

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2018-19(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.

Course Outcomes	Computational structural mechanics - 18CSE11
C01	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 - 18CSE12
C01	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 - 18CSE13
C01	a. Achieve Knowledge of design and development of problem solving skills
CO2	b. Understand the principles of stress-strain behaviour of continuum
CO3	c. Design and develop analytical skills
CO4	d. Describe the continuum in 2 and 3- dimensions
CO5	e. Understand the concepts of elasticity and plasticity.
Course Outcomes	Structural dynamics – 18CSE14
C01	a. Achieve Knowledge of design and development of problem solving skills.
CO2	b. Understand the principles of Structural Dynamics
CO3	c. Design and develop analytical skills.
CO4	d. Summarize the Solution techniques for dynamics of Multi-degree freedom systems
CO5	e. Understand the concepts of damping in structures.
Course Outcomes	SPECIAL CONCRETE - 18CSE15
C01	Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
CO2	Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete for special properties.
CO3	Evaluate the effect of the environment on service life performance, properties and failure of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure.
CO4	Understand the concepts, mix proportioning and methods of special concreting operations.
Course Outcomes	Structural engineering lab 1 -18CSEL16
C01	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 -18RMI17
C01	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 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 - 18CSE21
C01	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 - 18CSE22
C01	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 - 18CSE23
C01	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.
CO4	Summarize the Seismic evaluation and retrofitting of structures.
Course Outcomes	ADVANCED DESIGN OF PRE- STRESSED CONCRETE STRUCTURES (Elective 1) - 18CSE241
C01	Analyse , Design and detail PSC elements
Course Outcomes	STABILITY OF STRUCTURES (Elective 1) - 18CSE242
C01	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	Appraise the Stability analysis by finite element approach.
CO5	Understand the concepts of Lateral buckling of beams.
Course Outcomes	RELIABILITY ANALYSIS OF STRUCTURES (Elective- 1) - 18CSE244
C01	Understand the concepts of statistics for probabilistic analysis and importance of uncertainty (randomness) in structural analysis and design.
CO2	Apply the theoretical principles of randomness of variables in structural engineering through density functions.
CO3	Analyze components of structure to assess safety using concepts related to structural reliability by various methods.
CO4	Evaluate the safety reliability index at system level.
Course Outcomes	ADVANCED STRUCTURAL ANALYSIS (Elective 2) - 18CSE251
C01	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 HIGH RISE STRUCTURES (Elective 2) - 18CSE252
C01	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	DESIGN OF INDUSTRIAL STRUCTURES (Elective 2) - 18CSE253
C01	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the industrial building and the components.
CO3	Design and develop analytical skills
CO4	Summarize the principles of Structural Design and detailing
CO5	Understands the concept of Pre- engineered buildings.
Course Outcomes	Structural Engineering lab 2 - 18CSEL26
C01	Achieve Knowledge of design and development of programming skills.
CO2	Understand the principles of structural analysis and design
CO3	Design and develop analytical skills.
Course Outcomes	DESIGN OF CONCRETE BRIDGES - 18CSE31
C01	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) - 18CSE321
C01	Achieve Knowledge of design and development of problem solving skills
CO2	Understand the principles of subsoil exploration
CO3	Design and develop analytical skills.
Course	REPAIR AND REHABILITATION OF STRUCTURES (Elective -1) - 18CSE322

Outcomes	
CO4	Identify and evaluate the soil shear strength parameters
CO1	Achieve Knowledge of design and development of problem solving skills
CO2	Understand the cause of deterioration of concrete structures
CO3	Design and develop analytical skills
CO4	Summarize the principles of repair and rehabilitation of structures
CO5	Understands the concept of Serviceability and Durability
Course Outcomes	THEORY OF PLATES AND SHELLS (Elective 1) - 18CSE323
CO1	Achieve Knowledge of design and development of problem solving skills
CO2	Understand the principles of Analysis and Design
CO3	Design and develop analytical skills.
CO4	Summarize the performance of shells
CO5	Understand the concepts of energy principle
Course Outcomes	FRACTURE MECHANICS APPLIED TO CONCRETE (Elective 2) - 18CSE331
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	DESIGN OF MASONRY STRUCTURES (Elective 2) - 18CSE332
CO1	Achieve Knowledge of design and development of problem solving skills.
CO2	Understand the principles of design and construction of masonry structures
CO3	Design and develop analytical skills
CO4	Summarize the masonry Characteristics
CO5	Evaluate the strength and stability of the masonry structures
Course Outcomes	COMPOSITE MATERIALS (Elective 2) - 18CSE334
CO1	Define and classify the composite materials.
CO2	Analyze the macro-mechanical behaviour of composites.
CO3	Derive the engineering constants of composites.
CO4	Select the appropriate constituent materials for composite manufacture

Coarse Code	STRENGTH OF MATERIALS 17CV32
CO1	To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion.
CO2	To suggest suitable material from among the available in the field of construction and manufacturing
CO3	To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts
CO4	To understand the basic concept of analysis and design of members subjected to torsion.
CO5	To understand the basic concept of analysis and design of structural elements such as columns and struts.
Coarse Code	FLUIDS MECHANICS – 17CV33
CO1	Possess a sound knowledge of fundamental properties of fluids and fluid Continuum
CO2	Compute and solve problems on hydrostatics, including practical applications
CO3	Apply principles of mathematics to represent kinematic concepts related to fluid flow
CO4	Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
CO5	Compute the discharge through pipes and over notches and weirs
Coarse Code	BASIC SURVEYING – 17CV34
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
Coarse Code	ENGINEERING GEOLOGY – 17CV35
CO1	Students will able to apply the knowledge of geology and its role in Civil Engineering
CO2	Students will effectively utilize earth's materials such as mineral, rocks and water in civil engineering practices.
CO3	Analyze the natural disasters and their mitigation
CO4	Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.

CO5	Apply and asses use of building materials in construction and asses their properties
Coarse Code	BUILDING MATERIALS AND CONSTRUCTION - 17CV36
CO1	Select suitable materials for buildings and adopt suitable construction techniques
CO2	Adopt suitable repair and maintenance work to enhance durability of buildings.
Coarse Code	BUILDING MATERIALS TESTING LABORATORY – 17CVL37
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
Coarse Code	BASIC SURVEYING PRACTICE – 17CVL38
CO1	Apply the basic principles of engineering surveying 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.
Coarse Code	ANALYSIS OF DETERMINATE STRUCTURES – 17CV42
CO1	Evaluate the forces in determinate trusses by method of joints and sections.
CO2	Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods
CO3	Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.
CO4	Determine the stress resultants in arches and cables
CO5	Understand the concept of influence lines and construct the ILD diagram for the moving loads.
Coarse Code	APPLIED HYDRAULICS – 17CV43
CO1	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
Coarse Code	CONCRETE TECHNOLOGY – 17CV44
CO1	Relate material characteristics and their influence on microstructure of concrete.
CO2	Distinguish concrete behaviour based on its fresh and hardened properties.
CO3	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
Coarse Code	BASIC GEOTECHNICAL ENGINEERING – 17CV45
CO1	Will acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties
CO2	Will be able to determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures
CO3	Will be able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structure
CO4	Will be able to estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.
CO5	Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.
Coarse Code	ADVANCED SURVEYING – 17CV46
CO1	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
Coarse Code	FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY – 17CVL47
CO1	Properties of fluids and the use of various instruments for fluid flow measurement.
CO2	Working of hydraulic machines under various conditions of working and their characteristics.
Coarse Code	ENGINEERING GEOLOGY LABORATORY – 17CVL48
CO1	Identifying the minerals and rocks and utilize them effectively in civil engineering practices.

CO2	Understanding and interpreting the geological conditions of the area for the implementation of civil engineering projects.
CO3	Interpreting subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
CO4	The techniques of drawing the curves of electrical resistivity data and its interpretation for geotechnical and aquifer boundaries
Coarse Code	DESIGN OF RC STRUCTURAL ELEMENTS – 17CV51
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	owns professional and ethical responsibility
Coarse Code	ANALYSIS OF INDETERMINATE STRUCTURES – 17CV52
CO1	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.
CO4	Construct the bending moment diagram for beams and frames using flexibility method.
CO5	Analyze the beams and indeterminate frames by system stiffness method.
Coarse Code	APPLIED GEOTECHNICAL ENGINEERING – 17CV53
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	COMPUTER AIDED BUILDING PLANNING AND DRAWING – 17CV54
CO1	Gain a broad understanding of planning and designing of buildings

CO2	Prepare, read and interpret the drawings in a professional set up.
CO3	Know the procedures of submission of drawings and Develop working and submission drawings for building
CO4	Plan and design a residential or public building as per the given requirements
Coarse Code	AIR POLLUTION AND CONTROL - 17CV551
CO1	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
Coarse Code	RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS - 17 CV552
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.
Coarse Code	MASONRY STRUCTURES – 17CV553
CO1	Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.
CO2	Summarize various formulae's for finding compressive strength of masonry units.
CO3	Explain permissible stresses and design criteria as per IS: 1905 and SP-20.
CO4	Design different types of masonry walls for different load considerations.
Coarse Code	THEORY OF ELASTICITY – 17CV554
CO1	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
Coarse Code	TAFFIC ENGINEERING – 17CV561
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 an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
CO4	Understand the basic knowledge of Intelligent Transportation System.
Coarse Code	SUSTAINABILITY CONCEPTS IN ENGINEERING – 17CV562
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.
Coarse Code	REMOTE SENSING AND GIS – 17CV563
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 thematic maps for solving specific problems
CO4	Make decision based on the GIS analysis on thematic maps
Coarse Code	OCCUPATIONAL HEALTH AND SAFETY – 17CV564
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	GEOTECHNICAL ENGINEERING LAB – 17CVL57
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	CONCRETE AND HIGHWAY MATERIALS LABORATORY – 17CVL58
CO1	Conduct appropriate laboratory experiments and interpret the results
CO2	Determine the quality and suitability of cement
CO3	Design appropriate concrete mix
CO4	Determine strength and quality of concrete
CO5	Test the road aggregates and bitumen for their suitability as road material
CO6	Test the soil for its suitability as sub grade soil for pavements.
Coarse Code	CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP – 17CV61
CO1	Understand the construction management process.
CO2	Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
CO3	Fulfill the professional obligations effectively with global outlook
Coarse Code	DESIGN OF STEEL STRUCTURAL ELEMENTS – 17CV62
CO1	Possess a 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 Understand the Concept of Design of laterally supported and un-supported steel beams.

