the realistic constraints to solve the real-time problems for betterment of society.

PO 3: Design and conduct experiments as well as analyze and interpret data.

PO 4: Communicate and Present the information effectively.

PO 5: Use the techniques, skills and modern engineering tools necessary for engineering practice.

PO 6: Handle various technical, administrative and managerial responsibilities successfully in any organizations globally.

PO 7: Get Recognize as successful Entrepreneur globally.

PO 8: Demonstrate commitment in handling any responsibilities with professional, ethical and social importance.

PO 9: Engage in lifelong learning to upgrade their engineering skills consistently.

PO 10: Adapt to any working environment of heterogeneous and multidisciplinary teams with good sustainability and high performance.

PO 11: Clear successfully the competitive exams for placement, higher studies and government services.

PO 12: Understand and demonstrate the impact of engineering solutions in a global , economic , environmental and societal context.

Program Specific Outcomes (PSO's)

PSO 1: An ability to design and develop hardware and software in emerging technology environments like cloud computing embedded products and real-time systems. (Orientation towards Systems Programming)

PSO 2: Knowledge of data management system like data acquisition, big data so as to enable students in solving problems using the techniques of data analytics like pattern recognition and knowledge discovery. (Orientation towards Data Sciences)

UG-B.E (CS)2021-Scheme COs

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING	
COURSE CODE	21PSP23/13 -PROBLEM-SOLVING THROUGH PROGRAMMING
CO1	Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts.
CO2	Apply programming constructs of C language to solve the real world problem
CO3	Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting
CO4	Explore user-defined data structures like structures, unions and pointers in implementing solutions
CO5	Design and Develop Solutions to problems using modular programming constructs using functions
COURSE CODE	21CS32-DATA STRUCTURES AND APPLICATIONS
CO1	Identify different data structures and their applications
CO2	Apply stack and queues in solving problems.
CO3	Demonstrate applications of linked list.
CO4	Explore the applications of trees and graphs to model and solve the real-world problem
CO5	Make use of Hashing techniques and resolve collisions during mapping of key value pairs
COURSE CODE	21CS33-ANALOG AND DIGITAL ELECTRONICS
CO1	Design and analyze application of analog circuits using photo devices, timer IC, power supply and regulator IC and op-amp
CO2	Explain the basic principles of A/D and D/A conversion circuits and develop the same
CO3	Simplify digital circuits using Karnaugh Map, and Quine-McClusky Methods
CO4	Explain Gates and flip flops and make us in designing different data processing circuits, registers and counters and compare the types.
CO5	Develop simple HDL programs
COURSE CODE	21CS34 -COMPUTER ORGANIZATION AND ARCHITECTURE
CO1	Explain the organization and architecture of computer systems with machine instructions and programs
CO2	Analyze the input/output devices communicating with computer system
CO3	Demonstrate the functions of different types of memory devices
CO4	Apply different data types on simple arithmetic and logical unit
CO5	Analyze the functions of basic processing unit, Parallel processing and pipelining
COURSE CODE	21CSL35-OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY
CO1	Use Eclipse/NetBeans IDE to design, develop, debug Java Projects
CO2	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP.
CO3	Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results
CO4	Apply the concepts of multiprogramming, exception/event handling, abstraction to develop robust programs
CO5	Develop user friendly applications using File I/O and GUI concepts.

COURSE CODE	21CSL381-MASTERING OFFICE
C01	Know the basics of computers and prepare documents, spreadsheets, make small presentations with audio, video and graphs and would be acquainted with internet
C02	Create, edit, save and print documents with list tables, header, footer, graphic, spellchecker, mail merge and grammar checker
C03	Attain the knowledge about spreadsheet with formula, macros spell checker etc
C04	Demonstrate the ability to apply application software in an office environment
C05	Use Google Suite for office data management tasks
COURSE CODE	21CS382-PROGRAMMING IN C++
C01	Able to understand and design the solution to a problem using object-oriented programming concepts
C02	Able to reuse the code with extensible Class types, User-defined operators and function Overloading
C03	Achieve code reusability and extensibility by means of Inheritance and Polymorphism
C04	Identify and explore the Performance analysis of I/O Streams
C05	Implement the features of C++ including templates, exceptions and file handling for providing programmed solutions to complex problems
COURSE CODE	21CS42-DESIGN AND ANALYSIS OF ALGORITHMS
C01	Analyze the performance of the algorithms, state the efficiency using asymptotic notations and analyze mathematically the complexity of the algorithm
C02	Apply divide and conquer approaches and decrease and conquer approaches in solving the problems analyze the same
C03	Apply the appropriate algorithmic design technique like greedy method, transform and conquer approaches and compare the efficiency of algorithms to solve the given problem
C04	Apply and analyze dynamic programming approaches to solve some problems. and improve algorithm time efficiency by sacrificing space
C05	Apply and analyze backtracking, branch and bound methods and to describe P, NP and NP-Complete problems
COURSE CODE	21CS43-MICROCONTROLLER AND EMBEDDED SYSTEMS
C01	Explain C-Compilers and optimization
C02	Describe the ARM microcontroller's architectural features and program module
C03	Apply the knowledge gained from programming on ARM to different applications
C04	Program the basic hardware components and their application selection method
C05	Demonstrate the need for a real-time operating system for embedded system applications
COURSE CODE	21CS44-OPERATING SYSTEMS
C01	Identify the structure of an operating system and its scheduling mechanism
C02	Demonstrate the allocation of resources for a process using scheduling algorithm
C03	Identify root causes of deadlock and provide the solution for deadlock elimination
C04	Explore about the storage structures and learn about the Linux Operating system
C05	Analyze Storage Structures and Implement Customized Case study

COURSE CODE	21CSL46-PYTHON PROGRAMMING LABORATORY
C01	Demonstrate proficiency in handling of loops and creation of functions
C02	Identify the methods to create and manipulate lists, tuples and dictionaries
C03	Discover the commonly used operations involving regular expressions and file system
C04	Interpret the concepts of Object-Oriented Programming as used in Python
C05	Determine the need for scraping websites and working with PDF, JSON and other file formats
COURSE CODE	21CSL481-WEB PROGRAMMING
C01	Describe the fundamentals of web and concept of HTML
C02	Use the concepts of HTML, XHTML to construct the web pages
C03	Interpret CSS for dynamic documents
C04	Evaluate different concepts of JavaScript & Construct dynamic documents
C05	Design a small project with JavaScript and XHTML
COURSE CODE	21CS482-UNIX SHELL PROGRAMMING
C01	Know the basics of Unix concepts and commands
C02	Evaluate the UNIX file system
C03	Apply Changes in file system
C04	Understand scripts and programs
C05	Analyze Facility with UNIX system process
COURSE CODE	21CSL483-R PROGRAMMING
C01	To understand the fundamental syntax of R through readings, practice exercises, CO 2.
C02	To demonstrations, and writing R code.
C03	To apply critical programming language concepts such as data types, iteration
C04	To understand control structures, functions, and Boolean operators by writing R programs and through examples
C05	To import a variety of data formats into R using R-Studio
C06	To prepare or tidy data for in preparation for analyze
COURSE CODE	21CS51-AUTOMATA THEORY AND COMPILER DESIGN
C01	Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation
C02	Design and develop lexical analyzers, parsers and code generators
C03	Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and the irrelative powers
C04	Acquire fundamental understanding of the structure of a Compiler and Apply Concepts automata theory and Theory of Computation to design Compilers
C05	Design computations models for problems in Automata theory and adaptation of such model in the field of compilers
COURSE CODE	21CS52-COMPUTER NETWORKS
C01	Learn the basic needs of communication system
C02	Interpret the communication challenges and its solution.
C03	Identify and organize the communication system network components
C04	Design communication networks for user requirements
COURSE CODE	21CS53-DATABASE MANAGEMENT SYSTEMS
C01	Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
C02	Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation
C03	Design and build simple database systems and <i>relate</i> the concept of transaction, concurrency control and recovery in database
C04	Develop application to interact with databases, relational algebra expression
C05	Develop applications using tuple and domain relation expression from queries

COURSE CODE	21CS54-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
C01	Apply the knowledge of searching and reasoning techniques for different applications
C02	Have a good understanding of machine learning in relation to other fields and fundamental issues and challenges of machine learning
C03	Apply the knowledge of classification algorithms on various datasets and compare results
C04	Model the neuron and Neural Network, and to analyze ANN learning and its applications
C05	Identifying the suitable clustering algorithm for different patterns
COURSE CODE	21CSL55-DATABASE MANAGEMENT SYSTEM LABORATORY WITH MINI PROJECT
C01	Create, Update and query on the database
C02	Demonstrate the working of different concepts of DBMS
C03	Implement, analyze and evaluate the project developed for an application.
COURSE CODE	21CSL581-ANGULAR JS AND NODE JS
C01	Describe the features of Angular JS
C02	Recognize the form validations and controls
C03	Implement Directives and Controllers
C04	Evaluate and create database for simple application
C05	Plan and build web servers with node using Node .JS
COURSE CODE	21CS582-C# AND .NET FRAMEWORK
C01	Able to explain how C# fits into the .NET platform
C02	Describe the utilization of variables and constants of C#
C03	Use the implementation of object-oriented aspects in applications
C04	Analyze and Set up Environment of .NET Core
C05	Evaluate and create a simple project application
COURSE CODE	21CS61-SOFTWARE ENGINEERING & PROJECT MANAGEMENT
C01	Understand the activities involved in software engineering and analyze the role of various process models
C02	Explain the basics of object-oriented concepts and build a suitable class model using modelling techniques
C03	Describe various software testing methods and to understand the importance of agile methodology and DevOps
C04	Illustrate the role of project planning and quality management in software development CO 5. Understand the importance of activity planning and different planning models
COURSE CODE	21CS62-FULLSTACK DEVELOPMENT
C01	Understand the working of MVT based full stack web development with Django
C02	Designing of Models and Forms for rapid development of web pages
C03	Analyze the role of Template Inheritance and Generic views for developing full stack web applications
C04	Apply the Django framework libraries to render nonHTML contents like CSV and PDF
C05	Perform jQuery based AJAX integration to Django Apps to build responsive full stack web applications

COURSE CODE	21CS63-COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGEPROCESSING
C01	Construct geometric objects using Computer Graphics principles and OpenGL APIs
C02	Use OpenGL APIs and related mathematics for 2D and 3D geometric Operations on the objects
C03	Design GUI with necessary techniques required to animate the created objects
C04	Apply OpenCV for developing Image processing applications
C05	Apply Image segmentation techniques along with programming, using OpenCV, for developingsimple applications
COURSE CODE	21CS641-AGILE TECHNOLOGIES
C01	Understand the fundamentals of agile technologies
C02	Explain XP Lifecycle, XP Concepts and Adopting XP
C03	Apply different techniques on Practicing XP, Collaborating and Releasing
C04	Analyze the Values and Principles of Mastering Agility
C05	Demonstrate the agility to deliver good values
COURSE CODE	21CS642-ADVANCED JAVA PROGRAMMING
C01	Understanding the fundamental concepts of Enumerations and Annotations
C02	Apply the concepts of Generic classes in Java programs
C03	Demonstrate the concepts of String operations in Java
C04	Develop web based applications using Java servlets and JSP
C05	Illustrate database interaction and transaction processing in Java
COURSE CODE	21CS643-ADVANCED COMPUTER ARCHITECTURE
C01	Explain the concepts of parallel computing
C02	Explain and identify the hardware technologies
C03	Compare and contrast the parallel architectures
C04	Illustrate parallel programming concepts
COURSE CODE	21CS644-DATA SCIENCE AND VISUALIZATION
C01	Understand the data in different forms
C02	Apply different techniques to Explore Data Analysis and the Data Science Process
C03	Analyze feature selection algorithms & design a recommender system
C04	Evaluate data visualization tools and libraries and plot graphs
C05	Develop different charts and include mathematical expressions
COURSE CODE	21CS651-INTRODUCTION TO DATA STRUCTURES
C01	Express the fundamentals of static and dynamic data structure
C02	Summarize the various types of data structure with their operations
C03	Interpret various searching and sorting techniques
C04	Choose appropriate data structure in problem solving
C05	Develop all data structures in a high level language for problem solving
COURSE CODE	21CS652-INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS
C01	Identify, analyze and define database objects, enforce integrity constraints on a database usingRDBMS
C02	Use Structured Query Language (SQL) for database manipulation
C03	Design and build simple database systems
C04	Develop application to interact with databases
COURSE CODE	21CS653- INTRODUCTION TO CYBER SECURITY
C01	Describe the cyber crime terminologies
C02	Analyze cybercrime in mobiles and wireless devices along with the tools for Cybercrime andprevention
C03	Analyze the motive and causes for cybercrime, cybercriminals, and investigators
C04	Apply the methods for understanding criminal case and evidence, detection standing criminalcase and evidence

COURSE CODE	21CS654-PROGRAMMING IN JAVA
C01	Develop JAVA programs using OOP principles and proper program structuring
C02	Develop JAVA program using packages, inheritance and interface
C03	Develop JAVA programs to implement error handling techniques using exception handling
C04	Demonstrate string handling concepts using JAVA
COURSE CODE	21CSL66-COMPUTER GRAPHICS AND IMAGE PROCESSING LABORATORY
C01	Use openGL /OpenCV for the development of mini Projects
C02	Analyze the necessity mathematics and design required to demonstrate basic geometric transformation techniques
C03	Demonstrate the ability to design and develop input interactive techniques
C04	Apply the concepts to Develop user friendly applications using Graphics and IP concepts
COURSE CODE	21CS71-BIG DATA ANALYTICS
C01	Understand fundamentals and applications of Big Data analytics.
C02	Investigate Hadoop framework, Hadoop Distributed File system and essential Hadoop tools
C03	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
C04	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools
C05	Apply Machine Learning algorithms for real world big data, web contents and Social Networks to provide analytics with relevant visualization tools.
COURSE CODE	21CS72-CLOUD COMPUTING
C01	Understand and analyze various cloud computing platforms and service provider.
C02	Illustrate various virtualization concepts.
C03	Identify the architecture, infrastructure and delivery models of cloud computing.
C04	Understand the Security aspects of CLOUD.
C05	Define platforms for development of cloud applications
COURSE CODE	21CS731-OBJECT ORIENTED MODELING AND DESIGN
C01	Describe the concepts of object-oriented and basic class modelling.
C02	Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
C03	Choose and apply a befitting design pattern for the given problem.
COURSE CODE	21CS732-DIGITAL IMAGE PROCESSING
C01	Understand the fundamentals of Digital Image Processing
C02	Apply different Image transformation techniques
C03	Analyze various image restoration techniques
C04	Understand colour image and morphological processing
C05	Design image analysis and segmentation techniques
COURSE CODE	21CS733-CRYPTOGRAPHY AND NETWORK SECURITY
C01	Understand Cryptography, Network Security theories, algorithms and systems
C02	Apply different Cryptography and Network Security operations on different applications
C03	Analyze different methods for authentication and access control
C04	Evaluate Public and Private key, Key management, distribution and certification
C05	Design necessary techniques to build protection mechanisms to secure computer networks
COURSE CODE	21CS734-BLOCKCHAIN TECHNOLOGY
C01	Describe the concepts of Distributed computing and its role in Blockchain
C02	Describe the concepts of Cryptography and its role in Blockchain
C03	List the benefits, drawbacks and applications of Blockchain
C04	Appreciate the technologies involved in Bitcoin
C05	Appreciate and demonstrate the Ethereum platform to develop blockchain application

COURSE CODE	21CS735-INTERNET OF THINGS
C01	Understand the evolution of IoT, IoT networking components, and addressing strategies in IoT
C02	Analyze various sensing devices and actuator types
C03	Demonstrate the processing in IoT.
C04	Apply different connectivity technologies.
C05	Understand the communication technologies, protocols and interoperability in IoT.
COURSE CODE	21CS741-SOFTWARE ARCHITECTURE AND DESIGN PATTERNS
C01	Design and implement codes with higher performance and lower complexity
C02	Be aware of code qualities needed to keep code flexible
C03	Experience core design principles and be able to assess the quality of a design with respect to these principles.
C04	Capable of applying these principles in the design of object oriented systems.
C05	Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary.
C06	Be able to select and apply suitable patterns in specific contexts
COURSE CODE	21CS742-MULTIAGENT SYSTEMS
C01	Demonstrate the decision process with different constraints
C02	Analyze games in different forms
C03	Apply the cooperative learning in developing games
C04	Analyze different negotiation strategies of Multi-Agent System
C05	Design and develop solutions for voting problems
COURSE CODE	21CS743-DEEP LEARNING
C01	Understand the fundamental issues and challenges of deep learning data, model selection, model complexity etc.,
C02	Describe various knowledge on deep learning and algorithms
C03	Apply CNN and RNN model for real time applications
C04	Identify various challenges involved in designing and implementing deep learning algorithms
C05	Relate the deep learning algorithms for the given types of learning tasks in varied domain
COURSE CODE	21CS744-ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT
C01	To Understand the basic concepts of RPA
C02	To Describe various components and platforms of RPA
C03	To Describe the different types of variables, control flow and data manipulation techniques
C04	To Understand various control techniques and OCR in RPA
C05	To Describe various types and strategies to handle exceptions
COURSE CODE	21CS745-NOSQL DATABASE
C01	Demonstrate an understanding of the detailed architecture of Column Oriented NoSQL databases, Document databases, Graph databases.
C02	Use the concepts pertaining to all the types of databases.
C03	Analyze the structural Models of NoSQL.
C04	Develop various applications using NoSQL databases.
COURSE CODE	21CS751-PROGRAMMING IN PYTHON
C01	Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
C02	Demonstrate proficiency in handling Strings and File Systems.
C03	Represent compound data using Python lists, tuples, Strings, dictionaries
C04	. Read and write data from/to files in Python Programs
COURSE CODE	21CS752-INTRODUCTION TO AI AND ML
C01	Design intelligent agents for solving simple gaming problems.
C02	. Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning
C03	Understand data and applying machine learning algorithms to predict the outputs
C04	Model the neuron and Neural Network, and to analyze ANN learning and its

	applications.
COURSE CODE	21CS753-INTRODUCTION TO BIG DATA
C01	Master the concepts of HDFS and MapReduce framework.
C02	Investigate Hadoop related tools for Big Data Analytics and perform basic
C03	Infer the importance of core data mining techniques for data analytics
C04	Use Machine Learning algorithms for real world big data.
COURSE CODE	21CS754- INTRODUCTION TO DATA SCIENCE
C01	Describe the data science terminologies
C02	Apply the Data Science process on real time scenario.
C03	Analyze data visualization tools
C04	Apply Data storage and processing with frameworks

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING	
COURSE CODE	20SCS11-MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
CO1	Understand the numerical methods to solve and find the roots of the equations..
CO2	Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems
CO3	Understand vector spaces and related topics arising in magnification and rotation of images
CO4	Utilize the statistical tools in multi variable distributions.
CO5	Use probability formulations for new predictions with discrete and continuous RV's.
COURSE CODE	20SCS12- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
CO1	Define Artificial intelligence and identify problems for AI. Characterize the search techniques to solve problems and recognize the scope of classical search techniques
CO2	Define knowledge and its role in AI. Demonstrate the use of Logic in solving AI problems
CO3	Demonstrate handling of uncertain knowledge and reasoning in probability theory
CO4	Understanding of Learning methods
COURSE CODE	20SCS13-ADVANCES IN DATA BASE MANAGEMENT SYSTEM
CO1	Select the appropriate high-performance database like parallel and distributed database
CO2	Infer and represent the real-world data using object-oriented database
CO3	Interpret rule set in the database to implement data warehousing of mining
CO4	Discover and design database for recent applications database for better interoperability
COURSE CODE	20SCS14-ADVANCED ALGORITHMS
CO1	Design and apply iterative and recursive algorithms
CO2	Design and implement optimization algorithms in specific applications.
CO3	Design appropriate shared objects and concurrent objects for applications.
COURSE CODE	20SCS15-INTERNET OF THINGS AND APPLICATIONS
CO1	Develop schemes for the applications of IOT in real time scenarios
CO2	Manage the Internet resources
CO3	Model the Internet of things to business
CO4	Understand the practical knowledge through different case studies
CO5	Understand data sets received through IoT devices and tools used for analysis

COURSE CODE	20SCSL16-ALGORITHMS AND DATABASE MANAGEMENT SYSTEMS LABORATORY
CO1	Work on the concepts of Software Testing and ADBMS at the practical level
CO2	Compare and pick out the right type of software testing process for any given real-world problem
CO3	Carry out the software testing process in efficient way
CO4	Establish a quality environment as specified in standards for developing quality software
CO5	Model and represent the real-world data using object-oriented database
CO6	Embed the rules set in the database to implement various features of ADBMS
CO7	Choose, design and implement recent applications database for better interoperability
COURSE CODE	20RMI17-RESEARCH METHODOLOGY AND IPR
CO1	Discuss research methodology and the technique of defining a research problem
CO2	Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review
CO3	Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections
CO4	Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
CO5	Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.
COURSE CODE	20SCS21-DATA SCIENCE
CO1	Define data science and its fundamentals
CO2	Demonstrate the process in data science
CO3	Explain machine learning algorithms necessary for data sciences
CO4	Illustrate the process of feature selection and analysis of data analysis algorithms
CO5	Visualize the data and follow of ethics
COURSE CODE	20SCS22-SEMANTIC WEB AND SOCIAL NETWORKS
CO1	Demonstrate the semantic web technologies like RDF Ontology and others
CO2	Learn the various semantic web applications
CO3	Identify the architectures and challenges in building social networks
CO4	Analyse the performance of social networks using electronic sources
COURSE CODE	20SCS23-BLOCKCHAIN TECHNOLOGY
CO1	Understand the types, benefits and limitation of blockchain
CO2	Explore the blockchain decentralization and cryptography concepts
CO3	Enumerate the Bitcoin features and its alternative options.
CO4	Describe and deploy the smart contracts
CO5	Summarize the blockchain features outside of currencies.