Coarse Code	HIGHWAY ENGINEERING – 17CV63
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	WATER SUPPLY AND TREATMENT ENGINEERING – 17CV64
CO1	Estimate average and peak water demand for a community
CO2	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community
CO3	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system
CO4	Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.
Coarse Code	SOLID WASTE MANAGEMENT – 17CV651
CO1	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.
Coarse Code	MATRIX METHOD OF STRUCTURAL ANALYSIS – 17CV652
CO1	Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems
CO2	Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses
CO3	Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
Coarse Code	ALTERNATIVE BUILDING MATERIALS - 17CV653
CO1	Solve the problems of Environmental issues concerned to building materials and cost effective building technologies
CO2	Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.

CO3	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
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	GROUND IMPROVEMENT TECHNIQUES – 17CV654
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	WATER RESOURCES MANAGEMENT – 17CV661
CO1	Assess the potential of groundwater and surface water resources
CO2	Address the issues related to planning and management of water resources
CO3	Know how to implement IWRM in different regions.
Coarse Code	ENVIRONMENTAL PROTECTION AND MANAGEMENT – 17CV662
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
Coarse Code	NUMERICAL METHODS AND APPLICATIONS – 17CV663
CO1	After studying this course, 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.
Coarse Code	FINITE ELEMENT METHOD - 17CV664
CO1	The student will have the knowledge on advanced methods of analysis of structures
Coarse Code	SOFTWARE APPLICATION LAB – 17CVL67
CO1	use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work
Coarse Code	EXTENSIVE SURVEY PROJECT /CAMP – 17CVL68

CO1	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
Coarse Code	MUNICIPAL AND INDUSTRIAL WASTE WATER ENGINEERING – 17CV71
CO1	Acquires capability to design sewer and Sewerage treatment plant.
CO2	Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
CO3	Identify waste streams and design the industrial waste water treatment plant.
CO4	Manage sewage and industrial effluent issues.
Coarse Code	DESIGN OF RCC AND STEEL STRUCTURES – 17CV72
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	HYDROLOGY AND IRRIGATION ENGINEERING – 17CV73
CO1	Understand the importance of hydrology and its components
CO2	Measure precipitation and analyze the data and analyze the losses in precipitation
CO3	Estimate runoff and develop unit hydrographs.
CO4	Find the benefits and ill-effects of irrigation.
CO5	Find the quantity of irrigation water and frequency of irrigation for various crops.
CO6	Find the canal capacity, design the canal and compute the reservoir capacity
Coarse Code	DESIGN OF BRIDGES – 17CV741

CO1	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 and
CO5	Design Piers and abutments.
Coarse Code	GROUND WATER & HYDRAULICS – 17CV742
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
Coarse Code	DESIGN CONCEPT OF BUILDING SERVICES - 17CV743
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	STRUCTURAL DYNAMIC - 17CV744
CO1	Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.
CO2	Basic understanding of fundamental analysis methods for dynamic systems Interpret dynamic analysis results for design, analysis and research purposes
CO3	Apply structural dynamics theory to earthquake analysis, response, and design of structures
Coarse Code	URBAN TRANSPORTATION AND PLANNING - 17CV751
CO1	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.
Coarse Code	PREFABRICATED STRUCTURES - 17CV752
CO1	Use modular construction, industrialised 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
Coarse Code	REHABILITATION AND RETROFITTING OF STRUCTURES - 17CV753
CO1	Understand the cause of deterioration of concrete structures
CO2	Able to assess the damage for different type of structures
CO3	Summarize the principles of repair and rehabilitation of structures
CO4	Recognize ideal material for different repair and retrofitting technique
Coarse Code	REINFORCED EARTH STRUCTURES - 17CV754
CO1	identify, formulate reinforced earth techniques that are suitable for different soils and in different structures
CO2	understand the laboratory testing concepts of Geosynthetics
CO3	design RE retaining structures and Soil Nailing concepts
CO4	Determine the load carrying capacity of Foundations resting on RE soil bed.
CO5	asses the use of Geo synthetics in drainage requirements and landfill designs
Coarse Code	ENVIRONMENTAL ENGINEERING LABORATORY - 17CVL76
CO1	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.
Coarse Code	COMPUTER AIDED DETAILING OF STRUCTURES - 17CVL77
CO1	Prepare detailed working drawings
Coarse Code	QUANTITY SURVEYING AND CONTRACTS MANAGEMENT – 17CV81
CO1	Prepare detailed and abstract estimates for roads and building
CO2	Prepare valuation reports of buildings
CO3	Interpret Contract document's of domestic and international construction works
Coarse Code	DESIGN OF PRE STRESSED CONCRETE ELEMENTS - 17CV82
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	EARTHQUAKE ENGINEERING - 17CV831
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.
Coarse Code	HYDRAULIC STRUCTURES - 17CV832
CO1	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.
Coarse Code	PAVEMENT DESIGN - 17CV833
CO1	Systematically generate and compile required data's for design of pavement (Highway & Airfield).
CO2	Analyze stress, strain and deflection by boussinesq's, burmister'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.
Coarse Code	ADVANCED FOUNDATION DESIGN - 17CV834
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

**COs of All the Programmes**

CIVIL ENGINEERING	
Course Code	ELEMENTS OF CIVIL ENGINEERING AND MECHANICS - 15CIV13/23
CO1	Know basics of Civil Engineering, its scope of study, knowledge about Roads, Bridges and Dams;
CO2	Comprehend the action of Forces, Moments and other loads on systems of rigid bodies;
CO3	Compute the reactive forces and the effects that develop as a result of the external loads;
CO4	Locate the Centroid and compute the Moment of Inertia of regular crosssections.
CO5	Express the relationship between the motion of bodies and
CO6	Equipped to pursue studies in allied courses in Mechanics.
Course Code	ENVIRONMENTAL STUDIES - 15CIV18/15CIV28
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	STRENGTH OF MATERIALS - 15CV32
CO1	To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion.
CO2	To suggest suitable material from among the available in the field of construction and manufacturing
CO3	To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts.
CO4	To understand the basic concept of analysis and design of members subjected to torsion.
CO5	To understand the basic concept of analysis and design of structural elements such as columns and struts
Course Code	FLUIDS MECHANICS - 15CV33
CO1	Possess a sound knowledge of fundamental properties of fluids and fluid continuum
CO2	Compute and solve problems on hydrostatics, including practical applications
CO3	Apply principles of mathematics to represent kinematic concepts related to fluid flow
CO4	Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
CO5	Compute the discharge through pipes and over notches and weirs
Course Code	BASIC SURVEYING - 15CV34
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 - 15CV35
CO1	Students will able to apply the knowledge of geology and its role in Civil Engineering
CO2	Students will effectively utilize earth's materials such as mineral, rocks and water in civil engineering practices.
CO3	Analyze the natural disasters and their mitigation.
CO4	Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.
CO5	Apply and asses use of building materials in construction and asses their properties
Course Code	BUILDING MATERIALS AND CONSTRUCTION - 15CV36
CO1	Select suitable materials for buildings and adopt suitable construction techniques.
CO2	Adopt suitable repair and maintenance work to enhance durability of buildings.
Course Code	MATERIALS TESTING LABORATORY - 15CVL37
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	BASIC SURVEYING PRACTICE - 15CVL38
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	ANALYSIS OF DETERMINATE STRUCTURES - 15CV42
CO1	Evaluate the forces in determinate trusses by method of joints and sections.
CO2	Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods
CO3	Understand the energy principles and energy theorems and its applications to determine the Deflections of trusses and bent frames.
CO4	Determine the stress resultants in arches and cables.
CO5	Understand the concept of influence lines and construct the ILD diagram for the moving
Course Code	APPLIED HYDRAULICS - 15CV43
CO1	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, Compute water surface profiles at different conditions
CO4	Design turbines for the given data, and to know their operation characteristics under different Operating conditions
Course Code	CONCRETE TECHNOLOGY - 15CV44
CO1	Relate material characteristics and their influence on microstructure of concrete.
CO2	Distinguish concrete behaviour based on its fresh and hardened properties.
CO3	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

Course Code	BASIC GEOTECHNICAL ENGINEERING - 15CV45
CO1	Solving any practical problems related to Geotechnical properties of soils
CO2	Estimating the geostatical stresses
CO3	Solving practical problems related to consolidation settlement and time rate of settlement in soils
CO4	Communicating with other engineers (geotechnical engineers or non-geotechnical engineers) using the proper soil terminology.
CO5	Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same
Course Code	ADVANCED SURVEYING - 15CV46
CO1	Apply the knowledge of geomatic 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	FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY (0:1:2) - 15CVL47
CO1	Properties of fluids and the use of various instruments for fluid flow measurement.
CO2	Working of hydraulic machines under various conditions of working and their characteristics.
Course Code	ENGINEERING GEOLOGY LABORATORY - 15CVL48
CO1	The students able to identify the minerals and rocks and utilize them effectively in civil engineering practices.
CO2	The students will interpret and understand the geological conditions of the area for the Implementation of civil engineering projects.
CO3	The students will interpret subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
CO4	The students will learn the techniques in the interpretation of LANDSAT Imageries to find out the presence of lineaments and other structural features for the given area
Course Code	Design of RC Structural Elements - 15CV51
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
Course Code	ANALYSIS OF INDETERMINATE STRUCTURES - 15CV52
CO1	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.
CO4	Construct the bending moment diagram for beams and frames using flexibility method
CO5	Analyze the beams and indeterminate frames by system stiffness method.
Course Code	APPLIED GEOTECHNICAL ENGINEERING - 15CV53
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	COMPUTER AIDED BUILDING PLANNING AND DRAWING - 15CV54
CO1	Gain a broad understanding of planning and designing of buildings
CO2	Prepare, read and interpret the drawings in a professional set up.
CO3	Know the procedures of submission of drawings and Develop working and submission drawings for building
CO4	Plan and design a residential or public building as per the given requirements
Course Code	AIR POLLUTION AND CONTROL - 15CV551
CO1	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	OCCUPATIONAL HEALTH AND SAFETY-15CV564
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.
Course Code	GEOTECHNICAL ENGINEERING LAB - 15CVL57
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)
Course Code	CONCRETE AND HIGHWAY MATERIALS LABORATORY - 15CVL58
CO1	Conduct appropriate laboratory experiments and interpret the results
CO2	Determine the quality and suitability of cement
CO3	Design appropriate concrete mix
CO4	Determine strength and quality of concrete
CO5	Test the road aggregates and bitumen for their suitability as road material.
CO6	Test the soil for its suitability as sub grade soil for pavements.
Course Code	CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP - 15CV61
CO1	It gives a comprehensive knowledge to understand the construction management process.
CO2	It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.
CO3	It provides the student the sensitivity and global outlook in the contemporary world to Fulfil the professional obligations effectively.

Course Code	DESIGN OF STEEL STRUCTURAL ELEMENTS - 15CV62
CO1	Possess a 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.
Course Code	WATER SUPPLY AND TREATMENT ENGINEERING - 15CV64
CO1	Estimate average and peak water demand for a community.
CO2	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
CO3	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
CO4	Design a comprehensive water treatment and distribution system to purify and distribute water to the Required quality standards.
Course Code	ALTERNATIVE BUILDING MATERIALS - 15CV651
CO1	Solve the problems of Environmental issues concerned to building materials and cost-effective Building technologies;
CO2	Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also, they are able to Design Structural Masonry Elements under Axial Compression.
CO3	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.
CO4	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	WATER RESOURCES MANAGEMENT - 15CV661
CO1	Assess the potential of groundwater and surface water resources.
CO2	Address the issues related to planning and management of water resources.
CO3	Know how to implement IWRM in different regions.
CO4	Understand the legal issues of water policy.
CO5	Select the method for water harvesting based on the area.
Course Code	SOFTWARE APPLICATION LAB - 15CVL67
CO1	Use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work
Course Code	EXTENSIVE SURVEY PROJECT /CAMP - 15CVL68
CO1	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 behavioural 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	DESIGN OF RCC AND STEEL STRUCTURES - 15CV72
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.
Course Code	HYDROLOGY AND IRRIGATION ENGINEERING - 15CV73
CO1	Understand the importance of hydrology and its components.
CO2	Measure precipitation and analyze the data and analyze the losses in precipitation.
CO3	Estimate runoff and develop unit hydrographs.
CO4	Find the benefits and ill-effects of irrigation.
CO5	Find the quantity of irrigation water and frequency of irrigation for various crops.
CO6	Find the canal capacity, design the canal and compute the reservoir capacity
Course Code	URBAN TRANSPORTATION AND PLANNING - 15CV751
CO1	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	ENVIRONMENTAL ENGINEERING LABORATORY - 15CVL76
CO1	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	COMPUTER AIDED DETAILING OF STRUCTURES - 15CVL77
CO1	Prepare detailed working drawings
Course Code	QUANTITY SURVEYING AND CONTRACTS MANAGEMENT – 15CV81
CO3	Prepare detailed and abstract estimates for roads and building
CO4	Prepare valuation reports of buildings
CO5	Interpret Contract document's of domestic and international construction works
Course Code	DESIGN OF PRE STRESSED CONCRETE ELEMENTS – 15CV82
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.
COURSE CODE	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES – 15CV831
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 through exposure to different IS-codes of practices.

COURSE CODE	HYDRAULIC STRUCTURES – 15CV832
CO1	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	PAVEMENT DESIGN – 15CV833
CO1	Systematically generate and compile required data's for design of pavement (Highway & Airfield).
CO2	Analyze stress, strain and deflection by boussinesq's, burmister'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	Advanced Foundation Design - 15CV834
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

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2018-19(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) 2018-Scheme COs

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.

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COMPUTER SCIENCE AND ENGINEERING	
COURSE CODE	17PCD13/23-PROGRAMMING IN C AND DATA STRUCTURES
CO1	Achieve Knowledge of design and development of C problem solving skills.
CO2	Understand the basic principles of Programming in C language
CO3	Design and develop modular programming skills.
CO4	Effective utilization of memory using pointer technology
CO5	Understands the basic concepts of pointers and data structures.
COURSE CODE	17CPL16/26-COMPUTER PROGRAMMING LABORATORY
CO1	Gaining Knowledge on various parts of a computer.
CO2	Able to draw flowcharts and write algorithms
CO3	Able design and development of C problem solving skills.
CO4	Able design and develop modular programming skills.
CO5	Able to trace and debug a program
COURSE CODE	17CS32-ANALOG AND DIGITAL ELECTRONICS
CO1	Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application
CO2	Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique.
CO3	Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches,
CO4	Flip-Flops, Designing Registers, Counters, A/D and D/A Converters
CO5	Design of Counters, Registers and A/D & D/A converters
COURSE CODE	17CS33-DATA STRUCTURES AND APPLICATIONS
CO1	Explain different types of data structures, operations and algorithms
CO2	Apply searching and sorting operations on files
CO3	Make use of stack, Queue, Lists, Trees and Graphs in problem solving.
CO4	Develop all data structures in a high-level language for problem solving.
COURSE CODE	17CS34-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.
CO3	Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems.
CO4	Build simple arithmetic and logical units
COURSE CODE	17CS35-UNIX AND SHELL PROGRAMMING
CO1	Explain UNIX system and use different commands.
CO2	Compile Shell scripts for certain functions on different subsystems.
CO3	Demonstrate use of editors and Perl script writing
COURSE CODE	17CS36-DISCRETE MATHEMATICAL STRUCTURES
CO1	Make use of 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	Apply different mathematical proofs, techniques in proving theorems.

CO5	Compare graphs, trees and their applications.
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COURSE CODE	17CSL37-ANALOG AND DIGITAL ELECTRONICS LABORATORY
CO1	Demonstrate various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
CO2	Design and demonstrate various combinational logic circuits.
CO3	Design and demonstrate various types of counters and Registers using Flip-flops
CO4	Make use of simulation package to design circuits.
CO5	Infer the working and implementation of ALU.
COURSE CODE	17CSL38-DATA STRUCTURES LABORATORY
CO1	Analyze and Compare various linear and non-linear data structures
CO2	Demonstrate the working nature of different types of data structures and their applications
CO3	Develop, analyze and evaluate the searching and sorting algorithms
CO4	Choose the appropriate data structure for solving real world problems
COURSE CODE	17CS42-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 comprehend the event-based GUI handling principles using Applets and swings.
COURSE CODE	17CS43-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	Develop an algorithm using appropriate design strategies for problem solving.
COURSE CODE	17CS44-MICROPROCESSORS AND MICROCONTROLLERS
CO1	Differentiate between microprocessors and microcontrollers
CO2	Develop assembly language code to solve problems
CO3	Explain interfacing of various devices to x86 family and ARM processor
CO4	Demonstrate interrupt routines for interfacing devices
COURSE CODE	17CS45-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	Make use of techniques, skills, and modern engineering tools necessary for engineering practice
CO5	Comprehend software systems or parts of software systems
COURSE CODE	17CS46-DATA COMMUNICATION
CO1	Illustrate basic computer network technology.
CO2	Identify the different types of network topologies and protocols.
CO3	List and explain the layers of the OSI model and TCP/IP model.
CO4	Comprehend the different types of network devices and their functions within a network
CO5	Demonstrate subnetting and routing mechanisms.
COURSE CODE	17CSL47-DESIGN AND ANALYSIS OF ALGORITHM LABORATORY