COURSE CODE	20SCS241-ADVANCED CRYPTOGRAPHY
C01	Understand OSI security architecture and classical encryption techniques
C02	Acquire fundamental knowledge on the concepts of finite fields and number theory
C03	Understand various block cipher and stream cipher models.
C04	Describe the principles of public key cryptosystems, hash functions and digital signature
C05	Compare various Cryptographic Techniques
C06	Design Secure applications
C07	Inject secure coding in the developed applications
COURSE CODE	20SCS242-NATURAL LANGUAGE PROCESSING
C01	Analyse the natural language text
C02	Generate the natural language.
C03	Demonstrate Text mining.
C04	Apply information retrieval techniques.
COURSE CODE	20SCS24-CLOUD COMPUTING
C01	Compare the strengths and limitations of cloud computing
C02	Identify the architecture, infrastructure and delivery models of cloud computing
C03	Apply suitable virtualization concept.
C04	Choose the appropriate cloud player
C05	Address the core issues of cloud computing such as security, privacy and interoperability
C06	Design Cloud Services
C07	Set a private cloud
COURSE CODE	20SCS244-PATTERN RECOGNITION
C01	Explain pattern recognition principals
C02	Develop algorithms for Pattern Recognition
C03	Develop and analyse decision tress
C04	Design the nearest neighbour classifier
C05	Apply Decision tree and clustering techniques to various applications
COURSE CODE	20SCS251-IMAGE PROCESSING AND MACHINE VISION
C01	Explain the fundamentals of image processing and computer vision
C02	Illustrate the image enhancement techniques
C03	Illustrate Image restoration and image compression technique
C04	Tell about image segmentation and morphological image processing
C05	Summarize computer vision techniques and its uses

COURSE CODE	20SCS252-OBJECT ORIENTED DESIGN
C01	Identify the heuristics of the object-oriented programming
C02	Explain the fundamentals of OOP
C03	Examine fine object-oriented relations
C04	Explain the role of Physical Object-Oriented Design
C05	Make use of Heuristics in The Use of Heuristics in Object-Oriented Design
COURSE CODE	20SCS253-SOFTWARE DEFINED NETWORKS
C01	Explain the fundamentals of SDN and make use of open flow tool
C02	Illustrate the concepts of controllers and network programmability
C03	Explain data centre and NFV
C04	Build an SDN framework
C05	Report use case
COURSE CODE	20SCS254-MODERN COMPUTER ARCHITECTURE
C01	Explain the fundamentals of Fundamentals of Computer Design, Pipelining, ILP
C02	Summarize the concept of memory
C03	Abstracting the concept of parallelism
C04	Summarize the hardware technologies
C05	Outlineparallel and scalable architectures
COURSE CODE	20SCSL26-DATA SCIENCE LABORATORY
C01	Demonstration of data visualization methods
C02	Understanding and implementation of data science algorithms
COURSE CODE	20SCS27-TECHNICAL SEMINAR
C01	Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization
C02	Carryout literature survey, organize the Course topics in a systematic order.
C03	Prepare the report with own sentences.
C04	Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities
C05	Present the seminar topic orally and/or through power point slides.
C06	Answer the queries and involve in debate/discussion.
C07	Submit two copies of the typed report with a list of references

COURSE CODE	20SCS31-DEEP LEARNING
CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2	Implement deep learning algorithms and solve real-world problems.
CO3	Execute performance metrics of Deep Learning Techniques.
	20SCS321-ENGINEERING ECONOMICS
CO1	Describe the principles of economics that govern the operation of any organization under diverse market conditions
CO2	Comprehend macroeconomic principles and decision making in diverse business set up
CO3	Explain the Inflation & Price Change as well as Present Worth Analysis
CO4	Apply the principles of economics through various case studies
COURSE CODE	20SCS322-VIRTUAL REALITY
CO1	Explain fundamentals of virtual reality systems
CO2	Summarize the hardware and software of the VR
CO3	Analyse the applications of VR
COURSE CODE	20SCS322-SOFT AND EVOLUTIONARY COMPUTING
CO1	Implement machine learning through neural networks
CO2	Design Genetic Algorithm to solve the optimization problem.
CO3	Develop a Fuzzy expert system.
CO4	Model Neuro Fuzzy system for clustering and classification
COURSE CODE	20SCS324-MULTICORE ARCHITECTURE AND PROGRAMMING
CO1	Identify the limitations of single core architecture and the need for multicore architectures
CO2	Define fundamental concepts of parallel programming and its design issues
CO3	Solve the issues related to multiprocessing and suggest solutions
CO4	Demonstrate the role of OpenMP and programming concept
CO5	Make out the salient features of different multicore architectures and how they exploit parallelism
COURSE CODE	20SCS331-BUSINESS INTELLIGENCE AND ITS APPLICATIONS
CO1	Explain the complete life cycle of BI/Analytical development
CO2	Illustrate technology and processes associated with Business Intelligence framework
CO3	Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.
COURSE CODE	20SCS332-ROBOTICS AND AUTOMATION
CO1	Classify various types of automation & manufacturing systems
CO2	Discuss different robot configurations, motions, drive systems and its performance parameters
CO3	Describe the basic concepts of control systems, feedback components, actuators and power transmission systems used in robots.

C04	Explain the working of transducers, sensors and machine vision systems
C05	Discuss the future capabilities of sensors, mobility systems and Artificial Intelligence in the field of robotics
COURSE CODE	20SCS333-SPEECH PROCESSING
C01	Explain the fundamentals of speech processing
C02	Summarize the models of speech processing
C03	Infer the linear predictive coding
C04	Illustrate the application of speech processing
COURSE CODE	20SCS334-WIRELESS SENSOR NETWORKS
C01	Know the basics , characteristics and challenges of Wireless Sensor Network
C02	Apply the knowledge to identify appropriate physical and MAC layer protocol
C03	Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement
C04	Be familiar with the OS used in Wireless Sensor Networks and build basic modules
C05	Understand the applications of WSN in various fields
COURSE CODE	20SCS34-PROJECT WORK PHASE – 1
C01	Demonstrate a sound technical knowledge of their selected project topic
C02	Undertake problem identification, formulation, and solution
C03	Design engineering solutions to complex problems utilising a systems approach
C04	Communicate with engineers and the community at large in written an oral forms
C05	Demonstrate the knowledge, skills and attitudes of a professional engineer
COURSE CODE	20SCS35-MINI PROJECT
C01	Present the mini-project and be able to defend it
C02	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
C03	Habituated to critical thinking and use problem solving skills.
C04	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
C05	Work in a team to achieve common goal.
C06	Learn on their own, reflect on their learning and take appropriate actions to improve it.
COURSE CODE	20SCS36-INTERNSHIP / PROFESSIONAL PRACTICE
C01	Gain practical experience within industry in which the internship is done
C02	Acquire knowledge of the industry in which the internship is done.
C03	Apply knowledge and skills learned to classroom wor
C04	Develop a greater understanding about career options while more clearly defining personal career goals
C05	Experience the activities and functions of professionals.
C06	Develop and refine oral and written communication skills

CO7	Identify areas for future knowledge and skill development.
CO8	Expand intellectual capacity, credibility, judgment, intuition
CO9	Acquire the knowledge of administration, marketing, finance and economics.
COURSE CODE	20SCS41-PROJECT WORK PHASE -2
CO1	Present the project and be able to defend it
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING	
COURSE CODE	18CPS13/23-C PROGRAMMING FOR PROBLEM SOLVING
CO1	Illustrate simple algorithms from the different domains such as mathematics, physics etc
CO2	construct programming solution to the given problem using C
CO3	Identify and correct the syntax and logical errors in C programs
CO4	Modularise the given problems using functions and structures.
COURSE CODE	18CPS17/27-C PROGRAMMING LABORATORY
CO1	Write Algorithms, flowcharts, programs for simple problems
CO2	Correct Syntax and logical errors to execute a program
CO3	write iterative and wherever possible recursive programs
CO4	Demonstrate use of functions, arrays, strings, structures and pointers in problem solving
COURSE CODE	18CS32-DATA STRUCTURES AND APPLICATIONS
CO1	Use different types of data structures, operations and algorithms
CO2	Apply searching and sorting operations on files
CO3	Use stack, Queue, Lists, Trees and Graphs in problem solving
CO4	Implement all data structures in a high-level language for problem solving.
COURSE CODE	18CS33-ANALOG AND DIGITAL ELECTRONICS
CO1	Design and analyze application of analog circuits using photo devices, timer IC, power supply and regulator IC and op-amp.
CO2	Explain the basic principles of A/D and D/A conversion circuits and develop the same.
CO3	Simplify digital circuits using Karnaugh Map , and Quine-McClusky Methods
CO4	Explain Gates and flip flops and make us in designing different data processing circuits, registers and counters and compare the types.
CO5	Develop simple HDL programs
COURSE CODE	18CS34-COMPUTER ORGANIZATION
CO1	Explain the basic organization of a computer system.
CO2	Demonstrate functioning of different sub systems, such as processor, Input/output,and memory. Illustrate hardwired control and micro programmed control, pipelining, embedded and other computing systems.
CO3	Design and analyse simple arithmetic and logical units.
COURSE CODE	18CS35-SOFTWARE ENGINEERING
CO1	Design a software system, component, or process to meet desired needs within realistic constraints.
CO2	Assess professional and ethical responsibility
CO3	Function on multi-disciplinary teams
CO4	Use the techniques, skills, and modern engineering tools necessary for engineering practice
CO5	Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems

COURSE CODE	18CS36-DISCRETE MATHEMATICAL STRUCTURES
CO1	Use propositional and predicate logic in knowledge representation and truth verification.
CO2	Demonstrate the application of discrete structures in different fields of computer science.
CO3	Solve problems using recurrence relations and generating functions.
CO4	Application of different mathematical proofs techniques in proving theorems in the courses.
CO5	Compare graphs, trees and their applications.
COURSE CODE	18CSL37-ANALOG AND DIGITAL ELECTRONICS LABORATORY
CO1	Use appropriate design equations / methods to design the given circuit.
CO2	Examine and verify the design of both analog and digital circuits using simulators.
CO3	Make us of electronic components, ICs, instruments and tools for design and testing of circuits for the given the appropriate inputs.
CO4	Compile a laboratory journal which includes; aim, tool/instruments/software/components used, design equations used and designs, schematics, program listing, procedure followed, relevant theory, results as graphs and tables, interpreting and concluding the findings.
COURSE CODE	18CSL38-DATA STRUCTURES LABORATORY
CO1	Analyze and Compare various linear and non-linear data structures
CO2	Code, debug and demonstrate the working nature of different types of data structures and their applications
CO3	Implement, analyze and evaluate the searching and sorting algorithms
CO4	Choose the appropriate data structure for solving real world problems
COURSE CODE	18CS42-DESIGN AND ANALYSIS OF ALGORITHMS
CO1	Describe computational solution to well-known problems like searching, sorting etc.
CO2	Estimate the computational complexity of different algorithms.
CO3	Devise an algorithm using appropriate design strategies for problem solving.
COURSE CODE	18CS43-OPERATING SYSTEMS
CO1	Demonstrate need for OS and different types of OS
CO2	Apply suitable techniques for management of different resources
CO3	Use processor, memory, storage and file system commands
CO4	Realize the different concepts of OS in platform of usage through case studies
COURSE CODE	18CS44-MICROCONTROLLER AND EMBEDDED SYSTEMS
CO1	Describe the architectural features and instructions of ARM microcontroller
CO2	Apply the knowledge gained for Programming ARM for different applications.
CO3	Interface external devices and I/O with ARM microcontroller.
CO4	Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
CO5	Develop the hardware /software co-design and firmware design approaches.
CO6	Demonstrate the need of real time operating system for embedded system applications
COURSE CODE	18CS45-OBJECT ORIENTED CONCEPTS
CO1	Explain the object-oriented concepts and JAVA.
CO2	Develop computer programs to solve real world problems in Java.

CO3	Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings.
COURSE CODE	18CS46-DATA COMMUNICATION
CO1	Explain the various components of data communication.
CO2	Explain the fundamentals of digital communication and switching.
CO3	Compare and contrast data link layer protocols.
CO4	Summarize IEEE 802.xx standards
COURSE CODE	18CSL47-DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY
CO1	Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
CO2	Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
CO3	Analyze and compare the performance of algorithms using language features.
CO4	Apply and implement learned algorithm design techniques and data structures to solve real-world problems
COURSE CODE	18CSL48-MICROCONTROLLER AND EMBEDDED SYSTEMS LABORATORY
CO1	Develop and test program using ARM7TDMI/LPC2148
CO2	Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler.
COURSE CODE	18CS51-MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY
CO1	Define management, organization, entrepreneur, planning, staffing, ERP and outline their importance in entrepreneurship
CO2	Utilize the resources available effectively through ERP
CO3	Make use of IPRs and institutional support in entrepreneurship
COURSE CODE	18CS52-COMPUTER NETWORKS AND SECURITY
CO1	Explain principles of application layer protocols
CO2	Recognize transport layer services and infer UDP and TCP protocols
CO3	Classify routers, IP and Routing Algorithms in network layer
CO4	Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard
CO5	Describe Multimedia Networking and Network Management
COURSE CODE	18CS53-DATABASE MANAGEMENT SYSTEM
CO1	Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
CO2	Use Structured Query Language (SQL) for database manipulation.
CO3	Design and build simple database systems
CO4	Develop application to interact with databases
COURSE CODE	18CS54-AUTOMATA THEORY AND COMPUTABILITY
CO1	Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation
CO2	Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
CO3	Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
CO4	Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
CO5	Classify a problem with respect to different models of Computation.

COURSE CODE	18CS55-APPLICATION DEVELOPMENT USING PYTHON
CO1	Demonstrate proficiency in handling of loops and creation of functions.
CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.
CO3	Discover the commonly used operations involving regular expressions and file system.
CO4	Interpret the concepts of Object-Oriented Programming as used in Python.
CO5	Determine the need for scraping websites and working with CSV, JSON and other file formats.
COURSE CODE	18CS56-UNIX PROGRAMMING
CO1	Explain Unix Architecture, File system and use of Basic Commands
CO2	Illustrate Shell Programming and to write Shell Scripts
CO3	Categorize, compare and make use of Unix System Calls
CO4	Build an application/service over a Unix system.
COURSE CODE	18CSL57-COMPUTER NETWORK LABORATORY
CO1	Analyze and Compare various networking protocols.
CO2	Demonstrate the working of different concepts of networking.
CO3	Implement, analyze and evaluate networking protocols in NS2 / NS3 and JAVA programming language
COURSE CODE	18CSL58-DBMS LABORATORY WITH MINI PROJECT
CO1	Create, Update and query on the database.
CO2	Demonstrate the working of different concepts of DBMS
CO3	Implement, analyze and evaluate the project developed for an application.
COURSE CODE	18CIV59-ENVIRONMENTAL STUDIES
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
COURSE CODE	18CS61-SYSTEM SOFTWARE AND COMPILERS
CO1	Explain system software
CO2	Design and develop lexical analyzers, parsers and code generators
CO3	Utilize lex and yacc tools for implementing different concepts of system software
COURSE CODE	18CS62-COMUTER GRAPHICS AND VISUALIZATION
CO1	Design and implement algorithms for 2D graphics primitives and attributes.
CO2	Illustrate Geometric transformations on both 2D and 3D objects.
CO3	Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
CO4	Decide suitable hardware and software for developing graphics packages using OpenGL.
COURSE CODE	18CS63-WEB TECHNOLOGY AND ITS APPLICATIONS
CO1	Adapt HTML and CSS syntax and semantics to build web pages.
CO2	Construct and visually format tables and forms using HTML and CSS

CO3	Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
CO4	Appraise the principles of object oriented development using PHP
CO5	Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.
COURSE CODE	18CS642-OBJECT ORIENTED MODELING AND DESIGN
CO1	Describe the concepts of object-oriented and basic class modelling.
CO2	Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
CO3	Choose and apply a befitting design pattern for the given problem
COURSE CODE	18EE653-RENEWABLE ENERGY RESOURCES
CO1	Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2	Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
CO3	Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4	Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5	Discuss production of energy from biomass, biogas.
CO6	Summarize tidal energy resources, sea wave energy and ocean thermal energy.
COURSE CODE	18CSL66-SYSTEM SOFTWARE LABORATORY
CO1	Implement and demonstrate Lexer's and Parser's
CO2	Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.
COURSE CODE	18CSL67-COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT
CO1	Apply the concepts of computer graphics
CO2	Implement computer graphics applications using OpenGL
CO3	Animate real world problems using OpenGL
COURSE CODE	18CSMP68-MOBILE APPLICATION DEVELOPMENT
CO1	Create, test and debug Android application by setting up Android development environment.
CO2	Implement adaptive, responsive user interfaces that work across a wide range of devices.
CO3	Infer long running tasks and background work in Android applications.
CO4	Demonstrate methods in storing, sharing and retrieving data in Android applications.
COURSE CODE	18CS71-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
CO1	Appraise the theory of Artificial intelligence and Machine Learning.
CO2	Illustrate the working of AI and ML Algorithms.
CO3	Demonstrate the applications of AI and ML.
COURSE CODE	18CS72-BIG DATA AND ANALYTICS
CO1	Understand fundamentals of Big Data analytics.
CO2	Investigate Hadoop framework and Hadoop Distributed File system.
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.