CO1	Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
CO2	Develop 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	17CSL48-MICROPROCESSOR AND MICROCONTROLLER LABORATORY
CO1	Summarize 80x86 instruction sets and comprehend the knowledge of how assembly language works.
CO2	Design and develop assembly programs using 80x86 assembly language instructions
CO3	Infer functioning of hardware devices and interfacing them to x86 family
CO4	Choose processors for various kinds of applications.
COURSE CODE	17CS51-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	17CS52-COMPUTER NETWORKS
CO1	Explain principles of application layer protocols
CO2	Outline transport layer services and infer UDP and TCP protocols
CO3	Classify routers, IP and Routing Algorithms in network layer
CO4	Explain the Wireless and Mobile Networks covering IEEE 802.11 Standard
CO5	Define Multimedia Networking and Network Management
COURSE CODE	17CS53-DATABASE MANAGEMENT SYSTEM
CO1	Summarize the concepts of database objects; enforce integrity constraints on a database using RDBMS.
CO2	Use Structured Query Language (SQL) for database manipulation.
CO3	Design simple database systems
CO4	Design code for some application to interact with databases.
COURSE CODE	17CS54-AUTOMATA THEORY AND COMPUTABILITY
CO1	Tell the core concepts in automata theory and Theory of Computation
CO2	Explain how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
CO3	Interpret 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	17CS551-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	17CS565-CLOUD COMPUTING

CO1	Explain the concepts and terminologies of cloud computing
CO2	Demonstrate cloud frameworks and technologies
CO3	Define data intensive computing
CO4	Demonstrate cloud applications
COURSE CODE	17CSL57-COMPUTER NETWORK LABORATORY
CO1	Analyze and Compare various networking protocols.
CO2	Demonstrate the working of different concepts of networking.
CO3	Implement and analyze networking protocols in NS2 / NS3
COURSE CODE	17CSL58-DBMS LABORATORY WITH MINI PROJECT
CO1	Use Structured Query Language (SQL) for database Creation and manipulation.
CO2	Demonstrate the working of different concepts of DBMS
CO3	Implement and test the project developed for an application.
COURSE CODE	17CS61-CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW
CO1	Discuss the cryptography and its need to various applications
CO2	Design and Develop simple cryptography algorithms
CO3	Understand the cyber security and need cyber Law
COURSE CODE	17CS62-COMPUTER 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	Understand the concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.
CO4	Discuss about suitable hardware and software for developing graphics packages using OpenGL
COURSE CODE	17CS63-SYSTEM SOFTWARE AND COMPILER DESIGN
CO1	Illustrate system software such as assemblers, loaders, linkers and macroprocessors
CO2	Design and develop lexical analyzers, parsers and code generators
CO3	Discuss about lex and yacc tools for implementing different concepts of system software
COURSE CODE	17CS64-OPERATING SYSTEMS
CO1	Demonstrate need for OS and different types of OS
CO2	Discuss suitable techniques for management of different resources
CO3	Illustrate processor, memory, storage and file system commands
CO4	Explain the different concepts of OS in platform of usage through case studies
COURSE CODE	17CS653-OPERATIONS RESEARCH
CO1	Explain optimization techniques for various problems.
CO2	Understand the given problem as transportation and assignment problem and solve.
CO3	Illustrate game theory for decision support system.
COURSE CODE	17CS666-MULTI-CORE ARCHITECTURE AND PROGRAMMING
CO1	Identify the issues involved in multicore architectures
CO2	Explain fundamental concepts of parallel programming and its design issues
CO3	Solve the issues related to multiprocessing and suggest solutions
CO4	Discuss salient features of different multicore architectures and how they exploit parallelism
CO5	Illustrate OpenMP and programming concept
COURSE CODE	17CSL67-SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
CO1	Implement and demonstrate Lexer's and Parser's

CO2	Implement different algorithms required for management, scheduling, allocation and communication used in operating system.
COURSE CODE	17CSL68-COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT
CO1	Apply the concepts of computer graphics
CO2	Implement computer graphics applications using OpenGL
CO3	Implement real world problems using OpenGL
COURSE CODE	17CS71-WEB TECHNOLOGY AND ITS APPLICATIONS
CO1	Define HTML and CSS syntax and semantics to build web pages.
CO2	Understand the concepts of Construct , visually format tables and forms using HTML using CSS
CO3	Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
CO4	List the principles of object oriented development using PHP
CO5	Illustrate JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features
COURSE CODE	17CS72-ADVANCED COMPUTER ARCHITECTURES
CO1	Understand the concepts of parallel computing and hardware technologies
CO2	Illustrate and contrast the parallel architectures
CO3	Recall parallel programming concepts
COURSE CODE	17CS73-MACHINE LEARNING
CO1	Recall the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.
CO2	Understand theory of probability and statistics related to machine learning
CO3	Illustrate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,
COURSE CODE	17CS743-INFORMATION AND NETWORK SECURITY
CO1	Analyze the Digital security lapses
CO2	Illustrate the need of key management
COURSE CODE	17CS754-STORAGE AREA NETWORKS
CO1	Identify key challenges in managing information and analyze different storage networking technologies and virtualization
CO2	Explain components and the implementation of NAS
CO3	Describe CAS architecture and types of archives and forms of virtualization
CO4	Illustrate the storage infrastructure and management activities
COURSE CODE	17CSL76-MACHINE LEARNING LABORATORY
CO1	Understand the implementation procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems
COURSE CODE	17CSL77-WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
CO1	Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
CO2	Understand the concepts of Web Application Terminologies, Internet Tools other web services.
CO3	Recall how to link and publish web sites
COURSE CODE	17CS81-INTERNET OF THINGS TECHNOLOGY

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	17CS82-BIG DATA ANALYTICS
CO1	Explain the concepts of HDFS and MapReduce framework
CO2	Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop
CO3	Administration
CO4	Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making
CO5	Infer the importance of core data mining techniques for data analytics
CO6	Compare and contrast different Text Mining Techniques
COURSE CODE	17CS833-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	Infer SNMP for managing the network
CO5	Infer RMON for monitoring the behavior of the network
CO6	Identify the various components of network and formulate the scheme for the managing them

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COMPUTER SCIENCE AND ENGINEERING	
COURSE CODE	15PCD13/23-PROGRAMMING IN C AND DATA STRUCTURES
CO1	Achieve Knowledge of design and development of C problem solving skills
CO2	Understand the basic principles of Programming in C language
CO3	Design and develop modular programming skills.
CO4	Effective utilization of memory using pointer technology
CO5	Understands the basic concepts of pointers and data structures
COURSE CODE	15CPL16/26-COMPUTER PROGRAMMING LABORATORY
CO1	Gaining Knowledge on various parts of a computer.
CO2	Able to draw flowcharts and write algorithms
CO3	Able design and development of C problem solving skills.
CO4	Able design and develop modular programming skills.
CO5	Able to trace and debug a program
COURSE CODE	15CS32-ANALOG AND DIGITAL ELECTRONICS
CO1	Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application
CO2	Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique.
CO3	Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters
CO4	Design of Counters, Registers and A/D & D/A converters
COURSE CODE	15CS33-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	15CS34-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.
CO3	Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems.
CO4	Design and analyse simple arithmetic and logical units
COURSE CODE	15CS35-UNIX SHELL PROGRAMMING
CO1	Explain UNIX system and use different commands.
CO2	Write Shell scripts for certain functions on different subsystems.
CO3	Demonstrate use of editors and Perl script writing
COURSE CODE	15CS36-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	15CSL37-ANALOG AND DIGITAL ELECTRONICS LABORATORY
CO1	Use various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital
CO2	trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
CO3	Design and demonstrate various combinational logic circuits.
CO4	Design and demonstrate various types of counters and Registers using Flip-flops
CO5	Use simulation package to design circuits.
CO6	Understand the working and implementation of ALU
COURSE CODE	15CSL38-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	15CS42-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	15CS43-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	15CS44-MICROPROCESSORS AND MICROCONTROLLERS
CO1	Differentiate between microprocessors and microcontrollers
CO2	Design and develop assembly language code to solve problems
CO3	Gain the knowledge for interfacing various devices to x86 family and ARM processor
CO4	Demonstrate design of interrupt routines for interfacing devices
COURSE CODE	15CS45-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 Applets and swings
COURSE CODE	15CS46-DATA COMMUNICATION
CO1	Illustrate basic computer network technology.
CO2	Identify the different types of network topologies and protocols.