CO5	Use Machine Learning algorithms for real world big data.
CO6	Analyze web contents and Social Networks to provide analytics with relevant visualization tools.
COURSE CODE	18CS733-ADVANCED COMPUTER ARCHITECTURES
CO1	Explain the concepts of parallel computing and hardware technologies
CO2	Compare and contrast the parallel architectures
CO3	Illustrate parallel programming concepts
COURSE CODE	18CS742-NETWORK MANAGEMENT
CO1	Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
CO2	Apply network management standards to manage practical networks
CO3	Formulate possible approaches for managing OSI network model.
CO4	Use on SNMP for managing the network
CO5	Use RMON for monitoring the behavior of the network
CO6	Identify the various components of network and formulate the scheme for the managing them
COURSE CODE	18EE753-DISASTER MANAGEMENT
CO1	Discuss disaster management plan, cyclones and their hazard potential
CO2	Understand the role of IMD and cyclone prediction and cyclone warning system in India
CO3	Understand the role of different institutions defence and other services in natural disaster management.
CO4	Understand the role of Central Water Commission in river water sharing, Draught, its assessment and draught management plan
COURSE CODE	18CSL76-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY
CO1	Implement and demonstrate AI and ML algorithms.
CO2	Evaluate different algorithms.
COURSE CODE	18CS81-INTERNET OF THINGS
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
CO3	Appraise the role of IoT protocols for efficient network communication.
CO4	Elaborate the need for Data Analytics and Security in IoT.
CO5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry
COURSE CODE	18CS823-NOSQL DATABASE
CO1	Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
CO2	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
CO3	Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

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COURSE CODE	18SCS11-MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
CO1	Understand the numerical methods to solve and find the roots of the equations.
CO2	Utilize the statistical tools in multi variable distributions.
CO3	Use probability formulations for new predictions with discrete and continuous RV's.
CO4	To understand various graphs in different geometries related to edges.
CO5	Understand vector spaces and related topics arising in magnification and rotation of images.
COURSE CODE	18SCS12-ADVANCES IN OPERATING SYSTEMS
CO1	Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
CO2	Learn the various resource management techniques for distributed systems
CO3	Identify the different features of real time and mobile operating system
CO4	Modify existing open source kernels in terms of functionality or features used
COURSE CODE	18SCS13-ADVANCES IN DATA BASE MANAGEMENT SYSTEMS
CO1	Select the appropriate high performance database like parallel and distributed database
CO2	Infer and represent the real world data using object oriented database
CO3	Interpret rule set in the database to implement data warehousing of mining
CO4	Discover and design database for recent applications database for better interoperability
COURSE CODE	18SCS14-INTERNET OF THINGS
CO1	Develop schemes for the applications of IOT in real time scenarios
CO2	Manage the Internet resources
CO3	Model the Internet of things to business
CO4	Understand the practical knowledge through different case studies
CO5	Understand data sets received through IoT devices and tools used for analysis
COURSE CODE	18SCS151-ADVANCES IN COMPUTER NETWORKS
CO1	List and classify network services, protocols and architectures, explain why they are layered.
CO2	Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
CO3	Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
CO4	Explain various congestion control techniques.
COURSE CODE	18SCSL16-ADBMS AND IOT LABORATORY
CO1	Work on the concepts of Software Testing and ADBMS at the practical level
CO2	Compare and pick out the right type of software testing process for any given real world problem
CO3	Carry out the software testing process in efficient way
CO4	Establish a quality environment as specified in standards for developing quality software
CO5	Model and represent the real world data using object oriented database
CO6	Embed the rules set in the database to implement various features of ADBMS

CO7	Choose, design and implement recent applications database for better interoperability
COURSE CODE	18SCS21-MANAGING BIG DATA
CO1	Describe big data and use cases from selected business domains
CO2	Explain NoSQL big data management
CO3	Install, configure, and run Hadoop and HDFS
CO4	Perform map-reduce analytics using Hadoop
CO5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics
COURSE CODE	18SCS22-ADVANCED ALGORITHMS
CO1	Design and apply iterative and recursive algorithms.
CO2	Design and implement optimization algorithms in specific applications.
CO3	Design appropriate shared objects and concurrent objects for applications
COURSE CODE	18SCS23-CLOUD COMPUTING
CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Apply suitable virtualization concept.
CO4	Choose the appropriate cloud player
CO5	Address the core issues of cloud computing such as security, privacy and interoperability
CO6	Design Cloud Services
CO7	Set a private cloud
COURSE CODE	18SCS241-ADVANCES IN STORAGE AREA NETWORKS
CO1	Identify the need for performance evaluation and the metrics used for it
CO2	Apply the techniques used for data maintenance.
CO3	Realize strong virtualization concepts
CO4	Develop techniques for evaluating policies for LUN masking, file systems
COURSE CODE	18SCS253-OBJECT ORIENTED SOFTWARE ENGINEERING
CO1	Apply Object Oriented Software Engineering approach in every aspect of software project
CO2	Analyze the requirements from various domains
CO3	Adapt appropriate object oriented design aspects in the development process
CO4	Implement and test the software projects using object oriented approach
CO5	Learn the issues and concepts relating to maintenance of software projects
CO6	Adapt the concepts and tools related to software configuration management
COURSE CODE	18SCS31-MACHINE LEARNING TECHNIQUES
CO1	Choose the learning techniques with this basic knowledge.
CO2	Apply effectively neural networks and genetic algorithms for appropriate applications.
CO3	Apply bayesian techniques and derive effectively learning rules.
CO4	Choose and differentiate reinforcement and analytical learning techniques
COURSE CODE	18SCS323-WIRELESS NETWORKS AND MOBILE COMPUTING
CO1	Explain state of art techniques in wireless communication.
CO2	Discover CDMA, GSM. Mobile IP, Wimax
CO3	Demonstrate program for CLDC, MIDP let model and security concerns

COURSE CODE	18SCS332-SOFTWARE PROJECT PLANNING AND MANAGEMENT
CO1	Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities
CO2	Apply risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales
CO3	Identify the resources required for a project and to produce a work plan and resource schedule
CO4	Monitor the progress of a project and to assess the risk of slippage, revising targets counteract drift
CO5	Use appropriate metrics to management the software development outcome
CO6	Develop research methods and techniques appropriate to defining, planning and carrying out a research project within your chosen specialist area within the management of software projects.

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2021-22(CRITERIA- 2)

2.6.1 Program outcomes, program specific outcomes and course outcomes

Department of Electronics & Communication Engineering

Program Outcomes (PO's)

PO 1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's)

PSO 1: Analyse and Design Electronic Systems for Signal Processing and Communication Applications.

PSO 2: Demonstrate the Conceptual Domain Knowledge With Respect to Architecture, Design, Analysis and Engineering deployment in Data Communication and Computer Networking. Embedded system. Microcontroller, Advanced communication system.

PSO 3: Identify and Apply Domain Specific Tools For Design, Analysis, Synthesis and Validation Of VLSI, Optical Fiber Communication and Communication Systems.

ELECTRONICS AND COMMUNICATION ENGINEERING 2021-Scheme	
Course Code	21ELN14/24 - BASIC ELECTRONICS & COMMUNICATION ENGINEERING
CO1	Describe the concepts of electronic circuits encompassing power supplies, amplifiers and oscillators
CO2	Present the basics of digital logic engineering including data representation, circuits and the microcontroller system with associated sensors and actuators.
CO3	Discuss the characteristics and technological advances of embedded systems.
CO4	Relate to the fundamentals of communication engineering spanning from the frequency spectrum to the various circuits involved including antennas.
CO5	Explain the different modes of communications from wired to wireless and the computing involved
Course Code	21MAT 31 - TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
CO1	To solve ordinary differential equations using Laplace transform
CO2	Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory
CO3	To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z Transform techniques to solve difference equations
CO4	To solve mathematical models represented by initial or boundary value problems involving partial differential equations
CO5	Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
Course Code	21EC32 - Digital System Design Using Verilog
CO1	Simplify Boolean functions using K-map and Quine-McCluskey minimization technique
CO2	Analyze and design for combinational logic circuits
CO3	Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential circuits using Flip Flops.
CO4	Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.
Course Code	21EC33 - Basic Signal Processing
CO1	Understand the basics of Linear Algebra
CO2	Analyse different types of signals and systems
CO3	Analyse the properties of discrete time signals & systems
CO4	Analyse discrete time signals & systems using Z transforms
Course Code	21EC34 - Analog Electronic Circuits
CO1	Understand the characteristics of BJTs and FETs for switching and amplifier circuits.
CO2	Design and analyze FET amplifiers and oscillators with different circuit configurations and biasing conditions.
CO3	Understand the feedback topologies and approximations in the design of amplifiers and oscillators
CO4	Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers
CO5	Understand the power electronic device components and its functions for basic power electronic circuits.
Course Code	21ECL35 - Analog and Digital Electronics Lab
CO1	Design and analyze the BJT/FET amplifier and oscillator circuits

CO2	Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers.
CO3	Design and test the combinational logic circuits for the given specifications
CO4	Test the sequential logic circuits for the given functionality
CO5	Demonstrate the basic electronic circuit experiments using SCR and 555 timer.
Course Code	21EC382 - AEC (Analog Electronic Circuits) Lab
CO1	Understand the circuit schematic and its working
CO2	Study the characteristics of different electronic devices
CO3	Design and test simple electronic circuits as per the specifications using discrete electronic components.
CO4	Compute the parameters from the characteristics of active devices.
CO5	Familiarize with EDA software which can be used for electronic circuit simulation.
Course Code	21EC41 - Maths for Communication Engineers
CO1	Recall the basic laws and definitions (with mathematical representations) in Electric and Magnetic fields.
CO2	Apply the basic laws of Electric and Magnetic fields to arrive at Divergence Theorem, Current continuity Equation, Curl, Stokes' theorem
CO3	Apply Electric and Magnetic field concepts to arrive at Maxwell's equations, Electromagnetic wave equations and Poynting's theorem (Important concepts related to Communication link).
CO4	Recall the definitions related to Random variables and Random Processes
CO5	Model the Random events in the Communication set-up and determine useful statistical parameters.
Course Code	21EC42 - Digital Signal Processing
CO1	Determine response of LTI systems using time domain and DFT techniques
CO2	Compute DFT of real and complex discrete time signals
CO3	Compute DFT using FFT algorithms
CO4	Design FIR and IIR Digital Filters
CO5	Design of Digital Filters using DSP processor
Course Code	21EC43- Circuits & Controls
CO1	Analyse and solve Electric circuit, by applying, loop analysis, Nodal analysis and by applying network Theorems.
CO2	Evaluate two port parameters of a network and Apply Laplace transforms to solve electric networks
CO3	Deduce transfer function of a given physical system, from differential equation representation or Block Diagram representation and SFG representation
CO4	Calculate time response specifications and analyse the stability of the system
CO5	Draw and analyse the effect of gain on system behaviour using root loci.
CO6	Perform frequency response Analysis and find the stability of the system
CO7	Represent State model of the system and find the time response of the system.
Course Code	21EC44 - Communication Theory
CO1	Understand the amplitude and frequency modulation techniques and perform time and frequency domain transformations
CO2	Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance
CO3	Characterize the influence of channel noise on analog modulated signals
CO4	Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems

CO5	Illustration of digital formatting representations used for Multiplexers, Vocoders and Videotransmission.
Course Code	21ECL46 - Communication Laboratory I
CO1	Demonstrate the AM and FM modulation and demodulation by representing the signals in time and frequency domain.
CO2	Design and test the sampling, Multiplexing and PAM with relevant circuits
CO3	Demonstrate the basic circuitry and operations used in AM and FM receivers
CO4	Illustrate the operation of PCM and delta modulations for different input conditions
Course Code	21EC482- C++ Basics
CO1	Write C++ program to solve simple and complex problems
CO2	Apply and implement major object-oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems
CO3	Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set
CO4	Analyze, design and develop solutions to real-world problems applying OOP concepts of C++
Course Code	21EC51 - Digital Communication
CO1	Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications
CO2	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels
CO3	Differentiate various spread spectrum schemes and compute the performance parameters of communication system.
CO4	Apply the fundamentals of information theory and perform source coding for given message
CO5	Apply different encoding and decoding techniques with error Detection and Correction
Course Code	21EC52 - Computer Organization & ARM Microcontrollers
CO1	Explain the basic organization of a computer system
CO2	Demonstrate functioning of different sub systems, such as processor, Input/output, and memory
CO3	Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3
CO4	Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
Course Code	21EC53 - Computer Communication Networks
CO1	Understand the concepts of networking thoroughly
CO2	Identify the protocols and services of different layers
CO3	Distinguish the basic network configurations and standards associated with each network.
CO4	Discuss and analyse the various applications that can be implemented on networks
Course Code	21EC54 - ELECTROMAGNETIC WAVES
CO1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume
CO2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem
CO3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
CO4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials

	and voltage induced in electric circuits.
CO5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem
Course Code	21ECL55 - Communication Lab II
CO1	Design and test the digital modulation circuits and display the waveforms
CO2	To Implement the source coding algorithm using C/C++/ MATLAB code
CO3	To Implement the Error Control coding algorithms using C/C++/ MATLAB code.
CO4	Illustrate the operations of networking concepts and protocols using C programming and network simulators.
Course Code	21EC581 - IoT (Internet of Things) Lab
CO1	Understand internet of Things and its hardware and software components
CO2	Interface I/O devices, sensors & communication modules
CO3	Remotely monitor data and control devices
CO4	Develop real life IoT based projects
Course Code	21EC62 - Microwave Theory and Antennas
CO1	Describe the use and advantages of microwave transmission
CO2	Analyze various parameters related to transmission lines.
CO3	Identify microwave devices for several applications
CO4	Analyze various antenna parameters and their significance in building the RF system
CO5	Identify various antenna configurations for suitable applications
Course Code	21EC63- VLSI Design and Testing
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling
CO2	Draw the basic gates using the stick and layout diagram with the knowledge of physical design aspects
CO3	Interpret memory elements along with timing considerations
CO4	Interpret testing and testability issues in combinational logic design
CO5	Interpret testing and testability issues in combinational logic design
Course Code	21EC643 - Python Programming
CO1	To acquire programming skills in Python
CO2	To demonstrate data structure representation using Python
CO3	To develop the skill of pattern matching and files in Python
CO4	To acquire Object Oriented Skills in Python
CO5	To develop the ability to write database applications in Python
Course Code	21EC653 - Basic VLSI Design
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling
CO2	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects
CO3	Interpret Memory elements along with timing considerations
CO4	Demonstrate knowledge of FPGA based system design
CO5	Interpret testing and testability issues in VLSI Design
CO6	Analyze CMOS subsystems and architectural issues with the design constraints
Course Code	21ECL66 - VLSI Laboratory
CO1	Design and simulate combinational and sequential digital circuits using Verilog HDL.
CO2	Understand the synthesis process of digital circuits using EDA tool
CO3	Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.

CO4	Design and simulate basic CMOS circuits like inverter, common source amplifier, differential amplifier, SRAM
CO5	Perform RTL_GDSII flow and understand the stages in ASIC design
Course Code	21EC71 - Advanced VLSI
CO1	Understand VLSI design flow
CO2	Describe the concepts of ASIC design methodology
CO3	Create floor plan including partition and routing with the use of CAD algorithms
CO4	Will have better insights into VLSI back-end design flow
CO5	Learn verification basics and System Verilog
Course Code	21EC72 - Optical & Wireless Communication
CO1	Classification and characterization of optical fibers with different modes of signal propagation
CO2	Describe the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and reception
CO3	Understand the essential concepts and principles of mobile radio channel and cellular communication.
CO4	Describe various multiple access techniques used in wireless communication systems
CO5	Describe the GSM architecture and procedures to establish call set up, call progress handling and call tear down in a GSM cellular network.
Course Code	21EC722 – Digital Image Processing
CO1	Understand image formation and the role of human visual system plays in perception of gray and color image data
CO2	Compute various transforms on digital images
CO3	Conduct independent study and analysis of Image Enhancement techniques
CO4	Apply image processing techniques in frequency (Fourier) domain
CO5	Design image restoration techniques
Course Code	21EC732 – Network Security
CO1	Explain network security services and mechanisms and explain security concepts
CO2	Understand the concept of Transport Level Security and Secure Socket Layer
CO3	Explain Security concerns in Internet Protocol security
CO4	Explain Intruders, Intrusion detection and Malicious Software
CO5	Describe Firewalls, Firewall Characteristics, Biasing and Configuration
Course Code	21CS744 - ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT
CO1	To Understand the basic concepts of RPA
CO2	To Describe various components and platforms of RPA
CO3	To Describe the different types of variables, control flow and data manipulation techniques
CO4	To Understand various control techniques and OCR in RPA
CO5	To Describe various types and strategies to handle exceptions

ELECTRONICS AND COMMUNICATION ENGINEERING

2018 Scheme

Course Code	18ELN14/24 - BASIC ELECTRONICS
CO1	Describe the operation of diodes, BJT, FET and operational amplifiers
CO2	Design and explain the construction of rectifiers, regulators, amplifiers and oscillators.
CO3	Describe general operating principles of SCRs and its application.
CO4	Explain the working and design of fixed voltage regulator using 7805 and Astable oscillator using timer IC 555.
CO5	Explain the different number system and their conversions and construct simple combinational and sequential logic circuits using Flip-Flops
CO6	Describe the basic principle of operation of communication system and mobile phones.
Course Code	18EC32 - NETWORK THEORY
CO1	Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/ source transformation/ source shifting.
CO2	Solve network problems by applying Superposition/ Reciprocity/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions.
CO3	Calculate current and voltages for the given circuit under transient conditions and apply Laplace transform to solve the given network.
CO4	Solve the given network using specified two port network parameter like Z or Y or T or h.
CO5	Understand the concept of resonance and determine the parameters that characterize series/parallel resonant circuits.
Course Code	18EC33 - ELECTRONIC DEVICES
CO1	Understand the principles of semiconductor Physics
CO2	Understand the principles and characteristics of different types of semiconductor devices
CO3	Understand the fabrication process of semiconductor devices
CO4	Utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems
CO5	Identify the mathematical models of MOS transistors for circuits and systems.
Course Code	18EC34 - DIGITAL SYSTEM DESIGN
CO1	Explain the concept of combinational and sequential logic circuits
CO2	Analyze and design the combinational logic circuits.
CO3	Describe and characterize flip-flops and its applications.
CO4	Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines
CO5	Design applications of combinational & Sequential circuits
Course Code	18EC35 - COMPUTER ORGANIZATION AND ARCHITECTURE
CO1	Explain the basic organization of a computer system
CO2	Describe the addressing modes, instruction formats and program control statement.
CO3	Explain different ways of accessing an input / output device including interrupts

CO4	Illustrate the organization of different types of semiconductor and other secondary storage memories
CO5	Illustrate simple processor organization based on hardwired control and micro programmed control
Course Code	18EC36 - POWER ELECTRONICS AND INSTRUMENTATION
CO1	Build and test circuits using power electronic devices
CO2	Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters and SMPS
CO3	Analyze instrument characteristics and errors.
CO4	Describe the principle of operation and develop circuits for multirange ammeters, voltmeters and bridges to measure passive component values and frequency.
CO5	Explain the principle, design and analyze the transducers for measuring physical parameters,
Course Code	18ECL37 - ELECTRONIC DEVICES AND INSTRUMENTATION LABORATORY
CO1	Recognize and demonstrate functioning of semiconductor power devices.
CO2	Evaluate the characteristics, switching, power conversion and control by semiconductor power devices.
CO3	Analyze the response and plot the characteristics of transducers such as LDR, Photo Diode, etc.
CO4	Design and test simple electronic circuits for measurement of temperature and resistance.
CO5	Use of circuit simulation software are for the implementation and characterization of electronic circuits and devices
Course Code	18ECL38 - DIGITAL SYSTEM DESIGN LABORATORY
CO1	Design, realize and verify De Morgan's Theorem, SOP, POS forms.
CO2	Demonstrate the truth table of various expressions and combinational circuits using logic gates.
CO3	Design various combinational circuits such as adders, subtractors, comparators, multiplexers and de-multiplexers
CO4	Construct flips-flops, counters and shift registers.
CO5	Simulate serial adder and binary multiplier
Course Code	18EC42 - ANALOG CIRCUITS
CO1	Understand the characteristics of BJTs and FETs
CO2	Design and analyze BJT and FET amplifier circuits
CO3	Design sinusoidal and non sinusoidal oscillators
CO4	Understand the functioning of linear ICs
CO5	Design of linear IC based circuits
Course Code	18EC43- CONTROL SYSTEMS
CO1	Develop the mathematical model of mechanical and electrical systems
CO2	Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method
CO3	Determine time domain specifications for first and second order systems
CO4	Determine the stability of a system in the time domain using Routh Hurwitz criteria and root locus technique
CO5	Determine the stability of a system in the frequency domain using Nyquist and bode plots

Course Code	18EC44 - ENGINEERING STATISTICS and LINEAR ALGEBRA
CO1	Analyze the evaluate single and multiple random variables.
CO2	Identify and associate random variables and random processes in communication events
CO3	Analyze and model the random events in typical communication events to extract quantitative statistical parameters
CO4	Analyze and model typical signal sets in terms of a basis function set of amplitude, phase and frequency
CO5	Demonstrate by way of simulation or emulation the ease of analysis employing basis functions, statistical representation and eigen values
Course Code	18EC45 - SIGNALS AND SYSTEMS
CO1	Analyze the different types of signals and systems
CO2	Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
CO3	Evaluate the convolution sum and integral.
CO4	Represent continuous and discrete signals & systems in frequency domain using fourier representation.
CO5	Analyze discrete time signals and systems using Z-transforms.
Course Code	18EC46- MICROCONTROLLER
CO1	Explain the difference between Microprocessor & Microcontrollers, architectures of 8051 microcontroller, interfacing of 8051 to external memory and instruction set of 8051
CO2	Write 8051 assembly level programs using 8051 instruction set
CO3	Explain the interrupt system, operation of timers/counters and serial port of 8051
CO4	Write 8051 assembly language programs to generate square wave on 8051 i/o port pin using interrupt and c programme to send and receive serial data using 8051 serial port
CO5	Interface simple switches, simple LEDs, ADC 0804, LCD and stepper motor to 8051 using 8051 i/o ports
Course Code	18ECL47 - MICROCONTROLLER LABORATORY
CO1	Enhance programming skills using Assembly language and C.
CO2	Write assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051
CO3	Interface different input and output devices to 8051 and control them using assembly language programs
CO4	Interface the serial devices to 8051 and to the serial transfer using C Programming
CO5	Develop applications based on Microcontroller 8051.
Course Code	18ECL48 - ANALOG CIRCUITS LABORATORY
CO1	Analyze frequency response of JFET/MOSFET amplifier.
CO2	Design BJT/FETs amplifier with and without feedback and evaluate their performance characteristics
CO3	Apply the knowledge gained in the design of BJT/FET circuits in oscillators.
CO4	Design analog circuits using OPAMPs for different applications
CO5	Simulate and analyze analog circuits that uses IC s for different electronic applications

Course Code	18ES51 - TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP
CO1	Understand the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business
CO2	Identify the various organizations architecture
CO3	Describe the functions of Managers, Entrepreneurs and their social responsibilities
CO4	Understand the components in developing a business plan
CO5	Recognize the various sources of funding and institutions supporting entrepreneurs
Course Code	18EC52 - DIGITAL SIGNAL PROCESSING
CO1	Determine response of LTI systems using time domain and DFT techniques.
CO2	Compute DFT of real and complex discrete time signals.
CO3	Computation DFT using FFT algorithms and linear filtering approach.
CO4	Design and realize FIR and IIR digital filters
CO5	Understand the DSP processor architecture
Course Code	18EC53 - PRINCIPLES OF COMMUNICATION SYSTEMS
CO1	Analyze and compute performance of AM and FM modulation in the presence of noise at the receiver
CO2	Analyze and compute performance of digital formatting processes with quantization noise.
CO3	Multiplex digitally formatted signals at transmitter
CO4	De-multiplex the signals and reconstruct digitally formatted signals at the receiver
CO5	Design / Demonstrate the use of digital formatting in Multiplexers, vocoders and video transmission
Course Code	18EC54 - INFORMATION THEORY AND CODING
CO1	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
CO2	Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
CO3	Model the continuous and discrete communication channels using input, output and joint probabilities
CO4	Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
CO5	Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.
Course Code	18EC55 - ELECTROMAGNETIC WAVES
CO1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume
CO2	Apply Guass law to evaluate electric fields due to different charge distributions and volume charge distribution by using divergence theorem
CO3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and apply biot savarts and amperes laws for evaluating magnetic field for different current configurations
CO4	Calculate magnetic force, potential energy and magnetization with respect to magnetic materials and voltage induced in electric circuits
CO5	Apply maxwells equation for time varying fields, EM waves in free space and conductors and evaluate power associated with EM waves using poynting theorem

Course Code	18EC56- VERILOG HDL
CO1	Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
CO2	Design and verify the functionality of digital circuit/system using test benches.
CO3	Identify the suitable Abstraction level for a particular digital design.
CO4	Write the programs more effectively using Verilog tasks and directives.
CO5	Perform timing and delay Simulation and interpret the various constructs in logic synthesis
Course Code	18ECL57 - DIGITAL SIGNAL PROCESSING LABORATORY
CO1	Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
CO2	Modelling of discrete time signals and systems and verification of its properties and results.
CO3	Implementation of discrete computations using DSP processor and verify the results.
CO4	Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.
CO5	Write programs using Matlab / Scilab/Octave to illustrate DSP concepts.
Course Code	18ECL58 - HDL LABORATORY
CO1	Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
CO2	Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms. description and obtain simulation waveforms.
CO3	Use FPGA/CPLD kits for down loading verilog codes and check output.
CO4	Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
CO5	Interface the hardware to the programmable chips and obtain the required output.
Course Code	18CIV59 - ENVIRONMENTAL STUDIES
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a globe scale.
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
CO5	Relate to the latest developments in environmental pollution mitigation tools.
Course Code	18EC61 - DIGITAL COMMUNICATION
CO1	Associate and apply the concepts of Band pass sampling to well specified signals and channels.
CO2	Analyze and compute performance parameters and transfer rates for low pass and Band pass symbol under ideal and corrupted non band limited channels.
CO3	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted band limited channels.

CO4	Demonstrate that band pass signals subjected to corruption and distortion in a Band limited channel can be processed at the receiver to meet specified performance criteria
CO5	Understand the principles of spread spectrum communications.
Course Code	18EC62 -EMBEDDED SYSTEMS
CO1	Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3
CO2	Apply the knowledge gained for Programming ARM Cortex M3 for different applications
CO3	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system
CO4	Develop the hardware /software co-design and firmware design approaches
CO5	Explain the need of real time operating system for embedded system applications
Course Code	18EC63 – MICROWAVE AND ANTENNAS
CO1	Describe the use and advantages of microwave transmission
CO2	Analyze various parameters related to microwave transmission lines and waveguides
CO3	Identify microwave devices for several applications
CO4	Analyze various antenna parameters necessary for building an RF system
CO5	Recommend various antenna configurations according to the applications
Course Code	18EC641 – OPERATING SYSTEM
CO1	Explain the goals, structure, operation and types of operating systems.
CO2	Apply scheduling techniques to find performance factors.
CO3	Explain organization of file systems and IOCS.
CO4	Apply suitable techniques for contiguous and non-contiguous memory allocation.
CO5	Describe message passing, deadlock detection and prevention methods.
Course Code	18ECL66 - EMBEDDED SYSTEMS LABORATORY
CO1	Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language
CO2	Develop assembly language programs using ARM Cortex M3 for different applications
CO3	Interface external devices and I/O with ARM Cortex M3
CO4	Develop C language programs and library functions for embedded system applications
CO5	Analyze the functions of various peripherals, peripheral registers and power saving modes of ARM Cortex M3
Course Code	18ECL67 – COMMUNICATION LABORATORY
CO1	Design and test circuits for analog modulation and demodulation schemes viz., AM, FM, etc.
CO2	Determine the characteristics and response of microwave waveguide.
CO3	Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
CO4	Design and test the digital and analog modulation circuits and display the waveforms.
CO5	Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes
Course Code	18EC71 – COMPUTER NETWORKS
CO1	Understand the concepts of networking.

CO2	Describe the various networking architectures.
CO3	Identify the protocols and services of different layers.
CO4	Distinguish the basic network configurations and standards associated with each network
CO5	Analyze a simple network and measure its parameters
Course Code	18EC72 – VLSI DESIGN
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
CO2	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
CO3	Demonstrate ability to design Combinational, sequential and dynamic logic circuits as per the requirements
CO4	Interpret Memory elements along with timing considerations
CO5	Interpret testing and testability issues in VLSI Design
Course Code	18EC733 – DIGITAL IMAGE PROCESSING
CO1	Describe the fundamentals of digital image processing.
CO2	Understand image formation and the role human visual system plays in perception of gray and color image data.
CO3	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO4	Design and evaluate image analysis techniques
CO5	Conduct independent study and analysis of Image Enhancement and restoration techniques
Course Code	18EC743 – MULTIMEDIA COMMUNICATION
CO1	Understand basics of different multimedia networks and applications. Analyse different media types to represent them in digital form.
CO2	Understand different compression techniques to compress audio and video.
CO3	Describe multimedia Communication across Networks.
CO4	Analyze different media types to represent them in digital form.
CO5	Compress different types of text and images using different compression techniques
Course Code	18ECL76 – COMPUTER NETWORKS LABORATORY
CO1	Choose suitable tools to model a network.
CO2	Use the network simulator for learning and practice of networking algorithms.
CO3	Illustrate the operations of network protocols and algorithms using C programming.
CO4	Simulate the network with different configurations to measure the performance parameters.
CO5	Implement the data link and routing protocols using C programming.
Course Code	18ECL77 - VLSI LABORATORY
CO1	Design and simulate combinational and sequential digital circuits using Verilog HDL.
CO2	Understand the Synthesis process of digital circuits using EDA tool.
CO3	Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list
CO4	Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
CO5	Perform RTL-GDSII flow and understand the stages in ASIC design

Course Code	18EC81 – WIRELESS AND CELLULAR COMMUNICATION
CO1	Understand the communication theory both physical and networking associated with GSM, CDMA & LTE 4G systems.
CO2	Explain concepts of propagation mechanisms like Reflection, Diffraction, Scattering in wireless channels.
CO3	Develop a scheme for idle mode, call set up, call progress handling and call tear down in a GSM cellular network.
CO4	Develop a scheme for idle mode, call set up, call progress handling and call tear down in a CDMA cellular network.
CO5	Understand the Basic operations of Air interface in a LTE 4G system.
Course Code	18EC821 – NETWORK SECURITY
CO1	Explain network security services and mechanisms and explain security concepts
CO2	Understand the concept of Transport Level Security and Secure Socket Layer.
CO3	Explain Security concerns in Internet Protocol security
CO4	Explain Intruders, Intrusion detection and Malicious Software
CO5	Describe Firewalls, Firewall Characteristics, Biasing and Configuration

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2021-22(CRITERIA- 2)

2.6.1 Program outcomes, program specific outcomes and course outcomes

Department of Electrical & Electronics Engineering

Program Outcomes (PO's)

PO 1: Engineering Knowledge: Apply knowledge of differential equations, vector calculus, complex variables, matrix theory, probability theory, physics and chemistry, electrical and electronic engineering fundamentals.

PO 2: Problem Analysis: Graduates will Identify, formulate and solve complex electrical and electronics engineering problems using the first principles of mathematics natural sciences and engineering science

PO 3: Design: Graduates will design Electrical and Electronics systems meeting the given specifications for different problems taking safety and precautions into consideration.

PO 4: Investigations: Graduates will Perform investigations, design and conduct experiments, analyze and interpret the results to provide valid conclusions.

PO 5: Tool Usage: Graduates will use modern software tools to model and analyze problems, apply appropriate techniques and IT tools for the design & analysis of the systems keeping in view their limitations.

PO 6: The Engineer and Society: Graduates will understand the impact of local and global issues / happenings and assess societal, health, legal and cultural issues with competency in professional engineering practice on Electrical Engineers.

PO 7: Environment and Sustainability: Graduates will Demonstrate professional skills and contextual reasoning and provide sustainable solutions for problems related to Electrical and Electronics Engineering and also will understand their impact on environment.

PO 8: Ethics: Graduates will have knowledge of professional ethics and code of conduct as applied to Electrical Engineers.

PO 9: Individual and Team work: Graduates will work effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.

PO 10: Communication: Graduates will communicate effectively in both verbal and written form among engineering community, being able to comprehend and write reports, presentation and give / receive clear instructions.

PO 11: Project Management and Finance: Graduates will plan, demonstrate and execute engineering & management principles in their own / team projects in multidisciplinary environment

PO 12: Life-long learning: Graduates will have the ability for self- education ,recognize the need for and have the ability to engage in independent and lifelong learning.

Program Specific Outcomes (PSO's)

PSO 1: Ability to specify architect, design and analyze systems that efficiency generate, transmit, distribute and utilize electrical power.

PSO 2: Ability to specify design, prototype and test modern electronic systems that perform analog and digital processing function.

PSO 3: Ability to use software for design, simulation and analysis of electrical system.

**ELECTRICAL & ELECTRONICS ENGINEERING
21SCHEME**

COURSE CODE	21ELE13 BASIC ELECTRICAL ENGINEERING
CO1	Analyse basic DC and AC electric circuits.
CO2	Explain the working principles of transformers and electrical machines
CO3	Explain the concepts of electric power transmission and distribution of power
CO4	Understand the wiring methods, electricity billing, and working principles of circuit protective devices and personal safety measures.
COURSE CODE	21ELE23 BASIC ELECTRICAL ENGINEERING
CO1	Analyse basic DC and AC electric circuits.
CO2	Explain the working principles of transformers and electrical machines
CO3	Explain the concepts of electric power transmission and distribution of power
CO4	Understand the wiring methods, electricity billing, and working principles of circuit protective devices and personal safety measures.
COURSE CODE	21MAT31 Transform Calculus, Fourier Series and Numerical Techniques (Common to all Branches)
CO1	To solve ordinary differential equations using Laplace transform.
CO2	Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
CO3	To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
CO4	To solve mathematical models represented by initial or boundary value problems involving partial differential equations
CO5	Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
COURSE CODE	21EE32 Analog Electronic Circuits and Op - Amps
CO1	Obtain the output characteristics of clipper and clamper circuits
CO2	Design and compare biasing circuits for transistor amplifiers & explain the transistor switching.
CO3	Explain the concept of feedback, its types and design of feedback circuits

CO4	Design and analyse the power amplifier circuits and oscillators for different frequencies.
CO5	Design and analysis of FET and MOSFET amplifiers.
CO6	Demonstrate the application of Op-amps.
COURSE CODE	21EE33 Electric circuit Analysis
CO1	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations.
CO2	Solve complex electric circuits using network theorems.
CO3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.
CO4	Synthesize typical waveforms using Laplace transformation.
CO5	Solve unbalanced three phase systems and also evaluate the performance of two port networks.
COURSE CODE	21EE34 Transformer and generators
CO1	Understand the construction and operation of 1-phase, 3-Phase transformers, and Autotransformer.
CO2	Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation.
CO3	Understand the construction and working of AC and DC Generators
CO4	Analyze the performance of the AC Generators on infinite bus and parallel operation
CO5	Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods.
COURSE CODE	21EEL35 Electrical Machines Laboratory - 1
CO1	Evaluate the performance of transformers from the test data obtained.
CO2	Connect and operate two single phase transformers of different KVA rating in parallel.
CO3	Connect single phase transformers for three phase operation and phase conversion.
CO4	Compute the voltage regulation of synchronous generator using the test data obtained in the laboratory
CO5	Evaluate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus.
COURSE CODE	21EEL381 Scilab for Transformers and Generators
CO1	Analyse in an intelligent manner, think better, and perform better.

COURSE CODE	21EEL382 Circuit Laboratory using Pspice
CO1	Analyse in an intelligent manner, think better, and perform better.
COURSE CODE	21EEL383 555 IC Laboratory
CO1	Analyse in an intelligent manner, think better, and perform better.
COURSE CODE	21EEL384 Scilab for Mathematics
CO1	Analyse in an intelligent manner, think better, and perform better.
COURSE CODE	21MAT41 Complex Analysis, Probability and Statistical Methods
CO1	Use the concepts of an analytic function and complex potentials to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
CO2	Obtain Series Solutions of Ordinary Differential Equation.
CO3	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO4	Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.
COURSE CODE	21EE42 Digital System Design
CO1	Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques.
CO2	Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits
CO3	Design flip flops, counters, shift registers as sequential control circuits.
CO4	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.
CO5	Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory.
CO6	Realize Boolean expressions, adders and subtractors using gates.
CO7	Design and test Ring counter/Johnson counter, Sequence generator and 3 bit counters.

COURSE CODE	21EE43 Microcontroller
CO1	Outline the 8051 architecture, registers, internal memory organization, addressing modes.
CO2	Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
CO3	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
CO4	Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
CO5	Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control.
COURSE CODE	21EE44 Electric Motors
CO1	Explain the construction, operation and classification of DC Motor, AC motor and special purpose motors.
CO2	Describe the performance characteristics and applications of Electric motors.
CO3	Demonstrate and explain the methods of testing of DC machines and determine losses and efficiency.
CO4	Control the speed of DC motor and induction motor.
CO5	Explain the starting methods, equivalent circuit and phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and damping of synchronous motors.
COURSE CODE	21EEL46 Electrical Machines Laboratory - 2
CO1	Test DC machines to determine their characteristics and also to control the speed of DC motor.
CO2	Pre-determine the performance characteristics of DC machines by conducting suitable tests.
CO3	Perform load test on single phase and three phase induction motor to assess its performance.
CO4	Conduct test on induction motor to pre-determine the performance characteristics.
CO5	Conduct test on synchronous motor to draw the performance curves
COURSE CODE	21EEP481 Microcontroller Based Projects
CO1	Analyse in a systematic way, think better, and perform better.
COURSE CODE	21EEL482 Scilab for Electric Motors
CO1	Analyse in a systematic way, think better, and perform better.

COURSE CODE	21EEL483 Scilab for Electrical and Electronic Measurements
CO1	Analyse in a systematic way, think better, and perform better.

COURSE CODE	21EEL484 Simulation of Op-Amp Circuits
CO1	Analyse in a systematic way, think better, and perform better.

COURSE CODE	21EE51 Transmission and Distribution
CO1	Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators.
CO2	Analyze and compute the parameters of the transmission line for different configurations.
CO3	Assess the performance of overhead lines.
CO4	Interpret corona, explain the use of underground cables.
CO5	Classify different types of distribution systems; examine its quality & reliability.

COURSE CODE	21EE52 Control Systems
CO1	Analyze and model electrical and mechanical system using analogous.
CO2	Formulate transfer functions using block diagram and signal flow graphs
CO3	Analyze the stability of control system, ability to determine transient and steady state time response.
CO4	Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
CO5	Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification.
CO6	Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
CO7	Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.
CO8	Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.
CO9	Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
CO10	Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability of a system using software package.

COURSE CODE	21EE53 Power System Analysis - 1
CO1	Model the power system components & construct per unit impedance diagram of power system.
CO2	Analyze three phase symmetrical faults on power system.
CO3	Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks.
CO4	Analyze various unsymmetrical faults on power system.
CO5	Examine dynamics of synchronous machine and determine the power system stability.
Course Code	21EE54 Power Electronics
CO1	To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
CO2	To explain the techniques for design and analysis of single phase diode rectifier circuits.
CO3	To explain different power transistors, their steady state and switching characteristics and limitations.
CO4	To explain different types of Thyristors, their gate characteristics and gate control requirements.
CO5	To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.
Course Code	21EEL55 Power Electronics Laboratory
CO1	Obtain static characteristics of semiconductor devices to discuss their performance.
CO2	Trigger the SCR by different methods
CO3	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
CO4	Control the speed of a DC motor, universal motor and stepper motors.
CO5	Verify the performance of single phase full bridge inverter connected to resistive load.
Course Code	21EEL581 Scilab for Analysis of Power Systems
CO1	Analyse in an intelligent manner, think better, and perform better.
Course Code	21EEL582 Scilab for Power Electronics
CO1	Analyse in an intelligent manner, think better, and perform better.
Course Code	21EEP583 Energy Audit Project
CO1	To analyze the data collected for energy audit of a building or industry or organization.
CO2	To perform comparative analysis with and without energy audit.
CO3	To analyze the energy saving measures to be considered with economy considerations.