CO3	Enumerate the layers of the OSI model and TCP/IP functions of each layer.
CO4	Make out the different types of network devices and their functions within a network
CO5	Demonstrate the skills of subnetting and routing mechanisms.
COURSE CODE	15CSL-47DESIGN AND ANALYSIS OF ALGORITHM 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	15CSL48-MICROPROCESSOR AND MICROCONTROLLER LABORATORY
CO1	Learn 80 x86 instruction sets and gain the knowledge of how assembly language works.
CO2	Design and implement programs written in 80x86 assembly language
CO3	Know functioning of hardware devices and interfacing them to x86 family
CO4	Choose processors for various kinds of applications.
COURSE CODE	15CS51-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	15CS52-COMPUTER NETWORKS
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	15CS53-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	15CS54-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	15CS551-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	15CS565-CLOUD COMPUTING
CO1	Explain the concepts and terminologies of cloud computing
CO2	Demonstrate cloud frameworks and technologies
CO3	Define data intensive computing
CO4	Demonstrate cloud applications
COURSE CODE	15CSL57-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
COURSE CODE	15CSL58-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	15CS61-CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW
CO1	Discuss cryptography and its need to various applications
CO2	Design and develop simple cryptography algorithms
CO3	Understand cyber security and need cyber Law
COURSE CODE	15CS62-COMPUTER 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	15CS63-SYSTEM SOFTWARE AND COMPILER DESIGN
CO1	Explain system software such as assemblers, loaders, linkers and macroprocessors
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	15CS64-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	15CS653-OPERATIONS RESEARCH
CO1	Select and apply optimization techniques for various problems.
CO2	Model the given problem as transportation and assignment problem and solve.
CO3	Apply game theory for decision support system.
COURSE CODE	15CS666-MULTI-CORE ARCHITECTURE AND PROGRAMMING
CO1	Identify the issues involved in multicore architectures
CO2	Explain fundamental concepts of parallel programming and its design issues
CO3	Solve the issues related to multiprocessing and suggest solutions
CO4	Point out the salient features of different multicore architectures and how they exploit parallelism

CO5	Illustrate OpenMP and programming concept
COURSE CODE	15CSL67-SYSTEM SOFTWARE AND OPERATING SYSTEM LAB
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	15CSL68-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	15CS71-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	15CS72-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	15CS73-MACHINE LEARNING
CO1	Identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.
CO2	Explain theory of probability and statistics related to machine learning
CO3	Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,
COURSE CODE	15CS743-INFORMATION AND NETWORK SECURITY
CO1	Analyze the Digital security lapses
CO2	Illustrate the need of key management
COURSE CODE	15CS754-STORAGE AREA NETWORKS
CO1	Identify key challenges in managing information and analyze different storage networking technologies and virtualization
CO2	Explain components and the implementation of NAS
CO3	Describe CAS architecture and types of archives and forms of virtualization
CO4	Illustrate the storage infrastructure and management activities
COURSE CODE	15CSL76-MACHINE LEARNING LABORATORY
CO1	Understand the implementation procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems
COURSE CODE	WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
CO1	Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
CO2	Have a good understanding of Web Application Terminologies, Internet Tools other web services.
CO3	Learn how to link and publish web sites
COURSE CODE	15CS81-INTERNET OF THINGS TECHNOLOGY

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	15CS82-BIG DATA ANALYTICS
CO1	Master the concepts of HDFS and MapReduce framework
CO2	Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration
CO3	Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making
CO4	Infer the importance of core data mining techniques for data analytics
CO5	Compare and contrast different Text Mining Techniques
COURSE CODE	15CS833-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

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2018-19(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

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

ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code	17ELN15/25 - BASIC ELECTRONICS
CO1	Appreciate the significance of electronics in different applications
CO2	Understand the applications of diode in rectifiers filter circuits and wave shaping
CO3	Apply the concept of diode in rectifiers, filters circuits
CO4	Design simple circuits like amplifiers (inverting and non inverting), comparators, adders, integrator and differentiator using OPAMPS
CO5	Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates
CO6	Understand the functioning of a communication system, and different modulation technologies
CO7	Understand the basic principles of different types of Transducers
Course Code	17EC32 - ELECTRONIC INSTRUMENTATION
CO1	Describe instrument measurement errors and calculate them.
CO2	Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters.
CO3	Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions.
CO4	Describe functional concepts and operation of various Analog measuring instruments to measure field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance.
CO5	Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers.
CO6	Utilize AC and DC bridges for passive component and frequency measurements
Course Code	17EC33 - ANALOG ELECTRONICS
CO1	Describe the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers.
CO2	Describe the Phase shift, Wien bridge, tuned and crystal oscillators using BJT/FET/UJT.
CO3	Calculate the AC gain and impedance for BJT using re and h parameters models for CE and CC configuration.
CO4	Determine the performance characteristics and parameters of BJT and FET amplifier using small signal model.
CO5	Determine the parameters which affect the low frequency and high frequency responses of BJT and FET amplifiers and draw the characteristics.
CO6	Evaluate the efficiency of Class A and Class B power amplifiers and voltage regulators.

Course Code	17EC34 - DIGITAL ELECTRONICS
CO1	Develop simplified switching equation using Karnaugh Maps and Quine-McClusky techniques.
CO2	Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators.
CO3	Explain the working of Latches and Flip Flops (SR,D,T and JK).
CO4	Design Synchronous/Asynchronous Counters and Shift registers using Flip Flops.
CO5	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.
CO6	Apply the knowledge gained in the design of Counters and Registers.
Course Code	17EC35 - NETWORK ANALYSIS
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.
CO4	Apply Laplace transform to solve the given network.
CO5	Evaluate for RLC elements/ frequency response related parameters like resonant frequency, quality factor, half power frequencies, voltage across inductor and capacitor, current through the RLC elements, in resonant circuits
CO6	Solve the given network using specified two port network parameter like Z or Y or T or h.
Course Code	17EC36 - ENGINEERING ELECTROMAGNETICS
CO1	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law.
CO2	Determine potential and energy with respect to point charge and capacitance using Laplace equation.
CO3	Calculate magnetic field, force, and potential energy with respect to magnetic materials.
CO4	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors.
CO5	Evaluate power associated with EM waves using Poynting theorem
Course Code	17ECL37 - ANALOG ELECTRONICS LABORATORY
CO1	Test circuits of rectifiers, clipping circuits, clamping circuits and voltage regulators.
CO2	Determine the characteristics of BJT and FET amplifiers and plot its frequency response.
CO3	Compute the performance parameters of amplifiers and voltage regulators
CO4	Design and test the basic BJT/FET amplifiers, BJT Power amplifier and oscillators

Course Code	17ECL38 - DIGITAL ELECTRONICS LABORATORY
CO1	Demonstrate the truth table of various expressions and combinational circuits using logic gates.
CO2	Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers.
CO3	Realize Boolean expression using decoders.
CO4	Construct and test flips-flops, counters and shift registers.
CO5	Simulate full adder and up/down counters.
Course Code	17EC42 - SIGNALS AND SYSTEMS
CO1	Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals.
CO2	Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
CO3	Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. signal, odd vs. even, conjugate symmetric vs anti- symmetric
CO4	Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis.
CO5	Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems
Course Code	17EC43- CONTROL SYSTEMS
CO1	Develop the mathematical model of mechanical and electrical systems
CO2	Obtain the transfer function of electrical and mechanical systems by block diagram reduction rule and mason gain formula
CO3	Understand time domain specifications for first and second order systems
CO4	Determine the stability of a system in the time domain using Route Harvitz criteria and root locus technique
CO5	Determine the stability of a system in the frequency domain using Nyquist and bode plots
CO6	Model a control system in continuous and discrete time using state variable techniques
Course Code	17EC44 - PRINCIPLES OF COMMUNICATION SYSTEMS
CO1	Analyse communication systems in both the time and frequency domains
CO2	Have familiarity with amplitude modulated and angle modulated communication systems and be able to analyse their performance in the presence of noise.
CO3	Understand source coding, information theory and Shannon's theorem.
CO4	Have familiarity with various digital modulation systems and their properties, including bandwidth, channel capacity, transmission over bandlimited channels, inter-symbol interference (ISI), demodulation methods, and error performance in the presence of noise.
CO5	Have knowledge of error correcting codes, including block codes

Course Code	17EC45 - LINEAR INTEGRATED CIRCUITS
CO1	Operational amplifiers and characteristics as well as various types of op-amps.
CO2	Functioning of PLL, VCO, V-I, I-V converters.
CO3	Active Filters, ADC, DAC
CO4	555 Timer
CO5	Op-amps and Various applications
CO6	Instrumentation Amplifiers, Isolation Amplifiers, Wave Generators and Oscillators.
CO7	Interpretation of Performance Characteristics of Practical Op-amps.
CO8	Apply the knowledge gained in the design of practical circuits for amplifiers, filters oscillators, multi vibrators, voltage regulators and electronic systems
Course Code	17EC46- MICROPROCESSORS
CO1	The History of evolution of Microprocessors, Architecture of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU architecture
CO2	8086 Assembly level programs using the 8086 instruction set
CO3	Modular programs using procedures and macros
CO4	8086 Stack and Interrupts programming
CO5	Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors.
CO6	Use INT 21 DOS interrupt function calls to handle Keyboard and Display
Course Code	17ECL47 - MICROPROCESSOR LABORATORY
CO1	Proficiently use DOS assemblers like MASM
CO2	Use the knowledge of the 8086 instruction set and utilizes it in programming.
CO3	Perform Logical, Arithmetic and Rotate/shift operations on data
CO4	Understand and implement delay generation using 8086 instructions
CO5	Understand different interfacing concepts and use of PPI
CO6	Implement programming module of keyboard, stepper motor, waveform generator (DAC), Seven segment display to work with 8086.
Course Code	17ECL48 - LINEAR ICS AND COMMUNICATION LAB
CO1	To discuss the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp
CO2	Analyze and design basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters

ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code	15EC32 - ANALOG ELECTRONICS
CO1	Working principles, characteristics and basic applications of BJT and FET.
CO2	Single stage, cascaded and feedback amplifier configurations.
CO3	Frequency response characteristics of BJT and FET
CO4	Power amplifier classifications such as Class A, Class B, etc.
Course Code	15EC33 - DIGITAL ELECTRONICS
CO1	Combinational Logic circuits
CO2	Simplification Techniques using Karnaugh Maps, Quine-McClusky Technique
CO3	Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors.
CO4	Working of Latches, Flip-Flops, Designing Registers, Counters
CO5	Mealy and Moore Models, State Diagrams
CO6	Synchronous Sequential Circuits, Design and Develop Mealy and Moore Models for digital circuits, Apply the knowledge gained in the design of Counters and Registers
Course Code	15EC34 - NETWORK ANALYSIS
CO1	Series and Parallel combination of Passive Components, Source Transformation and Source Shifting.
CO2	Network Theorems and Electrical laws to reduce circuit complexities and to arrive at feasible solutions
CO3	Various Two port Parameters and their Relationship for finding Network Solutions.
CO4	Analyze the Performance of various Types of Networks Using different concepts and principles
Course Code	15EC35 - ELECTRONIC INSTRUMENTATION
CO1	Acquire knowledge and solve problems related to o Accuracy and precision
CO2	Functioning of various types of analog and digital measuring instruments.
CO3	Different types of quantization, resolution and sensitivity in digital instruments such as frequency meters, tachometers, pH meters etc.
CO4	Microprocessor based instrumentation
CO5	Functioning of various types of Oscilloscopes and signal generators
CO6	Different types of transducers in various applications.
CO7	Apply the knowledge of passive component measurement
Course Code	15EC36 - ENGINEERING ELECTROMAGNETICS
CO1	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law.
CO2	Determine potential and energy with respect to point charge and capacitance using Laplace equation.
CO3	Calculate magnetic field, force, and potential energy with respect to magnetic materials.
CO4	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors.
CO5	Evaluate power associated with EM waves using Poynting theorem.

Course Code	15ECL37 - ANALOG ELECTRONICS LABORATORY
CO1	Able to know the operation of all electronic devices like cathode ray oscilloscope (CRO), Regulated power supply (RPS), Signal generator (SG).
CO2	Students able to Design and test rectifiers, clipping circuits, voltage regulators
CO3	Compute the parameters from the characteristics of JFET and MOSFET devices.
CO4	Students able to Design test and evaluate BJT amplifier in CE configuration.
CO5	Students able to Design and test JFET/MOSFET amplifier
CO6	Students able to Design and test a power amplifier
Course Code	15ECL38 - DIGITAL ELECTRONICS LABORATORY
CO1	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
CO2	To prepare students to perform the analysis and design of various digital circuits
CO3	Have a thorough understanding of the fundamental concepts and techniques used in digital circuits.
CO4	To understand and examine the structure of various number systems and its application in digital design.
CO5	The ability to understand analyze and design various combinational and sequential circuits.
CO6	Ability to identify basic requirements for a design application and propose a cost effective solution.
CO7	The ability to identify and prevent various hazards and timing problems in a digital design.
CO8	To develop skill to build and troubleshoot digital circuits.
Course Code	15EC42- MICROPROCESSORS
CO1	The History of evolution of Microprocessors, Architecture of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU architecture
CO2	8086 Assembly level programs using the 8086 instruction set
CO3	Modular programs using procedures and macros
CO4	8086 Stack and Interrupts programming
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CO6	Use INT 21 DOS interrupt function calls to handle Keyboard and Display
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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
CO6	Model a control system in continuous and discrete time using state variable techniques
Course Code	15EC44 - SIGNALS AND SYSTEMS
CO1	Classify the signals as continuous/discrete, periodic/apperiodic, even/odd, energy/power and

	deterministic/random signals.
CO2	Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
CO3	Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. signal, odd vs. even, conjugate symmetric vs anti-symmetric
CO4	Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis.
CO5	Compute Z-transforms, inverse Z-transforms and transfer functions of complex LTI systems
Course Code	15EC45 - PRINCIPLES OF COMMUNICATION SYSTEMS
CO1	Analyse communication systems in both the time and frequency domains
CO2	Have familiarity with amplitude modulated and angle modulated communication systems and be able to analyse their performance in the presence of noise.
CO3	Understand source coding, information theory and Shannon's theorem.
CO4	Have familiarity with various digital modulation systems and their properties, including bandwidth, channel capacity, transmission over bandlimited channels, inter-symbol interference (ISI), demodulation methods, and error performance in the presence of noise.
CO5	Have knowledge of error correcting codes, including block codes
Course Code	15EC46 - LINEAR INTEGRATED CIRCUITS
CO1	Operational amplifiers and characteristics as well as various types of op-amps.
CO2	Functioning of PLL, VCO, V-I, I-V converters.
CO3	Active Filters, ADC, DAC
CO4	555 Timer
CO5	Op-amps and Various applications
CO6	Instrumentation Amplifiers, Isolation Amplifiers, Wave Generators and Oscillators.
CO7	Interpretation of Performance Characteristics of Practical Op-amps.
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CO1	Proficiently use DOS assemblers like MASM
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CO3	Perform Logical, Arithmetic and Rotate/shift operations on data
CO4	Understand and implement delay generation using 8086 instructions
CO5	Understand different interfacing concepts and use of PPI
CO6	Implement programming module of keyboard, stepper motor, waveform generator (DAC), Seven segment display to work with 8086.
Course Code	15ECL48 - LINEAR ICS AND COMMUNICATION LAB
CO1	To discuss the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp
CO2	Analyze and design basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters
Course Code	15ES51 - MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

CO1	Explain the meaning of Management, its characteristics and clarify management as science or art or profession. Identify the role of managers and their functions
CO2	Describe the nature and importance of planning process, types of plans and steps in planning. State the importance of decision making and planning.
CO3	Describe the nature and purpose of organization. Differentiate centralization and decentralization, authority and responsibility and finally MBO and MBE.
CO4	Explain the meaning and nature of Directing, various types of leadership styles and various motivational theories and at the end the need and importance of control.
CO5	Describe the meaning and role of an entrepreneur and the functions. Classify the Types of entrepreneurs Define SSIs and their need and characteristics. Explain the steps to start SSIs, to tell the impact of LPG, effect of WTO/GATT on SSIs.
CO6	Explain the important schemes of government through various agencies such as TECKSOK, KIADB, KSSIDC, DIC, SIDBI and KSFC for technical and financial assistance.
CO7	Identify and select a project and finally prepare a project report. Adopt the guidelines of planning commission for developing a project.
Course Code	15EC52 - DIGITAL SIGNAL PROCESSING
CO1	Identify time domain and frequency domain sequences
CO2	Calculate the DFT of the time domain sequence
CO3	Apply the FFT algorithm to optimize the calculation process for DFT
CO4	Determine the type of Filter to be used
CO5	Apply the proper filter characteristics.
Course Code	15EC53 - VERILOG HDL
CO1	Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
CO2	Write simple programs in VHDL in different styles.
CO3	Design and verify the functionality of digital circuit/system using test benches.
CO4	Identify the suitable Abstraction level for a particular digital design.
CO5	Write the programs more effectively using Verilog tasks and directives.
CO6	Perform timing and delay Simulation.
Course Code	15EC54 - INFORMATION THEORY AND CODING
CO1	Determine the amount of information per symbol and information rate of a discrete memory less source
CO2	Design lossless source codes for discrete memoryless source to improve the efficiency of information transmission
CO3	Evaluate the information capacity of discrete memoryless channels and determine possible code rate to achievable on such channels
CO4	Apply Shannon theorem for information transmission on Gaussian channels to determine the capacity.
Course Code	15EC553 - OPERATING SYSTEM
CO1	What is an operating system
CO2	Types of operating systems and differences among them
CO3	Processes, threads, and the differences between the two
CO4	Interrupts, synchronization, waiting, and atomic behavior.