CO4	Analyse in a systematic way, think better, and perform better.
Course Code	21EEP584 Renewable Energy Projects
CO1	Analyse in a systematic way, think better, and perform better.
Course Code	21EE61 Management and Entrepreneurship
CO1	Explain the field of management, task of the manager, planning and steps in decision making.
CO2	Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.
CO3	Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
CO4	Show an understanding of role of SSI's in the development of country and state/central level institutions/ agencies supporting business enterprises.
CO5	Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques.
Course Code	21EE62 Power System Analysis - 2
CO1	Formulate network matrices and models for solving load flow problems.
CO2	Perform steady state power flow analysis of power systems using numerical iterative techniques.
CO3	Solve issues of economic load dispatch and unit commitment problems.
CO4	Analyze short circuit faults in power system networks using bus impedance matrix.
CO5	Apply Point by Point method and Runge Kutta Method to solve Swing Equation.
CO6	Develop a program in suitable package to assess the performance of medium and long transmission lines.
CO7	Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator.
CO8	Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
Course Code	21EE63 Signals and Digital Signal Processing
CO1	Discuss classification and basic operations that can be performed on both continuous and discrete time signals.
CO2	Evaluate Discrete Fourier Transform of a sequence and the convolution of two sequences to determine the output sequence.
CO3	Evaluate Discrete Fourier Transform of a sequence by using fast methods.
CO4	Design Butterworth and Chebyshev IIR digital filters and FIR filters using different techniques.
CO5	Develop different structures for IIR and FIR filters.

Course Code	21EE641 Sensors and Transducers
CO1	Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
CO2	Explain the working of various transducers and sensors.
CO3	Outline the recent trends in sensor technology and their selection
CO4	Analyze the signal conditioning and signal conditioning equipment.
CO5	Illustrate different configuration of Data Acquisition System and data conversion.
CO6	Show knowledge of data transmission and telemetry.
CO7	Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity.
Course Code	21EE642 Electromagnetic Field Theory
CO1	Use different coordinate systems, Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
CO2	Calculate the energy and potential due to a system of charges & Explain the behavior of electric field across a boundary conditions
CO3	Explain the Poisson's, Laplace equations and behavior of steady magnetic fields.
CO4	Explain the behavior of magnetic fields and magnetic materials.
CO5	Asses time varying fields and propagation of waves in different media.
Course Code	21EE643 Electrical Machine Design
CO1	Identify and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
CO2	Derive the output equation of DC machine, discuss selection of specific loadings and magnetic circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine.
CO3	Derive the output equations of transformer, discuss selection of specific loadings, estimate the number of cooling tubes, no load current and leakage reactance of core type transformer.
CO4	Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor.
CO5	Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications.

Course Code	21EE644 Electrical Engineering Materials
CO1	Discuss electrical and electronics materials, their importance, classification and operational requirement
CO2	Discuss conducting, dielectric, insulating and magnetic materials used in engineering, their properties and classification.
CO3	Explain the phenomenon superconductivity, super conducting materials and their application in engineering.
CO4	Explain the plastic and its properties and applications.
Course Code	21EE651 Utilization of Electrical Power
CO1	Discuss different methods of electric heating & welding.
CO2	Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process.
CO3	Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
CO4	Analyze systems of electric traction, speed time curves and mechanics of train movement.
CO5	Explain the motors used for electric traction, their control & braking and power supply system used for electric traction.
Course Code	21EE652 Renewable Energy Resources
CO1	Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2	Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
CO3	Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4	Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5	Discuss production of energy from biomass, biogas.
CO6	Summarize tidal energy resources, sea wave energy and ocean thermal energy.
Course Code	21EE653 Industrial Servo Control Systems
CO1	Explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
CO2	Discuss system analogs, vectors and transfer functions of differential equations.
CO3	Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
CO4	Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
Course Code	21EE654 Advanced Control Systems
CO1	Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems.
CO2	Develop of state models for linear continuous-time and discrete-time systems.
CO3	Apply vector and matrix algebra to find the solution of state equations for linear continuous-time and discrete-time systems.

CO4	Define controllability and observability of a system and test for controllability and observability of a given system.
CO5	Design pole assignment and state observer using state feedback.
CO6	Develop the describing function for the nonlinearity present to assess the stability of the system.
CO7	Develop Lyapunov function for the stability analysis of nonlinear systems
Course Code	21EEL66 Digital Signal Processing Laboratory
CO1	Conduct sampling of signals in time and frequency domains.
CO2	Evaluate the impulse response of a system.
CO3	Obtain convolution of given sequences to evaluate the response of a system.
CO4	Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods.
CO5	Provide a solution for a given difference equation.
CO6	Design and implement IIR and FIR filters.
Course Code	21EE71 High Voltage and Power System Protection
CO1	Apply the knowledge of dielectric property for insulation, it's performances as per Standards and High voltage application in power system Equipment's.
CO2	Analyze the circuits of high voltages, high currents in Generation and Measurements.
CO3	Apply relays to the power system protection.
CO4	Discuss the construction, operating principles and performances of circuit breaker.
CO5	Discuss protection of generators, motors, Transformer and Bus Zone Protection.
CO6	Describe the causes of over voltages and their remedial measures.
CO7	Analyze the spark over characteristics using High voltages for checking the breakdown phenomenon and dielectric strength of dielectric materials
CO8	Experimentally verify the characteristics of over current, over voltage, under voltage using electromagnetic, static, distance and impedance relays.
CO9	Demonstration of protective schemes for motor and feeders.

Course Code	21EE72 Power System Operation and Control
CO1	Describe various levels of controls in power systems, architecture and configuration of SCADA.
CO2	Develop and analyze mathematical models of Automatic Load Frequency Control.
CO3	Develop mathematical model of Automatic Generation Control in Interconnected Power system.
CO4	Discuss the Control of Voltage, Reactive Power and Voltage collapse.

CO5	Explain security, contingency analysis, and state estimation of power systems.
Course Code	21EE721 Power System Planning
CO1	Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting.
CO2	Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions
CO3	Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.
CO4	Discuss principles of distribution planning, supply rules, network development and the system studies
CO5	Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies
CO6	Discuss planning and implementation of electric –utility activities, market principles and the norms framed.
Course Code	21EE722 Smart Grid
CO1	Discuss the progress made by different stakeholders in the design and development of smart grid.
CO2	Explain measurement techniques using Phasor Measurement Units and smart meters
CO3	Discuss tools for the analysis of smart grid and design, operation and performance
CO4	Discuss classical optimization techniques and computational methods for smart grid design, planning and operation.
CO5	Explain predictive grid management and control technology for enhancing the smart grid performance
CO6	Develop cleaner, more environmentally responsible technologies for the electric system.
CO7	Discuss the computational techniques, communication, measurement, and monitoring technology tools essential to the design of the smart grid.
CO8	Explain methods to promote smart grid awareness and making the existing transmission system smarter by investing in new technology.
Course Code	21EE723 ANN with Applications to Power Systems
CO1	Develop Neural Network and apply elementary information processing tasks that neural network can solve.
CO2	Develop Neural Network and apply powerful, useful learning techniques.
CO3	Develop and Analyze multilayer feed forward network for mapping provided through the first network layer and error back propagation algorithm.
CO4	Analyze and apply algorithmic type problems to tackle problems for which algorithms are not available.
CO5	Develop and Analyze supervised/unsupervised, learning modes of Neural Network for different applications.
Course Code	21EE724 Electrical Vehicle Technologies
CO1	Explain the working of electric vehicles and recent trends.

CO2	Analyze different power converter topology used for electric vehicle application.
CO3	Develop the electric propulsion unit and its control for application of electric vehicles.
CO4	Design converters for battery charging and explain transformer less topology.
Course Code	21EE725 PLC and SCADA
CO1	Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
CO2	Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
CO3	Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions
CO4	Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.
CO5	Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes.
Course Code	21EE731 Computer Aided Electrical Drawing
CO1	Develop armature winding diagram for DC and AC machines.
CO2	Develop a Single Line Diagram of Generating Stations and substation using the standard symbols.
CO3	Construct sectional views of core type and shell type transformers using the design data.
CO4	Construct sectional views of assembled DC and AC machine and their parts using the design data or the sketches.
Course Code	21EE732 Micro- and Nano-Scale Sensors and Transducers
CO1	Understand the differences between the sensor and transducer technology based on nanotechnology and nanofabrication and the classical sensor technologies
CO2	Make an informed selection of a sensor or transducer for a particular application
CO3	Become knowledgeable about the technologies that are available commercially at the present time.
Course Code	21EE733 Big Data Analytics in Power Systems
CO1	Discuss role of big data and machine-learning methods applicable to power systems and in particular to Smart Grid communications.
CO2	Discuss optimization methods which are suitable for big data models in power systems.
CO3	Discuss various cyber security issues, electricity theft detection and mitigation that exist in IoT-enabled future power systems.

CO4	Discuss renewable energy planning concerns associated with planned future power systems that have high renewable penetration.
Course Code	21EE734 Industrial Drives and Applications
CO1	Explain the advantages, choice and control of electric drive
CO2	Explain the dynamics, generating and motoring modes of operation of electric drives
CO3	Explain the selection of motor power rating to suit industry requirements
CO4	Analyze the performance & control of DC motor drives using controlled rectifiers
CO5	Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives.
Course Code	21EE735 FACTS and HVDC
CO1	Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.
CO2	Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.
CO3	Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
CO4	Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
CO5	Explain advantages of HVDC power transmission, overview and organization of HVDC system.
CO6	Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
CO7	Explain converter control for HVDC systems, commutation failure, control functions.
Course Code	21EE741 Carbon Capture and Storage
CO1	Discuss the impacts of climate change and the measures that can be taken to reduce emissions.
CO2	Discuss carbon capture and carbon storage.
CO3	Explain the fundamentals of power generation.
CO4	Explain methods of carbon capture from power generation and industrial processes.
CO5	Explain different carbon storage methods: storage in coal seams, depleted gas reservoirs and saline formations.
CO6	Explain Carbon dioxide compression and pipeline transport.
Course Code	21EE742 Electric Vehicles
CO1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
CO2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
CO3	Model batteries, Fuel cells, PEMFC and super capacitors

CO4	Analyze DC and AC drive topologies used for electric vehicle application.
CO5	Develop the electric propulsion unit and its control for application of electric vehicles.
Course Code	21EE743 Disasters Management
CO1	Discuss disaster management plan, cyclones and their hazard potential
CO2	Understand the role of IMD and cyclone prediction and cyclone warning system in India
CO3	Understand the role of different institutions defence and other services in natural disaster management.
CO4	Understand the role of Central Water Commission in river water sharing, Draught, its assessment and draught management plan
CO5	Understand occurrence of earth quake, Tsunamis and thunderstorms.
Course Code	21EE744 Electrical Power Quality
CO1	Define Power quality; evaluate power quality procedures and standards.
CO2	Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.
CO3	Identify various sources of harmonics, explain effects of harmonic distortion.
CO4	Evaluate harmonic distortion, control harmonic distortion.
CO5	Estimate power quality in distribution planning. Identify power quality issues in utility system.
Course Code	21EE745 Energy Conservation and Audit
CO1	Analyze about energy scenario nationwide and worldwide , also outline Energy Conservation Act and its features.
CO2	Discuss load management techniques and energy efficiency.
CO3	Understand the need of energy audit and energy audit methodology.
CO4	Understand various pillars of electricity market design.
CO5	Conduct energy audit of electrical systems and buildings.
CO6	Show an understanding of demand side management and energy conservation.

ELECTRICAL & ELECTRONICS ENGINEERING DEPARTMENT

COURSE CODE	18ELE14/24 BASIC ELECTRICAL ENGINEERING
C01	To predict the behaviour of electrical and magnetic circuits.
C02	Select the type of generator / motor required for a particular application.
C03	Realize the requirement of transformers in transmission and distribution of electric power and other applications.
C04	Practice Electrical Safety Rules & standards.
C05	To function on multi-disciplinary teams.
COURSE CODE	18ELE17/27 BASIC ELECTRICAL ENGINEERING LABORATORY
C01	Identify the common electrical components and measuring instruments used for conducting experiments in the electrical laboratory.
C02	Compare power factor of lamps.
C03	Determine impedance of an electrical circuit and power consumed in a 3 phase load.
C04	Determine the Earth Resistance and understand two way and three way control of lamps.
COURSE CODE	18MAT31 TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
C01	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering
C02	Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory
C03	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems
C04	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
C05	Determine the external of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
COURSE CODE	18EE32 ELECTRIC CIRCUIT ANALYSIS (Core Subject)
C01	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations

C02	Solve complex electric circuits using network theorems
C03	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.
C04	Synthesize typical waveforms using Laplace transformation.
C05	Solve unbalanced three phase systems and also evaluate the performance of two port networks
COURSE CODE	18EE33 TRANSFORMERS AND GENERATORS
C01	Understand the construction and operation of 1-phase, 3-Phase transformers and Autotransformer.
C02	Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation.
C03	Understand the construction and working of AC and DC Generators. .
C04	Analyze the performance of the AC Generators on infinite bus and parallel operation
C05	Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods.
COURSE CODE	18EE34 ANALOG ELECTRONIC CIRCUITS
C01	Obtain the output characteristics of clipper and clamper circuits. .
C02	Design and compare biasing circuits for transistor amplifiers & explain the transistor switching.
C03	Explain the concept of feedback, its types and design of feedback circuits .
C04	Design and analyze the power amplifier circuits and oscillators for different frequencies
C05	Design and analysis of FET and MOSFET amplifiers
COURSE CODE	18EE35 DIGITAL SYSTEM DESIGN
C01	Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques. .
C02	Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits.
C03	Design flip flops, counters, shift registers as sequential control circuits. .
C04	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.
C05	Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory
COURSE CODE	18EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS (Core Course)
C01	Measure resistance, inductance and capacitance using bridges and determine earth resistance. .
C02	Explain the working of various meters used for measurement of Power, Energy & understand the adjustments, calibration & errors in energy meters.
C03	Understand methods of extending the range of instruments & instrument transformers.
C04	Explain the working of different electronic instruments.
C05	Explain the working of different display and recording devices

COURSE CODE	18EEL37 ELECTRICALMACHINES LABORATORY - 1
C01	Evaluate the performance of transformers from the test data obtained. .
C02	Connect and operate two single phase transformers of different KVA rating in parallel.
C03	Connect single phase transformers for three phase operation and phase conversion. .
C04	Compute the voltage regulation of synchronous generator using the test data obtained in the laboratory.
C05	Evaluate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus.
COURSE CODE	18EEL38 ELECTRONICS LABORATORY
C01	Design and test rectifier circuits with and without capacitor filters. .
C02	Determine h-parameter models of transistor for all modes.
C03	Design and test BJT and FET amplifier and oscillator circuits. .
C04	Realize Boolean expressions, adders and subtractors using gates.
C05	Design and test Ring counter/Johnson counter, Sequence generator and 3 bit counters
COURSE CODE	18MAT41 COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS
C01	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory. .
C02	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
C03	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field. .
C04	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
C05	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.
COURSE CODE	18EE42 POWER GENERATION AND ECONOMICS
C01	Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants. .
C02	Classify various substations and explain the functions of major equipments in substations.
C03	Explain the types of grounding and its importance.
C04	Infer the economic aspects of power system operation and its effects
C05	Explain the importance of power factor improvement.
COURSE CODE	18EE43 TRANSMISSION AND DISTRIBUTION
C01	Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators.

CO2	Analyze and compute the parameters of the transmission line for different configurations.
CO3	Assess the performance of overhead lines. .
CO4	Interpret corona, explain the use of underground cables.
CO5	Classify different types of distribution systems; examine its quality & reliability.
COURSE CODE	18EE44 ELECTRIC MOTORS
CO1	Explain the construction, operation and classification of DC Motor, AC motor and Special purpose motors.
CO2	Describe the performance characteristics & applications of Electric motors.
CO3	Demonstrate and explain the methods of testing of DC machines and determine losses and efficiency.
CO4	Control the speed of DC motor and induction motor. .
CO5	Explain the starting methods, equivalent circuit and phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and damping of synchronous motors.
COURSE CODE	18EE45 ELECTROMAGNETIC FIELD THEORY
CO1	Use different coordinate systems , Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
CO2	Calculate the energy and potential due to a system of charges & Explain the behavior of electric field across a boundary conditions.
CO3	Explain the Poisson's, Laplace equations and behavior of steady magnetic fields. .
CO4	Explain the behavior of magnetic fields and magnetic materials.
CO5	Asses time varying fields and propagation of waves in different media.
COURSE CODE	18EE46 OPERATIONAL AMPLIFIERS AND LINEAR ICs
CO1	Describe the characteristics of ideal and practical operational amplifier.. .
CO2	Design filters and signal generators using linear ICs
CO3	Demonstrate the application of Linear ICs as comparators and rectifiers.
CO4	Analyze voltage regulators for given specification using op-amp and IC voltage regulators.
CO5	Summarize the basics of PLL and Timer.
COURSE CODE	18EEL47 ELECTRICAL MACHINES LABORATORY - 2
CO1	Test DC machines to determine their characteristics and also to control the speed of DC motor.
CO2	Pre-determine the performance characteristics of DC machines by conducting suitable tests.
CO3	Perform load test on single phase and three phase induction motor to assess its performance.
CO4	Conduct test on induction motor to pre-determine the performance characteristics.

CO5	Conduct test on synchronous motor to draw the performance curves.
COURSE CODE	18EEL48 OP- AMP AND LINEAR ICS LABORATORY 2
CO1	To conduct experiment to determine the characteristic parameters of OP-Amp .
CO2	To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator.
CO3	To design test the OP-Amp as oscillators and filters.
CO4	Design and study of Linear IC's as multivibrator power supplies.
COURSE CODE	18EE51 MANAGEMENT AND ENTREPRENEURSHIP
CO1	Explain the field of management, task of the manager, planning and steps in decision making.
CO2	Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.
CO3	Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
CO4	Show an understanding of role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises. .
CO5	Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques
COURSE CODE	18EE52 MICROCONTROLLER
CO1	Outline the 8051 architecture, registers, internal memory organization, addressing modes.
CO2	Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming. . and timer/counter programming.
CO3	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion
CO4	Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
CO5	Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control.
COURSE CODE	18EE53 POWER ELECTRONICS
CO1	To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
CO2	To explain the techniques for design and analysis of single phase diode rectifier circuits. . .
CO3	To explain different power transistors, their steady state and switching characteristics and limitations.
CO4	To explain different types of Thyristors, their gate characteristics and gate control requirements.

CO5	To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.
COURSE CODE	18EE54 SIGNALS AND SYSTEM
CO1	Explain the generation of signals, behavior of system and the basic operations that can be performed on signals and properties of systems.
CO2	Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.
CO3	Solve the continuous time and discrete time systems by various methods and their representation by block diagram.
CO4	Perform Fourier analysis for continuous and discrete time, linear time invariant systems.
CO5	Apply Z-transform and properties of Z transform for the analysis of discrete time systems.
COURSE CODE	18EE55 ELECTRICAL MACHINE DESIGN (Core Course)
CO1	Identify and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
CO2	Derive the output equation of DC machine, discuss selection of specific loadings and magnetic circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine.
CO3	To explain different power transistors, their steady state and switching characteristics and limitations.
CO4	Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor.
CO5	Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications.
COURSE CODE	18EE56 HIGH VOLTAGE ENGINEERING
CO1	Explain conduction and breakdown phenomenon in gases, liquid dielectrics and breakdown phenomenon in solid dielectrics.
CO2	Summarize generation of high voltages and currents
CO3	Outline measurement techniques for high voltages and currents.
CO4	Summarize overvoltage phenomenon and insulation coordination in electric power systems.
CO5	Explain non-destructive testing of materials and electric apparatus, high-voltage testing of electric apparatus
COURSE	18EEL57 MICROCONTROLLER LABORATORY

CODE	
CO1	Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions and code conversions.
CO2	Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
CO3	Perform interfacing of stepper motor and dc motor for controlling the speed, elevator, LCD, external ADC and temperature control.
CO4	Generate different waveforms using DAC interface.
CO5	Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work.
COURSE	18EEL58 POWER ELECTRONICS LABORATORY
CODE	
CO1	Obtain static characteristics of semiconductor devices to discuss their performance.
CO2	Trigger the SCR by different methods
CO3	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
CO4	Control the speed of a DC motor, universal motor and stepper motors.
CO5	Verify the performance of single phase full bridge inverter connected to resistive load.
COURSE	18EE61 CONTROL SYSTEMS (Core Subject)
CODE	
CO1	Analyze and model electrical and mechanical system using analogous.
CO2	Formulate transfer functions using block diagram and signal flow graphs.
CO3	Analyze the stability of control system, ability to determine transient and steady state time response.
CO4	Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
CO5	Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification.
COURSE	18EE62 POWER SYSTEM ANALYSIS - 1 (Core Subject)
CODE	
CO1	Model the power system components & construct per unit impedance diagram of power system.
CO2	Analyze three phase symmetrical faults on power system.
CO3	Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks.

CO4	Analyze various unsymmetrical faults on power system.
CO5	Examine dynamics of synchronous machine and determine the power system stability
COURSE CODE	18EE63 DIGITAL SIGNAL PROCESSING (Core Subject)
CO1	Apply DFT and IDFT to perform linear filtering techniques on given sequences to determine the output.
CO2	Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
CO3	Design and realize infinite impulse response Butterworth and Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
CO4	Develop a digital IIR filter by direct, cascade, parallel, ladder and FIR filter by direct, cascade and linear phase methods of realization.
CO5	Design and realize FIR filters by use of window function and frequency sampling method.
COURSE CODE	18EE647 SENSORS AND TRANSDUCERS (PROFESSIONAL ELECTIVE)
CO1	Use gauges and transducers to measure pressure, direction and distance.
CO2	Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.
CO3	Explain the working of different temperature sensing devices.
CO4	Discuss the principles and applications of audio electrical sensors and transducers used for the measurement of sound.
CO5	Discuss the use of sensors for the measurement of mass, volume and environmental quantities.
COURSE CODE	18EE653 RENEWABLE ENERGY RESOURCES (OPEN ELECTIVE)
CO1	Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2	Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
CO3	Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4	Discuss production of energy from biomass, biogas.
CO5	Summarize tidal energy resources, sea wave energy and ocean thermal energy.
COURSE CODE	18EEL66 CONTROL SYSTEM LABORATORY
CO1	Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
CO2	Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.
CO3	Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.

CO4	Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
CO5	Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability
COURSE CODE	18EEL67 DIGITAL SIGNAL PROCESSING LABORATORY
CO1	Explain physical interpretation of sampling theorem in time and frequency domains
CO2	Evaluate the impulse response of a system.
CO3	Perform convolution of given sequences to evaluate the response of a system.
CO4	Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods.
CO5	Provide a solution for a given difference equation.
CO6	Design and implement IIR and FIR filters.
COURSE CODE	18EEMP68 MINI PROJECT
CO1	Present the mini-project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills.
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.
COURSE CODE	18EEMP68 INTERNSHIP
CO1	Gain practical experience within industry in which the internship is done.
CO2	Acquire knowledge of the industry in which the internship is done.
CO3	Apply knowledge and skills learnt to classroom work.
CO4	Develop a greater understanding about career options while more clearly defining personal career goals.
CO5	Experience the activities and functions of professionals.
CO6	Develop and refine oral and written communication skills.

CO7	Identify areas for future knowledge and skill development.
CO8	Expand intellectual capacity, credibility, judgment, intuition.
CO9	Acquire the knowledge of administration, marketing, finance and economics
COURSE CODE	18EE71 POWER SYSTEM ANALYSIS – 2(Core Course)
CO1	Formulate network matrices and models for solving load flow problems.
CO2	Perform steady state power flow analysis of power systems using numerical iterative techniques.
CO3	Solve issues of economic load dispatch and unit commitment problems.
CO4	Analyze short circuit faults in power system networks using bus impedance matrix.
CO5	Apply Point by Point method and Runge Kutta Method to solve Swing Equation.
COURSE CODE	18EE72 POWER SYSTEM PROTECTION (Core Subject)
CO1	Discuss performance of protective relays, components of protection scheme and relay terminology over current protection.
CO2	Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.
CO3	Discuss pilot protection, construction, operating principles and performance of differential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.
CO4	Explain the construction and operation of different types of circuit breakers.
CO5	Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection.
COURSE CODE	18EE731 SOLAR AND WIND ENERGY (Professional Elective)
CO1	Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices
CO2	Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system.
CO3	Describe the process of harnessing solar energy and its applications in heating and cooling.
CO4	Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection.
CO5	Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects.
COURSE CODE	18EE742 UTILIZATION OF ELECTRICAL POWER (PROFESSIONAL ELECTIVE)

CO1	Discuss different methods of electric heating & welding.
CO2	Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process.
CO3	Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
CO4	Analyze systems of electric traction, speed time curves and mechanics of train movement.
CO5	Explain the motors used for electric traction, their control & braking and power supply system used for electric traction.
COURSE CODE	18EE753 DISASTERS MANAGEMENT (OPEN ELECTIVE)
CO1	Discuss disaster management plan, cyclones and their hazard potential
CO2	Understand the role of IMD and cyclone prediction and cyclone warning system in India
CO3	Understand the role of different institutions defence and other services in natural disaster management.
CO4	Understand the role of Central Water Commission in river water sharing, Draught, its assessment and draught management plan
CO5	Understand occurrence of earth quake, Tsunamis and thunderstorms.
COURSE CODE	18EEL76 POWER SYSTEM SIMULATION LABORATORY
CO1	Develop a program in suitable package to assess the performance of medium and long transmission lines.
CO2	Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator.
CO3	Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
CO4	Develop programs in suitable package to formulate bus admittance and bus impedance matrices of interconnected power systems.
CO5	Use suitable package to solve power flow problem for simple power systems
CO6	Use suitable package to study unsymmetrical faults at different locations in radial power systems
CO7	Use of suitable package to study optimal generation scheduling problems for thermal power plants.
COURSE CODE	18EEL77 RELAY AND HIGH VOLTAGE LABORATORY
CO1	Verify the characteristics of over current, over voltage, under voltage and negative sequence relay both electromagnetic and static type
CO2	Verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
CO3	Show knowledge of protecting generator, motor and feeders.

CO4	Analyze the spark over characteristics for both uniform and non-uniform configurations using High A and DC voltages.
CO5	Measure high AC and DC voltages and breakdown strength of transformer oil.
CO6	Draw electric field and measure the capacitance of different electrode configuration models.
CO7	Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation.
COURSE CODE	18EEP78 PROJECT PHASE – I
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilizing a systems approach.
CO4	Communicate with engineers and the community at large in written and oral forms.
COURSE CODE	18EE81 POWER SYSTEM OPERATION AND CONTROL(Core Course)
CO1	Describe various levels of controls in power systems, architecture and configuration of SCADA.
CO2	Develop and analyze mathematical models of Automatic Load Frequency Control
CO3	Develop mathematical model of Automatic Generation Control in Interconnected Power system
CO4	Discuss the Control of Voltage , Reactive Power and Voltage collapse
CO5	Explain security, contingency analysis, state estimation of power systems
COURSE CODE	18EEP83 PROJECT WORK PHASE -II
CO1	Present the project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.
COURSE CODE	18EES84 TECHNICAL SEMINAR

CODE	
CO1	Attain, use and develop knowledge in the field of engineering and other disciplines through independent learning and collaborative study.
CO2	Identify, understand and discuss current, real-time issues.
CO3	Improve oral and written communication skills.
CO4	Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
CO5	Apply principles of ethics and respect in interaction with others.

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2021-22(CRITERIA- 2)

2.6.1 Program outcomes, program specific outcomes and course outcomes

Department of Mechanical Engineering

Program Outcomes (PO's)

PO 1: Engineering Knowledge: Apply the knowledge of Mathematics, Science, Mechanical Engineering, Engineering fundamentals, to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, including prediction and modeling to complex Engineering activities with an understanding of the limitations.

PO 6: The Engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex Engineering activities with the Engineering Community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO 12: Life-long Learning: Recognize the need for identifying contemporary technical challenges and redefining to develop solutions to satisfy given criteria in an optimal manner using creativity in design.

Program Specific Outcomes (PSO's)

PSO 1: Apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.

PSO 2: Successfully apply the principles of design, analysis and implementation of mechanical systems/processes which have been learned as a part of the curriculum.

PSO 3: Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices.

MECHANICAL ENGINEERING (21 SCHEME)	
Course Code	21EVN15/25 - Engineering Visualisation
CO1	Understand and visualize the objects with definite shape and dimensions
CO2	Analyze the shape and size of objects through different views
CO3	Develop the lateral surfaces of the object
CO4	Create a 3D view using CAD software
CO5	Identify the interdisciplinary engineering components or systems through its graphical representation.
Course Code	21ME15/25-ELEMENTS OF MECHANICAL ENGINEERING
CO1	Understand basic concepts of mechanical engineering in the fields of energy and its utilization, materials technology, manufacturing techniques, and transmission
CO2	Understand the application of energy sources in Power generation and utilization, Engineering materials, manufacturing, and machining techniques leading to the latest
CO3	Apply the skills in developing simple mechanical elements and processes
Course Code	21IDT19/29 - INNOVATION and DESIGN THINKING
CO1	Appreciate various design process procedure
CO2	Generate and develop design ideas through different technique
CO3	Identify the significance of reverse Engineering to Understand products
CO4	Draw technical drawing for design ideas
Course Code	21MAT 31 TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
CO1	To solve ordinary differential equations using Laplace transform.
CO2	Demonstrate the Fourier series To study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
CO3	To use Fourier transforms To analyze problems involving continuous-time signals and To apply Z-Transform techniques To solve difference equations
CO4	To solve mathematical models represented by initial or boundary value problems involving partial differential equations

CO5	Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
Course Code	21ME32 - METAL CASTING FORMING & JOINING PROCESS (IPCC)
CO1	Select appropriate primary manufacturing process and related parameters for obtaining initial shape and size of components.
CO2	Design and develop adequate Tooling linked with casting, welding and forming operations.
CO3	Appreciate the effect of process parameters on quality of manufactured components
CO4	Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
CO5	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.
CO6	Demonstrate skills in preparation of Welding models.
Course Code	21ME33 - MATERIAL SCIENCE AND ENGINEERING (IPCC)
CO1	Understand the atomic arrangement in crystalline materials and describe the periodic arrangement of atoms in terms of
CO2	Understand the importance of phase diagrams and the phase transformations.
CO3	Know various heat treatment methods for controlling the microstructure..
CO4	Correlate between material properties with component design and identify various kinds of defects.
CO5	Apply the method of materials selection, material data and knowledge sources for computer-aided selection of materials.
Course Code	21ME34 - THERMODYNAMICS
CO1	Describe the fundamental concepts and principles of engineering thermodynamics.
CO2	Apply the governing laws of thermodynamics for different engineering applications.
CO3	Analyse the various thermodynamic processes, cycles and results.
CO4	Interpret and relate the impact of thermal engineering practices To real life problems.
Course Code	21MEL35 - MACHINE DRAWING AND GD & T
CO1	Interpret the Machining and surface finish symbols on the component drawings.
CO2	Apply limits and Tolerances To assemblies and choose appropriate fits for given assemblies.
CO3	Illustrate various machine components through drawings
CO4	Create assembly drawings as per the conventions.

Course Code	21ME381 - INTRODUCTION To PYTHON
CO1	Demonstrate proficiency in handling of loops and creation of functions.
CO2	Identify the methods To create and manipulate lists, tuples and dictionaries.
CO3	Discover the commonly used operations involving regular expressions and file system.
CO4	Examine working of PDF and word file formats
Course Code	21ME382 - INTRODUCTION To VIRTUAL REALITY
CO1	Describe how VR systems work and list the applications of VR.
CO2	Understand the design and implementation of the hardware that enables VR systems To be built.
CO3	Understand the system of human vision and its implication on perception and rendering.
CO4	Explain the concepts of motion and tracking in VR systems.
CO5	Describe the importance of interaction and audio in VR systems.
Course Code	21ME383 - DIGITAL SOCIETY
CO1	Identify the ways in which digital media shape identity
CO2	Utilize new opportunities for meaningful data collection from and using sophisticated forms of artificial intelligence
CO3	Identify knowledge and truth amongst the abundance of information
Course Code	21MATME41 - COMPLEX ANALYSIS, PROBABILITY AND LINEAR PROGRAMMING
CO1	Use the concepts of an analytic function and complex potentials To solve the problems arising in fluid flow.
CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering
CO4	Analyze and solve linear programming models of real-life situations and solve LPP by the simplex method
CO5	Learn techniques To solve Transportation and Assignment problems.
Course Code	21ME42 - MACHINING SCIENCE AND JIGS & FIXTURES (IPCC)
CO1	Demonstrate the Conventional CNC machines and advanced manufacturing process operations
CO2	Determine Tool life, cutting force, and economy of the machining process.
CO3	Analyze the influence of various parameters on machine Tools' performance.
CO4	Select the appropriate machine Tools and process, the Jigs, and fixtures for various applications.
Course Code	21ME43 - FLUID MECHANICS (IPCC)
CO1	Understand the basic principles of fluid mechanics and fluid kinematics

CO2	Acquire the basic knowledge of fluid dynamics and flow measuring instruments
CO3	Understand the nature of flow and flow over bodies and the dimensionless analysis
CO4	Acquire the compressible flow fundamental and basics of CFD packages and the need for CFD analysis.
CO5	Conduct basic experiments of fluid mechanics and understand the experimental uncertainties.
Course Code	21ME44 - MECHANICS OF MATERIALS
CO1	Understand simple, compound, thermal stresses and strains their relations and strain energy.
CO2	Analyse structural members for stresses, strains and deformations.
CO3	Analyse the structural members subjected To bending and shear loads.
CO4	Analyse shafts subjected To twisting loads.
CO5	Analyse the short columns for stability.
Course Code	21MEL46 - MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY
CO1	Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.
CO2	Apply concepts of Measurement of angle
CO3	Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
CO4	Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear Tooth profile using gear Tooth Vernier/Gear
CO5	Understand the concepts of measurement of surface roughness.
CO6	Demonstrate the use of Coordinate Measuring Machine (CMM) / Laser Scanner
Course Code	21MT481 - SPREAD SHEETS FOR ENGINEERS
CO1	To create different plots and charts
CO2	To compute different functions, conditional functions and make regression analysis
CO3	To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
CO4	To carryout matrix operations
CO5	To Understand VBA and UDF
CO6	To understand VBA subroutines and Macros
CO7	To carryout numerical integration and solving differential equations using different methods
Course Code	21ME482 - INTRODUCTION To AI AND ML
CO1	Understand the basic principles and goals of AI tasks.
CO2	Outline the role of AI in different real-time applications.
CO3	Construct a problem with the suitable AI task.
CO4	Demonstrate the importance of biology in AI.

CO5	Survey the future development of AI.
Course Code	21ME483 - Introduction To Augmented Reality
CO1	Describe how AR systems work and list the applications of AR.
CO2	Understand and analyse the hardware requirement of AR.
CO3	Use computer vision concepts for AR and describe AR techniques
CO4	Analyse and understand the working of various state of the art AR devices
CO5	Acquire knowledge of mixed reality
Course Code	21ME51 - THEORY OF MACHINES
CO1	Knowledge of mechanisms and their motion and the inversions of mechanisms
CO2	Analyse the velocity, acceleration of links and joints of mechanisms..
CO3	Analyse the mechanisms for static and dynamic equilibrium.
CO4	Carry out the balancing of rotating and reciprocating masses
CO5	Analyse different types of governors used in real life situation.
CO6	Analyze the free and forced vibration phenomenon.
Course Code	21ME52 - THERMO-FLUIDS ENGINEERING (IPCC)
CO1	Apply the concepts of testing of I. C. Engines and evaluate their performance, and evaluate the performance of
CO2	Apply and analyse the concepts related To Refrigeration and Air conditioning, and get conversant with Psychrometric
CO3	Explain the construction, classification and working principle of the Turbo machines and apply of Euler's turbine equation To evaluate the energy transfer and other related parameters. Compare and evaluate the performance of positive displacement pumps.
CO4	Classify, Explain and analyse the various types of hydraulic turbines and centrifugal pumps.
CO5	Classify, Explain and analyse various types of steam turbines and centrifugal compressor.
Course Code	21ME53 - FINITE ELEMENT ANALYSIS
CO1	Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements.
CO2	Develop element characteristic equation and generation of global equation.
CO3	Formulate and solve Axi-symmetric and heat transfer problems.
CO4	Apply suitable boundary conditions To a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems.

Course Code	21ME54 - MODERN MOBILITY & AUTOMOTIVE MECHANICS
CO1	Understand the working of different systems employed in automobile
CO2	Analyse the limitation of present day automobiles
CO3	Evaluate the energy sources suitability
CO4	Apply the knowledge for selection of automobiles based on their suitability
Course Code	21MEL55 - DESIGN LAB
CO1	Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.
CO2	Carry out balancing of rotating masses and gyroscope phenomenon.
CO3	Analyse the governor characteristics.
CO4	Determine stresses in disk, beams and plates using photo elastic bench.
CO5	Determination of Pressure distribution in Journal bearing
CO6	Analyse the stress and strains using strain gauges in compression and bending test
CO7	To realize different mechanisms and cam motions
Course Code	21ME581 - BASICS OF MATLAB
CO1	Able To implement loops, branching, control instruction and functions in MATLAB programming environment.
CO2	Able To program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and
CO3	Able To understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in
CO4	Able To simulate MATLAB Simulink examples
Course Code	21ME582- DIGITAL MARKETING
CO1	To identify the importance of the digital marketing for marketing success,
CO2	To manage customer relationships across all digital channels and build better customer relationships
CO3	To create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations,
CO4	To perceive ways of the integration taking into consideration the available budget.

Course Code	21ME583 - VFX: VISUAL EFFECTS
CO1	Gain good understanding about compositing process.
CO2	Identify major applications of compositing process used in industry.
CO3	Develop a visual effects pipeline.
CO4	Demonstrate an in-depth knowledge of grading and VFX principles, practice and system capabilities.
CO5	Create cusTomized Tools through software or scripting To allow for more creative application of visual effects
Course Code	21ME61 - PRODUCTION AND OPERATIONS MANAGEMENT
CO1	Apply the necessary Tools for decision making in operations management.
CO2	Examinevariousapproachesforforecastingthesalesdemandforanorganization.
CO3	ListvariouscapacityandlocationplansTodeterminethesuitablecapacityrequiredformeeingtheforecastdemandofanorganizati
CO4	Analyse the aggregate plan and master production schedule for an organization, given its periodic demand.
CO5	Apply MRP, purchasing and SCM techniques inTo practice.
Course Code	21ME62 - HEAT TRANSFER (IPCC)
CO1	Solve steady state heat transfer problems in conduction.
CO2	Solve transient heat transfer problems
CO3	solve convection heat transfer problems using correlations
CO4	Solve radiation heat transfer problems
CO5	Explain the mechanisms of boiling and condensation. And Determine performance parameters of heat exchangers.
Course Code	21ME63 - MACHINE DESIGN
CO1	Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's
CO2	Analyse the performance and failure modes of mechanical components subjected To combined loading and fatigue
CO3	Demonstrate the application of engineering design Tools To the design of machine components like shafts, springs,
CO4	Design different types of gears and simple gear boxes for relevant applications.
CO5	Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.
Course Code	21ME641 - SUPPLY CHAIN MANAGEMENT & INTRODUCTION To SAP
CO1	Understand the framework and scope of supply chain management.