CO5	Virtual memory, paging, and memory allocation.
Course Code	15EC562- Object Oriented Programming Using C++
CO1	List object oriented programming features in C++. Apply these features to program design and implementation
CO2	Define object oriented concepts and how they are supported by C++.Gain some practical experience of C++. Demonstrate implementation issues related to object- oriented techniques.
CO3	Demonstrate the basic components of an object oriented program including methods and attributes, Differentiate between classes and instances
CO4	Define and use friend functions and friend classes. Explain the need for Data Encapsulation
CO5	Create Class and Function Templates. Use Standard Template Library functions and classes.
CO6	Define and Use of constructors and destructors in object oriented programming approach and different types of constructors
CO7	Explaining the concepts of polymorphism and inheritance in object oriented programming.
CO8	Define and use of iostream files and algorithms in c++ approach
Course Code	15ECL57 - DSP Lab
CO1	The students will be able to carry out simulation of DSP system.
CO2	Effectively utilize the MATLAB tool.
CO3	Determine the performance of sampling theorem
CO4	Understand the concepts of correlation properties.
CO5	Understand the characteristic of DFT and IDFT
CO6	Design and implementation FIR and IIR filters.
CO7	Solving a difference equation using MATLAB
CO8	Develop and implement DSP algorithms in software using a computer language such as C with CCS studio.
CO9	Utilize the procedures for simulating and hardware built of Code compressor Studio programming.
Course Code	15ECL58 - HDL Lab
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.
CO3	Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
CO4	Interface the hardware to the programmable chips and obtain the required output.
Course Code	15EC61 - DIGITAL COMMUNICATION
CO1	Analyze the performance of a baseband and passband in a digital communication system.
CO2	Perform the time and frequency domain analysis of the signal in a digital communication system.
CO3	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.
CO4	Describe the different digital modulation schemes and concepts.
CO5	Identify the presence of error bit signal and calculate unknown phase of noise in the received signal.

C06	Analyze the performance of spread spectrum communication system.
Course Code	15EC62 - ARM MICROCONTROLLER & 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	15EC63 - 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	15EC64 - COMPUTER COMMUNICATION NETWORKS
CO1	Identify the protocols and services of Data link layer
CO2	Identify the protocols and functions associated with the transport layer services
CO3	Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite
CO4	Distinguish the basic network configurations and standards associated with each network
CO5	Construct a network model and determine the routing of packets using different routing algorithms
Course Code	15EC654 - DIGITAL SWITCHING SYSTEMS
CO1	Describe the electromechanical switching systems and its comparison with the digital switching
CO2	Determine the telecommunication traffic and its measurements
CO3	Define the technologies associated with the data switching operations
CO4	Describe the software aspects of switching systems and its maintenance
Course Code	15EC663 - DIGITAL SYSTEM DESIGN USING VERILOG
CO1	Construct the combinational circuits, using discrete gates and programmable logic devices.
CO2	Describe Verilog model for sequential circuits and test pattern generation.
CO3	Design a semiconductor memory for specific chip design
CO4	Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores
CO5	Synthesize different types of processor and I/O controllers that are used in embedded system.
Course Code	15ECL67 - EMBEDDED CONTROLLER LAB
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
Course Code	15ECL68 - COMPUTER NETWORKS LABORATORY
CO1	Use the network simulator for learning and practice of networking algorithms
CO2	Illustrate the operations of network protocols and algorithms using C programming
CO3	Simulate the network with different configurations to measure the performance parameters.
CO4	Implement the data link and routing protocols using C programming
Course Code	15EC72 - DIGITAL IMAGE PROCESSING
CO1	Understand image formation and the role human visual system plays in perception of gray and color image data.
CO2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO3	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
CO4	Conduct independent study and analysis of Image Enhancement techniques.
Course Code	15EC73 - POWER ELECTRONICS
CO1	Describe the characteristics of different power devices and identify the various applications associated with it.
CO2	Illustrate the working of power circuit as DC-DC converter.
CO3	Illustrate the operation of inverter circuit and static switches.
CO4	Determine the output response of a thyristor circuit with various triggering options.
CO5	Determine the response of controlled rectifier with resistive and inductive loads.
Course Code	15EC743 - REAL TIME SYSTEMS
CO1	Understand the fundamentals of Real time systems and its classifications.
CO2	Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications.
CO3	Develop the software languages to meet Real time applications.
CO4	Apply suitable methodologies to design and develop Real-Time Systems.
Course Code	15EC755 - SATELLITE COMMUNICATION
CO1	Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
CO2	Describe the electronic hardware systems associated with the satellite subsystem and earth station.
CO3	Describe the various applications of satellite with the focus on national satellite system.
Course Code	15ECL767 - ADVANCED COMMUNICATION LABORATORY
CO1	Determine the characteristics and response of microwave devices and optical waveguide.

CO2	Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
CO3	Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters.
CO4	Design and test the digital modulation circuits/systems and display the waveforms.
Course Code	15ECL77 - VLSI LABORATORY
CO1	Write test bench to simulate various digital circuits.
CO2	Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
CO3	Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
CO4	Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
CO5	Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Course Code	15EC81 - Wireless Cellular and LTE 4G Broadband
CO1	Understand the basics of LTE standarization phases and specifications.
CO2	Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles
CO3	Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.
CO4	Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth
Course Code	15EC82 - FIBER OPTICS and NETWORKS
CO1	Explain the working of fiber optics communication system, graded index fibers in single mutli code propagation connectors and couplers
CO2	Compute angle of accpetancy, mode volume cutoff wavelength observation scattering, bundling, alignment and joint losses
CO3	Describe optical signal emission using LED, laser, optical signal using photo detector, optical reception using receivers
CO4	Explain WDM concepts, active and passive optical components and optical amplifiers used in fiber optic networks
CO5	Explain optical networks, concepts, terminology, standards used in fiber optic networks
CO6	Analyse impact of high speed optical communication links on human health and society
Course Code	15EC835 - NETWORK AND CYBER SECURITY
CO1	Network layer protpcal and security
CO2	E-Mail security concepts
CO3	IP-security to secure IP
CO4	Cyber security and antipatterns
CO5	Enterprise wide network security algorithms

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2018-19(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 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.

ELECTRICAL & ELECTRONICS ENGINEERING DEPARTMENT

COURSE CODE	17ELE15/25 BASIC ELECTRICAL ENGINEERING
CO1	To predict the behaviour of electrical and magnetic circuits.
CO2	Select the type of generator / motor required for a particular application.
CO3	Realize the requirement of transformers in transmission and distribution of electric power and other
CO4	Practice Electrical Safety Rules & standards.
CO5	To function on multi-disciplinary teams.
COURSE CODE	17MAT31 ENGINEERING MATHEMATICS –III (Core Subject)
CO1	Know the use of periodic signals and Fourier series to analyze circuits and system communications.
CO2	Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform
CO3	Employ appropriate numerical methods to solve algebraic and transcendental equations.
CO4	Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems
CO5	Determine the extremals of functional and solve the simple problems of the calculus of variations.
COURSE CODE	17EE32 ELECTRIC CIRCUIT ANALYSIS (Core Subject)
CO1	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks.
CO2	Reduce the complexity of network using source shifting, source transformation and network reduction using transformations.
CO3	Solve complex electric circuits using network theorems.
CO4	Discuss resonance in series and parallel circuits.
CO5	Discuss the importance of initial conditions and their evaluation.
CO6	Synthesize typical waveforms using Laplace transformation.
CO7	Solve unbalanced three phase systems.
CO8	Evaluate the performance of two port networks
COURSE CODE	17EE33 TRANSFORMERS AND GENERATORS (Core Course)
CO1	Explain the construction and operation and performance of single phase and three phase transformers.
CO2	Explain the use of auto transformer, tap changing and tertiary winding transformer and need of operating transformers in parallel.
CO3	Explain the armature reaction and commutation and their effects in a DC generators.
CO4	Explain the construction, operation and performance of Synchronous machines.
COURSE CODE	17EE34 ANALOG ELECTRONIC CIRCUITS (Core Course)

C01	Predict the output response of clipper and clamper circuits.
C02	Design and compare biasing circuits for transistor amplifiers
C03	Explain the transistor switching.
C04	Explain the concept of feedback, its types and design of feedback circuits
C05	Design and analyze the power amplifier circuits and oscillators for different frequencies.
C06	Perform design and analysis of FET and MOSFET amplifiers in the common source mode with fixed bias.
COURSE CODE	17EE35 DIGITAL SYSTEM DESIGN(Core Course)
C01	Simplify switching equations generated from truth tables.
C02	Design combinational logic circuits; adders, Subtractors and comparators.
C03	Design synchronous sequential circuits; latches, flip-flops, binary counters and Mod – 6 counters.
C04	Design Mealy and Moore synchronous sequential circuit models.
C05	Construct state diagrams for sequential circuits.
C06	Describe the structure of HDL module, operators,data types.
C07	Give Comparison between VHDL and Verilog.
C08	Understand the concept of data-flow description.
COURSE CODE	17EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation 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.
C03	Understand the adjustments, calibration & errors in energy meters & also methods of extending the range of instruments & instrument transformers.
C04	Explain the working of different electronic instruments, display devices and recording mechanisms.
COURSE CODE	17EEL37 ELECTRICAL MACHINES 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
COURSE CODE	17EEL38 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.