CO2	Build and manage a competitive supply chain using strategies, models, techniques and information technology.
CO3	Plan the demand, inventory and supply and optimize supply chain network.
CO4	Understand the emerging trends and impact of IT on Supply chain.
CO5	Understand the basics of SAP material management system
Course Code	21ME642 - MECHATRONICS SYSTEM DESIGN
CO1	Discuss about Mechatronics design process and select the sensor and Actuator for a Mechatronics application
CO2	Explain Modeling and Simulation of mechanical Elements, electrical Elements and fluid system the sensors in mechatronics systems and Fault detection techniques in Mechatronics.
CO3	Understand the elements of Data Acquisition and Control System, Convert the data in real time interfacing
CO4	Model the dynamic response of first order and second order systems.
Course Code	21ME643 - AUTONOMOUS VEHICLES
CO1	Describe the evolution of Automotive Electronics and the operation of ECUs.
CO2	Compare the different type of sensing mechanisms involved in Autonomous Vehicles.
CO3	Discuss about the use of computer vision and learning algorithms in vehicles.
CO4	Summarize the aspects of connectivity fundamentals existing in a driverless car.
CO5	Identify the different levels of automation involved in an Autonomous Vehicle.
CO6	Outline the various controllers employed in vehicle actuation
Course Code	21ME644 - INTERNET OF THINGS (IOT)
CO1	Explain IoT architecture, interpret the design principles that govern connected devices, summarize the roles of various
CO2	Explain the basics of microcontrollers, outline the architecture of Arduino, develop simple applications using Arduino
CO3	outline the architecture of Raspberry Pi, develop simple applications using Raspberry Pi, select a platform for a particular
CO4	interpret different protocols and compare them, select which protocol can be used for a specific application, Utilize the
CO4	select IoT APIs for an application, design and develop a solution for a given application using APIs, test for errors in the
Course Code	21ME651 - PROJECT MANAGEMENT
CO1	Understand the selection, prioritization and initiation of individual projects and strategic role of project management.
CO2	Understand the work breakdown structure by integrating it with organization.
CO3	Understand the scheduling and uncertainty in projects.
CO4	Understand risk management planning using project quality Tools.

CO5	Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related To performing
CO6	Determine project progress and results through balanced scorecard approach
CO7	Draw the network diagram To calculate the duration of the project and reduce it using crashing.
Course Code	21ME652 - RENEWABLE ENERGY POWER PLANTS (OPEN ELECTIVE)
CO1	Describe the various forms of non-conventional energy resources.
CO2	Apply the fundamental knowledge of mechanical engineering To design various renewable energy systems
CO3	Analyze the implications of renewable energy forms for selecting an appropriate system for a specific application
CO4	Discuss on the environmental aspects and impact of non-conventional energy resources, in comparison with various conventional energy systems, their prospects and limitations.
Course Code	21ME653 - MECHATRONICS
CO1	Illustrate various components of Mechatronics systems.
CO2	Assess various control systems used in auTomation.
CO3	Design and conduct experiments To evaluate the performance of a mechatronics system or component with respect To specifications, as well as To analyse and interpret data.
CO4	Apply the principles of Mechatronics design To product design.
CO5	Function effectively as members of multidisciplinary teams.
Course Code	21ME654 - MODERN MOBILITY
CO1	Understand the working of different systems employed in auTomobile
CO2	Analyse the limitation of present day auTomobiles
CO3	Evaluate the energy sources suitability
CO4	Apply the knowledge for selection of auTomobiles based on their suitability
Course Code	21MEL66 - CNC PROGRAMMING AND 3-D PRINTING LAB
CO1	Students will have knowledge of G-code and M-code for machining operations.
CO2	Students will able To perform CNC programming for turning, drilling, milling and threading operation.
CO3	Students will able To visualize the 3D models using CAD software's
CO4	Students will able To use 3D printing technology
CO5	Students are able To understand robotic programming and FMS

Course Code	21ME71 - AUTOMATION AND ROBOTICS (PCC)
CO1	Translate and simulate a real time activity using modern Tools and discuss the Benefits of auTomation.
CO2	Identify suitable auTomation hardware for the given application.
CO3	Recommend appropriate modelling and simulation Tool for the given manufacturing Application.
CO4	Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.
CO5	Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications
Course Code	21ME72 -CONTROL ENGINEERING
CO1	Identify the type of control and control actions and develop the mathematical model of the physical systems.
CO2	Estimate the response and error in response of first and second order systems subjected standard input signals.
CO3	Represent the complex physical system using block diagram and signal flow graph and obtain transfer function.
CO4	Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.
CO5	Analyse the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots.
Course Code	21ME731 - ADDITIVE MANUFACTURING
CO1	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO2	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO3	Understand the various software Tools, processes and techniques that enable advanced/additive manufacturing.
CO4	Apply the concepts of additive manufacturing To design and create components that satisfy product development/proTototyping requirements, using advanced/additive manufacturing devices and processes.
CO5	Understand characterization techniques in additive manufacturing.
CO6	Understand the latest trends and business opportunities in additive manufacturing.
Course Code	21ME732 - ToTAL QUALITY MANAGEMENT

CO1	Explain the various approaches of TQM
CO2	Infer the customer perception of quality
CO3	Analyse customer needs and perceptions To design feedback systems.
CO4	Apply statistical Tools for continuous improvement of systems
CO5	Apply the Tools and technique for effective implementation of TQM.
Course Code	21ME733 - REFRIGERATION AND AIR-CONDITIONING
CO1	Illustrate the principles, nomenclature and applications of refrigeration systems.
CO2	Explain vapour compression refrigeration system and identify methods for performance improvement
CO3	Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems.
CO4	Estimate the performance of air-conditioning systems using the principles of psychrometry.
CO5	Compute and Interpret cooling and heating loads in an air-conditioning system.
CO6	Identify suitable refrigerant for various refrigerating systems.
Course Code	21ME734 - MEMS AND MICROSYSTEM TECHNOLOGY
CO1	Explain MEMS Technology, Present, Future, and Challenges.
CO2	Explain micro-sensors, micro-actuators, their types, and applications.
CO3	Explain fabrication processes for producing micro-sensors and actuators.
CO4	Apply Reliability and Failure Analysis Testing.
CO5	Understand the operation of microdevices, microsystems, and their applications. Design the microdevices and microsystems using the MEMS fabrication process.
Course Code	21ME735 - DESIGN FOR MANUFACTURING & ASSEMBLY
CO1	have knowledge on design principles for manufacturability
CO2	have knowledge Influencing factors on Design.
CO3	have knowledge on Machining consideration while design.
CO4	have knowledge on casting consideration while design.
CO5	have knowledge on environment consideration while design.
CO6	have ability To understand contemporary issues and their impact on design for manufacturing and assembly.
Course Code	21ME741 - ADVANCED VIBRATIONS AND CONDITION MONITORING
CO1	Identify & classify the vibration systems

CO2	Analyse the vibration parameters through different theoretical methods
CO3	Apply the knowledge of vibration measurement instruments and control system
CO4	Understand the sound generation and propagation arising through vibration
Course Code	21ME742 - Theory and Design of IC Engines
CO1	Understand various types of I.C. Engines, Cycles of operation and Identify fuel metering, fuel supply systems for different types of engines.
CO2	Understand combustion phenomena in SI and CI engines and Analyze the effect of various operating variables on engine performance.
CO3	Evaluate performance Analysis of IC Engine and Justify the suitability for different applications.
CO4	Understand the conventional and non-conventional fuels and effects of emission formation of IC engines, its effects, and the legislation standards
Course Code	21ME743-ADVANCED TURBOMACHINES
CO1	Explain the various thermodynamic processes involved in turbomachines with the application of 1st and 2nd law of Thermodynamics and also apply of the concept of law of conservation of energy for the flow through nozzle and diffuser.
CO2	Demonstrate the concept of two-dimensional cascading and evaluating the cascade performance in compressor and turbines.
CO3	Explain the thermodynamics of axial flow turbines and analyse its performance and characteristics.
CO4	Explain the thermodynamics of axial flow compressor and fans and analyse its performance and characteristics.
CO5	Explain and apply the various vortex flow concepts for designing the blades and describe the process of control and maintenance aspects of turbomachines.
Course Code	21ME744-PRODUCT DESIGN & ERGONOMICS
CO1	To learn the concept of product design and the ergonomics.
CO2	Design the various controls and displays by knowing the anthropometric data's.
CO3	To learn the psychology of visuals effects.
CO4	Learning the different colour combinations for optimal design of engineering equipments.
CO5	Realize the importance of environmental factors and aesthetics in industrial design.

Course Code	21ME751-NON-TRADITIONAL MACHINING
CO1	Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process.
CO2	Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
CO3	Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
CO4	Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
CO5	Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.
Course Code	21ME752-HYDRAULICS AND PNEUMATICS
CO1	Have knowledge of hydraulic and pneumatic system and its components.
CO2	Understand the working principle of various hydraulic and pneumatic components.
CO3	Apply working principles of Hydraulic and Pneumatic Systems for various applications.
CO4	Determine cause for hydraulic and pneumatic system break down and performance of hydraulic pumps, moTors.
Course Code	21ME753-OPERATIONS RESEARCH
CO1	Understand the meaning, definitions, scope, need, phases and techniques of operations research.
CO2	Formulate as L.P.P and derive optimal solutions To linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
CO3	Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
CO4	Solve problems on game theory for pure and mixed strategy under competitive environment.
CO5	Solve waiting line problems for M/M/1 and M/M/K queuing models.
CO6	Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks

MECHANICAL ENGINEERING	
Course Code 20MTP12	FINITE ELEMENT METHOD IN HEAT TRANSFER
CO1	Establish the mathematical models for the complex analysis problems and predict the nature of solution.
CO2	Formulate the element characteristic for linear and nonlinear matrices and vectors.
CO3	Identify the boundary conditions and their incorporation in to the FE equations.
CO4	Solve the problems with simple geometries, with hand calculations involving the fundamental concepts.
CO5	Interpret the analysis results for the improvement or modification of the system.
Course Code 20 MTP13	ADVANCED FLUID MECHANICS
CO1	Illustrate the basic concepts fluid flow and their governing equations
CO2	Analyse the laminar and turbulent flow problems.
CO3	Analyse one dimensional incompressible and compressible fluid flow Problems
CO4	Distinguish normal and oblique shocks and their governing Equations.
CO5	Describe the instruments and methods for flow measurements
Course Code 20MTP14	COMBUSTION THERMODYNAMICS
CO1	Understand the basic thermodynamic concepts for combustion phenomena.
CO2	Describe the fuel energy conversion systems.
CO3	Apply the concept of flam flow mechanism in combustion process.
CO4	knowledge of adiabatic flame temperature in the design of combustion devices.
CO5	Identify the phenomenon of flame stabilization in laminar and turbulent flames.
Course Code 20 MTP15	ADVANCED POWER PLANT CYCLES
CO1	Distinguish the various power plant cycle and their working principles.
CO2	Describe the working principles of different components of power plant.
CO3	Explain the concepts of power generation by nuclear power plant.
CO4	Illustrate the concept of hydroelectric power generation.
CO5	Explain the concept of pollution and its effects.

Course Code 20 MTPL16	THERMAL ENGINEERING MEASUREMENT LABORATORY
CO1	Perform experiments to determine the coefficient of discharge of flow measuring devices.
CO2	Conduct experiments on hydraulic turbines and pumps to draw characteristics.
CO3	Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
CO4	Identify exhaust emission, factors affecting them and report the remedies.
CO5	Determine the energy flow pattern through the hydraulic machines and I C Engine
CO6	Exhibit his competency towards preventive maintenance of IC engines.
Course Code 20RMI17	RESEARCH METHODOLOGY AND IPR
CO1	Discuss research methodology and the technique of defining a research problem
CO2	Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
CO3	Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
CO4	Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
CO5	Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ■
Course Code 20 MTP21	ADVANCED HEAT TRANSFER
CO1	Describe the different modes of heat transfer with both physics and the mathematical concept.
CO2	Use the concepts of radiation heat transfer for enclosure analysis.
CO3	Explain the concepts of Boundary layer.
CO4	Formulate mathematical functions for two-dimensional and three dimensional heat conduction problems.
CO5	Describe the free and forced convection problems in real time applications.
Course Code 20 MTP22	STEAM AND GAS TURBINES
CO1	Describe the working principles of Gas and steam turbines nozzle and diffusers.

CO2	Explain the principles of thermodynamic concept to determine the performance of steam and gas turbines.
CO3	Illustrate the concepts of axial flow and centrifugal compressors.
CO4	Differentiate axial flow and radial flow gas turbines for their analysis.
CO5	Identify the various losses associated with the turbines.
Course Code 20MTP23	REFRIGERATION AND AIR CONDITIONING
CO1	Understand concepts of refrigeration and air-conditioning process and systems.
CO2	Employ the theoretical principles to simple, complex vapour compression and vapour absorption refrigeration systems.
CO3	Understand conventional and alternate refrigerants and their impact on environment.
CO4	Apply the heat load calculation to design the air-conditioning systems.
CO5	Describe the concepts to design air distribution systems.
Course Code 20MTP241	ENERGY CONSERVATION AND MANAGEMENT
CO1	Understand the various energy conservation and improvement techniques.
CO2	Illustrate the Energy scenario.
CO3	Employ the principles of thermal engineering and energy management to improve the Performance of thermal systems.
CO4	Assess energy projects on the basis of economic and financial criteria.
CO5	Describe methods of energy production for improved utilization
Course Code 20MTP251	SOLAR THERMAL TECHNOLOGIES AND ITS APPLICATIONS
CO1	Analyse the energy concepts on solar devices for various thermal properties.
CO2	Analyse the solar thermal devices for various tracking modes.
CO3	Evaluate the performance of various solar thermal technologies.
Course Code 20 MTPL26	SIMULATION LABORATORY
Course Code 20MTP27	TECHNICAL SEMINAR
Course Code 20MTP31	DESIGN OF HEAT TRANSFER EQUIPMENTS FOR THERMAL POWER PLANT
CO1	Understand the physics and the mathematical treatment of typical heat exchangers.
CO2	Employ LMTD and Effectiveness methods in the design of heat exchangers and analyze the importance of LMTD approach over AMTD approach.
CO3	Examine the performance of double-pipe counter flow (hair-pin) heat exchangers.
CO4	Design and analyze the shell and tube heat exchanger.

CO5	Understand the fundamental, physical and mathematical aspects of boiling and condensation.
CO6	Classify cooling towers and explain their technical features.
Course Code 20MTP322	THEORY OF IC ENGINES
CO1	Distinguish different Fuel-air and actual cycles.
CO2	Demonstrate the different types of injection and carburetor systems
CO3	Formulate the flow and combustion phenomenon for modeling
CO4	Identify the various types of emissions, noise and their control systems
CO5	Recommend the suitable alternative fuel for IC Engine.
Course Code 20MTP332	NON-CONVENTIONAL ENERGY SOURCES
CO1	Describe the need of renewable energy resources, historical and latest developments.
CO2	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc.
CO3	Appreciate the need of Wind Energy, wave power, tidal power, ocean thermal power and geothermal and the various components used in energy generation.
CO4	Understand the concept of Biomass energy resources and their classification, types of biogas Plants applications
Course Code 20MTP34	PROJECT WORK PHASE – 1
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation, and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach.
CO4	Communicate with engineers and the community at large in written and oral forms.
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Course Code 20MTP35	MINI PROJECT
CO1	Present the mini-project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

Course Code 20MTPI36	INTERNSHIP / PROFESSIONAL PRACTICE
CO1	Gain practical experience within industry in which the internship is done.
CO2	Acquire knowledge of the industry in which the internship is done.
CO3	Apply knowledge and skills learned to classroom work.
CO4	Develop a greater understanding about career options while more clearly defining personal career goals.
CO5	Experience the activities and functions of professionals.
CO6	Develop and refine oral and written communication skills.
CO7	Identify areas for future knowledge and skill development.
CO8	Expand intellectual capacity, credibility, judgment, intuition.
CO9	Acquire the knowledge of administration, marketing, finance and economics
Course Code 20MTP41	PROJECT WORK PHASE -2
CO1	Present the project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

MECHANICAL ENGINEERING

Course Code	18EGDL15/18EGDL25 - ENGINEERING GRAPHICS AND DESIGN
CO1	Produce computer generated drawings using CAD software.
CO2	Prepare drawings as per BIS following the conventions mentioned in the relevant codes.
CO3	Apply the knowledge of orthographic projections to represent engineering information/concepts and present the same in the form of drawings.
CO4	Read and evaluate engineering drawings.
CO5	Create isometric drawings of simple objects reading the orthographic projections of those objects.
Course Code	18ME15/25-ELEMENTS OF MECHANICAL ENGINEERING
CO1	Identify different sources of energy and their conversion process.
CO2	Explain the working principle of hydraulic turbines, pumps, IC engines and refrigeration.
CO3	Recognize various metal joining processes and power transmission elements
CO4	Understand the properties of common engineering materials and their applications in engineering industry.
CO5	Discuss the working of conventional machine tools, machining processes, tools and accessories.
CO6	Describe the advanced manufacturing systems.
Course Code	18ME32 - MECHANICS OF MATERIALS
CO1	Understand simple, compound, thermal stresses and strains their relations and strain energy.
CO2	Analyse structural members for stresses, strains and deformations.
CO3	Analyse the structural members subjected to bending and shear loads.
CO4	Analyse shafts subjected to twisting loads.
CO5	Analyse the short columns for stability.
Course Code	18ME33 - BASIC THERMODYNAMICS
CO1	Explain fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems
CO2	Evaluate the feasibility of cyclic and non-cyclic processes using 2nd law of thermodynamics.
CO3	Apply the knowledge of entropy, reversibility and irreversibility to solve numerical problems and apply 1st law of thermodynamics to closed and open systems and determine quantity of energy transfers and change in properties
CO4	Interpret the behavior of pure substances and its application in practical problems.
CO5	Recognize differences between ideal and real gases and evaluate thermodynamic properties of ideal and real gas mixtures using various relations.
Course Code	18ME34 - MATERIAL SCIENCE
CO1	Understand the mechanical properties of metals and their alloys.
CO2	Analyze the various modes of failure and understand the microstructures of ferrous and nonferrous materials
CO3	Describe the processes of heat treatment of various alloys.
CO4	Acquire the Knowledge of composite materials and their production process as well as applications.
CO5	Understand the properties and potentialities of various materials available and material selection procedures

Course Code	18ME35B - METAL CASTING AND WELDING
CO1	Explain the construction & specification of various machine tools.
CO2	Discuss different cutting tool materials, tool nomenclature & surface finish.
CO3	Apply mechanics of machining process to evaluate machining time.
CO4	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.
CO5	Understand the concepts of different metal forming processes.
CO6	Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.
Course Code	18ME36B - MECHANICAL MEASUREMENTS AND METROLOGY
CO1	Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters.
CO2	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design
CO3	Understand the working principle of different types of comparators.
CO4	Describe measurement of major & minor diameter, pitch, angle and effective diameter of screw threads.
CO5	Explain measurement systems, transducers, intermediate modifying devices and terminating devices
CO6	Describe functioning of force, torque, pressure, strain and temperature measuring devices
Course Code	18MEL37B - MECHANICAL MEASUREMENTS AND METROLOGY LAB
CO1	Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.
CO2	Apply concepts of Measurement of angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
CO3	Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
CO4	Analyse tool forces using Lathe/Drill tool dynamometer.
CO5	Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometre
CO6	Understand the concepts of measurement of surface roughness.
Course Code	18MEL38B - FOUNDRY, FORGING AND WELDING LAB
CO1	Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
CO2	Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.
CO3	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.
Course Code	18ME42 - APPLIED THERMODYNAMICS
CO1	Apply thermodynamic concepts to analyze the performance of gas power cycles.
CO2	Apply thermodynamic concepts to analyze the performance of vapour power cycles.
CO3	Understand combustion of fuels and performance of I C engines.
CO4	Understand the principles and applications of refrigeration systems.
CO5	Apply Thermodynamic concepts to determine performance parameters of refrigeration and air conditioning systems.
CO6	Understand the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement.

Course Code	18ME43 - FLUID MECHANICS
CO1	Identify and calculate the key fluid properties used in the analysis of fluid behavior.
CO2	Explain the principles of pressure, buoyancy and floatation
CO3	Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.
CO4	Describe the principles of fluid kinematics and dynamics.
CO5	Explain the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.
CO6	Illustrate and explain the basic concept of compressible flow and CFD
Course Code	18ME44 - KINEMATICS OF MACHINES
CO1	Knowledge of mechanisms and their motion.
CO2	Analyse the velocity, acceleration of links and joints of mechanisms.
CO3	Analysis of cam follower motion for the motion specifications.
CO4	Understand the working of the spur gears.
CO5	Analyse the gear trains speed ratio and torque.
CO6	Understand the inversions of four bar mechanisms.
Course Code	18ME45A - METAL CUTTING AND FORMING
CO1	Explain the construction & specification of various machine tools
CO2	Discuss different cutting tool materials, tool nomenclature & surface finish.
CO3	Apply mechanics of machining process to evaluate machining time.
CO4	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.
CO5	Understand the concepts of different metal forming processes.
CO6	Apply the concepts of design of sheet metal dies to design different dies for simple sheet metal components.
Course Code	18ME46A - COMPUTER AIDED MACHINE DRAWING
CO1	Identify the national and international standards pertaining to machine drawing.
CO2	Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings
CO3	Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.
CO4	Interpret the Machining and surface finish symbols on the component drawings.
CO5	Preparation of the part or assembly drawings as per the conventions.
Course Code	18MEL47A - MATERIAL TESTING LAB
CO1	Acquire experimentation skills in the field of material testing.
CO2	Develop theoretical understanding of the mechanical properties of materials by performing experiments.
CO3	Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.
CO4	Apply the knowledge of testing methods in related areas.

CO5	Understand how to improve structure/behavior of materials for various industrial applications.
Course Code	18MEL48A - WORKSHOP AND MACHINE SHOP PRACTICE
CO1	To read working drawings, understand operational symbols and execute machining operations.
CO2	Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc.
CO3	Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used.
CO4	Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
CO5	Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
CO6	Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and Gear cutting and estimate cutting time.
Course Code	18ME51 - MANAGEMENT AND ECONOMICS
CO1	Understand needs, functions, roles, scope and evolution of Management
CO2	Understand importance, purpose of Planning and hierarchy of planning and also analyse its types.
CO3	Discuss Decision making, Organizing, Staffing, Directing and Controlling.
CO4	Select the best economic model from various available alternatives.
CO5	Understand various interest rate methods and implement the suitable one.
CO6	Estimate various depreciation values of commodities.
CO7	Prepare the project reports effectively.
Course Code	18ME52 - DESIGN OF MACHINE ELEMENTS I
CO1	Apply the concepts of selection of materials for given mechanical components.
CO2	List the functions and uses of machine elements used in mechanical systems.
CO3	Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue.
CO4	Analyze the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.
CO5	Demonstrate the application of engineering design tools to the design of machine components like shafts, couplings, power screws, fasteners, welded and riveted joints
CO6	Understand the art of working in a team.
Course Code	18ME53 - DYNAMICS OF MACHINES
CO1	Analyse the mechanisms for static and dynamic equilibrium.
CO2	Carry out the balancing of rotating and reciprocating masses
CO3	Analyse different types of governors used in real life situation.
CO4	Analyse the gyroscopic effects on disks, airplanes, stability of ships, two and four wheelers
CO5	Understand the free and forced vibration phenomenon.
CO6	Determine the natural frequency, force and motion transmitted in vibrating systems.
Course Code	18ME54 - TURBO MACHINES
CO1	CO1: Model studies and thermodynamics analysis of turbomachines.

CO2	Analyse the energy transfer in Turbo machine with degree of reaction and utilisation factor.
CO3	Classify, analyse and understand various type of steam turbine.
CO4	Classify, analyse and understand various type of hydraulic turbine.
CO5	Understand the concept of radial power absorbing machine and the problems involved during its operation.
Course Code	18ME55 - FLUID POWER ENGINEERING
CO1	CO1: Identify and analyse the functional requirements of a fluid power transmission system for a given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro- pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagram by integrating the components selected for the given application.
Course Code	18ME56 - OPERATIONS MANAGEMENT
CO1	Explain the concept and scope of operations management in a business context
CO2	Recognize the role of Operations management among various business functions and its role in the organizations' strategic planning and gaining competitive advantage
CO3	Analyze the appropriateness and applicability of a range of operations management systems/models in decision making.
CO4	Assess a range of strategies for improving the efficiency and effectiveness of organizational operations.
CO5	Evaluate a selection of frameworks used in the design and delivery of operations
Course Code	18MEL57 - FLUID MECHANICS AND MACHINES LAB
CO1	Perform experiments to determine the coefficient of discharge of flow measuring devices.
CO2	Conduct experiments on hydraulic turbines and pumps to draw characteristics.
CO3	Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
CO4	Determine the energy flow pattern through the hydraulic turbines and pumps.
CO5	Exhibit his competency towards preventive maintenance of hydraulic machines.
Course Code	18MEL58 - ENERGY CONVERSION LABORATORY
CO1	Perform experiments to determine the properties of fuels and oils.
CO2	Conduct experiments on engines and draw characteristics
CO3	Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
CO4	Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC engines.
Course Code	18MEL59 - ENVIRONMENTAL STUDIES
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
CO4	Apply their ecological knowledge to illustrate an and graph a problem and describe the realities that managers face when dealing with complex issues.

Course Code	18ME61 - FINITE ELEMENT METHODS
CO1	Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements.
CO2	Develop element characteristic equation and generation of global equation.
CO3	Formulate and solve Axi-symmetric and heat transfer problems.
CO4	Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems
Course Code	18ME62 - DESIGN OF MACHINE ELEMENTS II
CO1	Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes.
CO2	Design different types of gears and simple gear boxes for relevant applications.
CO3	Understand the design principles of brakes and clutches.
CO4	Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue
CO5	Apply engineering design tools to product design.
CO6	Become good design engineers through learning the art of working in a team.
Course Code	18ME63 - HEAT TRANSFER
CO1	Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.
CO2	Understand and apply the basic laws of heat transfer to extended surface, composite material and unsteady state heat transfer problems.
CO3	Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems.
CO4	Analyze heat transfer due to free and forced convective heat transfer.
CO5	Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena
Course Code	18ME641 - NON-TRADITIONAL MACHINING
CO1	Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process.
CO2	Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
CO3	Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
CO4	Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
CO5	Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.
Course Code	18ME653 - RENEWABLE ENERGY RESOURCES (OPEN ELECTIVE)
CO1	Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2	Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
CO3	Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
CO4	Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5	Discuss production of energy from biomass, biogas.
CO6	Summarize tidal energy resources, sea wave energy and ocean thermal energy.

Course Code	18MEL66 - COMPUTER AIDED MODELLING AND ANALYSIS LAB
CO1	Use the modern tools to formulate the problem, create geometry, descritize, apply boundary conditions to solve problems of bars, truss, beams, and plate to find stresses with different-loading conditions.
CO2	Demonstrate the ability to obtain deflection of beams subjected to point, uniformly distributed and varying loads and use the available results to draw shear force and bending moment diagrams.
CO3	Analyze and solve 1D and 2D heat transfer conduction and convection problems with different boundary conditions.
CO4	Carry out dynamic analysis and finding natural frequencies of beams, plates, and bars for various boundary conditions and also carry out dynamic analysis with forcing functions.
Course Code	18MEL67 - HEAT TRANSFER LAB
CO1	Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs.
CO2	Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
CO3	Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally.
CO4	Determine surface emissivity of a test plate and Stefan Boltzmann constant
CO5	Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchanger
Course Code	18ME71 - CONTROL ENGINEERING
CO1	Identify the type of control and control actions.
CO2	Develop the mathematical model of the physical systems.
CO3	Estimate the response and error in response of first and second order systems subjected standard input signals.
CO4	Represent the complex physical system using block diagram and signal flow graph and obtain transfer function
CO5	Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain.
Course Code	18ME72 - COMPUTER AIDED DESIGN AND MANUFACTURING
CO1	CO1: Define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyzedifferent types of automated flow lines.
CO3	Analyse the automated flow lines to reduce time and enhance productivity.
CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.
Course Code	18ME732 - AUTOMATION & ROBOTICS
CO1	Translate and simulate a real time activity using modern tools and discuss the Benefits of automation.
CO2	Identify suitable automation hardware for the given application
CO3	Recommend appropriate modelling and simulation tool for the given manufacturing Application.
CO4	Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.
CO5	Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications
Course Code	18ME741 - ADDITIVE MANUFACTURING

CO1	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO2	Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available.
CO3	Understand the various software tools, processes and techniques that enable advanced/additive manufacturing.
CO4	Apply the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes.
CO5	Understand characterization techniques in additive manufacturing.
CO6	Understand the latest trends and business opportunities in additive manufacturing.
Course Code	18ME753 - DISASTERS MANAGEMENT (OPEN ELECTIVE)
CO1	Discuss disaster management plan, cyclones and their hazard potential
CO2	Understand the role of IMD and cyclone prediction and cyclone warning system in India
CO3	Understand the role of different institutions defence and other services in natural disaster management
CO4	Understand the role of Central Water Commission in river water sharing, Draught, its assessment and draught management plan
CO5	Understand occurrence of earth quake, Tsunamis and thunderstorms.
Course Code	18MEL76 - COMPUTRE AIDED MANUFACTURING LAB
Course Code	18MEL77 - DESIGN LAB
CO1	Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.
CO2	Carry out balancing of rotating masses
CO3	Analyse the governor characteristics.
CO4	Determine stresses in disk, beams, plates and hook using photo elastic bench.
CO5	Determination of Pressure distribution in Journal bearing
CO6	Analyse the stress and strains using strain gauges in compression and bending test and stress distribution in curved beams.
Course Code	18ME81 - ENERGY ENGINEERING
CO1	Understand the construction and working of steam generators and their accessories.
CO2	Identify renewable energy sources and their utilization.
CO3	Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.
Course Code	18ME822 - TRIBOLOGY
CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

MECHANICAL ENGINEERING	
Course Code 20MTP12	FINITE ELEMENT METHOD IN HEAT TRANSFER
CO1	Establish the mathematical models for the complex analysis problems and predict the nature of solution.
CO2	Formulate the element characteristic for linear and nonlinear matrices and vectors.
CO3	Identify the boundary conditions and their incorporation in to the FE equations.
CO4	Solve the problems with simple geometries, with hand calculations involving the fundamental concepts.
CO5	Interpret the analysis results for the improvement or modification of the system.
Course Code 20 MTP13	ADVANCED FLUID MECHANICS
CO1	Illustrate the basic concepts fluid flow and their governing equations
CO2	Analyse the laminar and turbulent flow problems.
CO3	Analyse one dimensional incompressible and compressible fluid flow Problems
CO4	Distinguish normal and oblique shocks and their governing Equations.
CO5	Describe the instruments and methods for flow measurements
Course Code 20MTP14	COMBUSTION THERMODYNAMICS
CO1	Understand the basic thermodynamic concepts for combustion phenomena.
CO2	Describe the fuel energy conversion systems.
CO3	Apply the concept of flam flow mechanism in combustion process.
CO4	knowledge of adiabatic flame temperature in the design of combustion devices.
CO5	Identify the phenomenon of flame stabilization in laminar and turbulent flames.
Course Code 20 MTP15	ADVANCED POWER PLANT CYCLES
CO1	Distinguish the various power plant cycle and their working principles.
CO2	Describe the working principles of different components of power plant.
CO3	Explain the concepts of power generation by nuclear power plant.
CO4	Illustrate the concept of hydroelectric power generation.
CO5	Explain the concept of pollution and its effects.

Course Code 20 MTPL16	THERMAL ENGINEERING MEASUREMENT LABORATORY
CO1	Perform experiments to determine the coefficient of discharge of flow measuring devices.
CO2	Conduct experiments on hydraulic turbines and pumps to draw characteristics.
CO3	Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
CO4	Identify exhaust emission, factors affecting them and report the remedies.
CO5	Determine the energy flow pattern through the hydraulic machines and I C Engine
CO6	Exhibit his competency towards preventive maintenance of IC engines.
Course Code 20RMI17	RESEARCH METHODOLOGY AND IPR
CO1	Discuss research methodology and the technique of defining a research problem
CO2	Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
CO3	Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
CO4	Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
CO5	Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ■
Course Code 20 MTP21	ADVANCED HEAT TRANSFER
CO1	Describe the different modes of heat transfer with both physics and the mathematical concept.
CO2	Use the concepts of radiation heat transfer for enclosure analysis.
CO3	Explain the concepts of Boundary layer.
CO4	Formulate mathematical functions for two-dimensional and three dimensional heat conduction problems.
CO5	Describe the free and forced convection problems in real time applications.
Course Code 20 MTP22	STEAM AND GAS TURBINES
CO1	Describe the working principles of Gas and steam turbines nozzle and diffusers.

CO2	Explain the principles of thermodynamic concept to determine the performance of steam and gas turbines.
CO3	Illustrate the concepts of axial flow and centrifugal compressors.
CO4	Differentiate axial flow and radial flow gas turbines for their analysis.
CO5	Identify the various losses associated with the turbines.
Course Code 20MTP23	REFRIGERATION AND AIR CONDITIONING
CO1	Understand concepts of refrigeration and air-conditioning process and systems.
CO2	Employ the theoretical principles to simple, complex vapour compression and vapour absorption refrigeration systems.
CO3	Understand conventional and alternate refrigerants and their impact on environment.
CO4	Apply the heat load calculation to design the air-conditioning systems.
CO5	Describe the concepts to design air distribution systems.
Course Code 20MTP241	ENERGY CONSERVATION AND MANAGEMENT
CO1	Understand the various energy conservation and improvement techniques.
CO2	Illustrate the Energy scenario.
CO3	Employ the principles of thermal engineering and energy management to improve the Performance of thermal systems.
CO4	Assess energy projects on the basis of economic and financial criteria.
CO5	Describe methods of energy production for improved utilization
Course Code 20MTP251	SOLAR THERMAL TECHNOLOGIES AND ITS APPLICATIONS
CO1	Analyse the energy concepts on solar devices for various thermal properties.
CO2	Analyse the solar thermal devices for various tracking modes.
CO3	Evaluate the performance of various solar thermal technologies.
Course Code 20 MTPL26	SIMULATION LABORATORY
Course Code 20MTP27	TECHNICAL SEMINAR
Course Code 20MTP31	DESIGN OF HEAT TRANSFER EQUIPMENTS FOR THERMAL POWER PLANT
CO1	Understand the physics and the mathematical treatment of typical heat exchangers.
CO2	Employ LMTD and Effectiveness methods in the design of heat exchangers and analyze the importance of LMTD approach over AMTD approach.
CO3	Examine the performance of double-pipe counter flow (hair-pin) heat exchangers.
CO4	Design and analyze the shell and tube heat exchanger.

CO5	Understand the fundamental, physical and mathematical aspects of boiling and condensation.
CO6	Classify cooling towers and explain their technical features.
Course Code 20MTP322	THEORY OF IC ENGINES
CO1	Distinguish different Fuel-air and actual cycles.
CO2	Demonstrate the different types of injection and carburetor systems
CO3	Formulate the flow and combustion phenomenon for modeling
CO4	Identify the various types of emissions, noise and their control systems
CO5	Recommend the suitable alternative fuel for IC Engine.
Course Code 20MTP332	NON-CONVENTIONAL ENERGY SOURCES
CO1	Describe the need of renewable energy resources, historical and latest developments.
CO2	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc.
CO3	Appreciate the need of Wind Energy, wave power, tidal power, ocean thermal power and geothermal and the various components used in energy generation.
CO4	Understand the concept of Biomass energy resources and their classification, types of biogas Plants applications
Course Code 20MTP34	PROJECT WORK PHASE – 1
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Undertake problem identification, formulation, and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach.
CO4	Communicate with engineers and the community at large in written and oral forms.
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Course Code 20MTP35	MINI PROJECT
CO1	Present the mini-project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

Course Code 20MTPI36	INTERNSHIP / PROFESSIONAL PRACTICE
CO1	Gain practical experience within industry in which the internship is done.
CO2	Acquire knowledge of the industry in which the internship is done.
CO3	Apply knowledge and skills learned to classroom work.
CO4	Develop a greater understanding about career options while more clearly defining personal career goals.
CO5	Experience the activities and functions of professionals.
CO6	Develop and refine oral and written communication skills.
CO7	Identify areas for future knowledge and skill development.
CO8	Expand intellectual capacity, credibility, judgment, intuition.
CO9	Acquire the knowledge of administration, marketing, finance and economics
Course Code 20MTP41	PROJECT WORK PHASE -2
CO1	Present the project and be able to defend it.
CO2	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO3	Habituated to critical thinking and use problem solving skills
CO4	Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
CO5	Work in a team to achieve common goal.
CO6	Learn on their own, reflect on their learning and take appropriate actions to improve it.

DEPARTMENT OF PHYSICS

2021 Scheme

Course Code	21PHY12/22 – ENGINEERING PHYSICS
CO1	Interpret the types of mechanical vibrations and their applications, the role of shock waves in various fields.
CO2	Demonstrate the quantization of energy for microscopic system.
CO3	Apply LASER and optical fibers in opto electronic system.
CO4	Illustrate merits of quantum free electron theory and applications of Hall Effect.
CO5	Analyze the importance of XRD and Electron Microscopy in nano material characterization.

DEPARTMENT OF CHEMISTRY**2021 Scheme**

Course Code	ENGINEERING CHEMISTRY (21CHE12/22)
CO1	Use of free energy in equilibrium, rationalize bulk properties and processes using thermodynamic considerations, electrochemical
CO2	Cause & effects of corrosion of metals and control of corrosion. Modification of surface properties of metals to develop resistance to corrosion, wear, tear impact etc. by electroplating and electroless plating.
CO3	Production & consumption of energy for industrialization of country and living standards of people. Electrochemical and concentration cells. Classical, modern batteries and fuel cells. Utilization of solar energy for different useful forms of energy.
CO4	Environmental pollution, waste management and water chemistry.
CO5	Different techniques of instrumental methods of analysis. Fundamental principles of nano materials.
Course Code	ENGINEERING CHEMISTRY LAB (21CHEL16/26)
CO1	Handling different types of instruments for analysis using small quantities of materials involved for quick and accurate results
CO2	Carrying out different types of titrations for estimation of concerned in materials using comparatively more quantities of materials involved for good results

COURSE: TRANSFORM CALCULUS , FOURIER SERIES AND NUMERICAL METHODS

COURSE CODE:18MAT31

SEMESTER: III

SCHEME: 2018

Course outcomes: At the end of the course the student will be able to:

- **CO1:** Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- **CO2:** Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- **CO3:** Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- **CO4:** Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- **CO5:** Determine the external of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

SUBJECT: COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

SUBJECT CODE:18MAT41

SCHEME:2018

SEMESTER: IV

Course outcomes: At the end of the course the student will be able to:

CO1 :Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.

CO2:Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.

CO3: Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.

CO4:Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.

CO5:Construct joint probability distributions and demonstrate the validity of testing the hypothesis.