COURSE CODE	17MAT41 ENGINEERING MATHEMATICS
C01	Use appropriate single step and multi-step numerical methods to solve first and second order ordinary differential equations arising in flow data design problems. □
C02	Explain the idea of analyticity, potential fields residues and poles of complex potentials in field theory and electromagnetic theory.
C03	Employ Bessel's functions and Legendre's polynomials for tackling problems arising in continuum mechanics, hydrodynamics and heat conduction.
C04	Describe random variables and probability distributions using rigorous statistical methods to analyze problems associated with optimization of digital circuits, information, coding theory and stability analysis of systems.
C05	Apply the knowledge of joint probability distributions and Markov chains in attempting engineering problems for feasible random events.
COURSE CODE	17EE42 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 importance of grounding.
C03	Understand the economic aspects of power system operation and its effects.
C04	Explain the importance of power factor improvement
COURSE CODE	17EE43 TRANSMISSION AND DISTRIBUTION
C01	Explain the concepts of various methods of generation of power.
C02	Explain the importance of HVAC, EHVAC, UHVAC and HVDC transmission.
C03	Design and analyze overhead transmission system for a given voltage level.
C04	Calculate the parameters of the transmission line for different configurations and assess the performance of line.
C05	Explain the use of underground cables and evaluate different types of distribution systems.
COURSE CODE	17EE44 ELECTRIC MOTORS
C01	Explain the constructional features of Motors and select a suitable drive for specific application.
C02	Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method.
C03	Explain the constructional features of Three Phase and Single phase induction Motors and assess their performance.
C04	Control the speed of induction motor by a suitable method.
C05	Explain the operation of Synchronous motor and special motors.

COURSE CODE	17EE45 ELECTROMAGNETIC FIELD THEORY
C01	Use different coordinate systems to explain the concept of gradient, divergence and curl of a vector.
C02	Use Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
C03	Calculate the energy and potential due to a system of charges.
C04	Explain the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics.
C05	Explain the behavior of magnetic fields and magnetic materials.
C06	Assess time varying fields and propagation of waves in different media.
COURSE CODE	17EE46 OPERATIONAL AMPLIFIERS AND LINEAR ICs
C01	Describe the characteristics of ideal and practical operational amplifier.
C02	Design filters and signal generators using linear ICs.
C03	Demonstrate the application of Linear ICs as comparators and rectifiers.
C04	Use ICs in the electronic projects
COURSE CODE	17EEL47 ELECTRICAL MACHINES LABORATORY -2
C01	Test dc machines to determine their characteristics.
C02	Control the speed of dc motor.
C03	Pre-determine the performance characteristics of dc machines by conducting suitable tests.
C04	Perform load test on single phase and three phase induction motor to assess its performance.
C05	Conduct test on induction motor to pre-determine the performance characteristics.
C06	Conduct test on synchronous motor to draw the performance curves.
COURSE CODE	17EEL48 OP- AMP AND LINEAR ICS LABORATORY
C01	To design test the OP-Amp as oscillators and filters
C02	Design and study of Linear IC's as multivibrator power supplies.

ELECTRICAL & ELECTRONICS ENGINEERING DEPARTMENT

COURSE CODE	15MAT31 ENGINEERING MATHEMATICS
CO1	Know the use of periodic signals and Fourier series to analyze circuits and system communications
CO2	Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform.
CO3	Employ appropriate numerical methods to solve algebraic and transcendental equations.
CO4	Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.
CO5	Determine the extremals of functional and solve the simple problems of the calculus of variations.
COURSE CODE	15EE32 ELECTRIC CIRCUIT ANALYSIS
CO1	Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
CO2	Identify, formulate, and solve engineering problems in the area circuits and systems.
CO3	Analyze the solution and infer the authenticity of it.
COURSE CODE	15EE33 TRANSFORMERS AND GENERATORS
CO1	Explain the construction and operation and performance of transformers.
CO2	Explain different connections for the three phase operations, their advantages and applications.
CO3	Explain the construction and operation of Synchronous machines and evaluate the regulation of synchronous machines by different methods.
CO4	Analyze the operation of the synchronous machine connected to infinite machine.
COURSE CODE	15EE34 ANALOG ELECTRONIC CIRCUITS
CO1	Utilize the characteristics of transistor for different applications.
CO2	Design and analyze biasing circuits for transistor.
CO3	Design, analyze and test transistor circuitry as amplifiers and oscillators.
COURSE CODE	15EE35 DIGITAL SYSTEM DESIGN
CO1	Design and analyze combinational & sequential circuits
CO2	Design circuits like adder, sub tractor, code converter etc.
CO3	Understand counters and sequence generators.

COURSE CODE	15EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS
CO1	Explain the importance of units and dimensions.
CO2	Measure resistance, inductance and capacitance by different methods.
CO3	Explain the working of various meters used for measurement of power and energy.
CO4	Explain the working of different electronic instruments and display devices.
COURSE CODE	15EEL37 ELECTRICAL MACHINES LABORATORY - 1
CO1	Conduct different tests on transformers and synchronous generators and evaluate their performance.
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	Assess the performance of synchronous generator connected to infinite bus.
COURSE CODE	15EEL38 ELECTRONICS LABORATORY
CO1	Design and test different diode circuits.
CO2	Design and test amplifier and oscillator circuits and analyse their performance.
CO3	Use universal gates and ICs for code conversion and arithmetic operations.
CO4	Design and verify on of different counters.
COURSE CODE	15MAT41 ENGINEERING MATHEMATICS
CO1	Use appropriate single step and multi-step numerical methods to solve first and second order ordinary differential equations arising in flow data design problems.
CO2	Explain the idea of analyticity, potential fields residues and poles of complex potentials in field theory and electromagnetic theory.
CO3	Employ Bessel's functions and Legendre's polynomials for tackling problems arising in continuum mechanics, hydrodynamics and heat conduction.
CO4	Describe random variables and probability distributions using rigorous statistical methods to analyze problems associated with optimization of digital circuits, information, coding theory and stability analysis of systems.
CO5	Apply the knowledge of joint probability distributions and Markov chains in attempting engineering problems for feasible random events.
COURSE CODE	15EE42 POWER GENERATION AND ECONOMICS

CO1	Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants.
CO2	Classify various substations and explain the importance of grounding.
CO3	Understand the economic aspects of power system operation and its effects.
CO4	Explain the importance of power factor improvement.
COURSE CODE	15EE43 TRANSMISSION AND DISTRIBUTION
CO1	Explain the concepts of various methods of generation of power.
CO2	Explain the importance of HVAC, EHVAC, UHVAC and HVDC transmission.
CO3	Design and analyze overhead transmission system for a given voltage level.
CO4	Calculate the parameters of the transmission line for different configurations and assess the performance of line.
CO5	Explain the use of underground cables and evaluate different types of distribution systems.
COURSE CODE	15EE44 ELECTRIC MOTORS
CO1	Explain the constructional features of Motors and select a suitable drive for specific application.
CO2	Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method.
CO3	Explain the constructional features of Three Phase and Single phase induction Motors and assess their performance.
CO4	Control the speed of induction motor by a suitable method.
CO5	Explain the operation of Synchronous motor and special motors.
COURSE CODE	15EE45 ELECTROMAGNETIC FIELD THEORY
CO1	Use different coordinate systems to explain the concept of gradient, divergence and curl of a vector.
CO2	Use Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
CO3	Calculate the energy and potential due to a system of charges.
CO4	Explain the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics.
CO5	Explain the behavior of magnetic fields and magnetic materials.
CO6	Assess time varying fields and propagation of waves in different media.

COURSE CODE	15EE46 OPERATIONAL AMPLIFIERS AND LINEAR ICs
CO1	At the end of the course the student will be able to:
CO2	Explain the basics of linear ICs.
CO3	Design circuits using linear ICs.
CO4	Demonstrate the application of Linear ICs.
CO5	Use ICs in the electronic projects.
COURSE CODE	15EEL47 ELECTRICAL MACHINES LABORATORY -2
CO1	To perform tests on dc machines to determine their characteristics.
CO2	To control the speed of dc motor.
CO3	To conduct test for pre-determination of the performance characteristics of dc machines
CO4	To conduct load test on single phase and three phase induction motor.
CO5	To conduct test on induction motor to determine the performance characteristics.
CO6	To conduct test on synchronous motor to draw the performance curves.
COURSE CODE	15EEL48 OP- AMP AND LINEAR ICS LABORATORY
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	15EE51 MANAGEMENT AND ENTREPRENEURSHIP
CO1	Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process.
CO2	Discuss work allocation, the structure of organization, the modes of communication and importance of managerial control in business.
CO3	To explain need of coordination between the manager and staff in exercising the authority and delegating duties.
CO4	To explain the social responsibility of business and leadership
CO5	Explain the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development.
CO6	Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation.

CO7	Discuss the concepts of project management, capitol building process, project feasibility study, project appraisal and project financing.
CO8	Discuss the state /central level institutions / agencies supporting business enterprises.
COURSE CODE	15EE52 MICROCONTROLLER
CO1	Discuss the history of the 8051 and features of other 8051 family members and the internal architecture of the 8051.
CO2	Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions.
CO3	Discuss 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs.
CO4	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization
CO5	Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051 to the RS232.
CO6	Discuss in detail 8051 interrupts and writing interrupt handler programs.
CO7	Interface 8051 with real-world devices such as LCDs and keyboards, ADC, DAC chips and sensors.
CO8	Interface 8031/51 with external memories, 8255 chip to add ports and relays, opt isolators and motors
COURSE CODE	15EE53 POWER ELECTRONICS
CO1	Explain application area of power electronics, types of power electronic circuits and switches their characteristics and specifications.
CO2	Explain types of power diodes, their characteristics, and the effects of power diodes on RL circuits.
CO3	Explain the techniques for design, operation and analysis of single phase diode rectifier circuits.
CO4	Explain steady state, switching characteristics and gate control requirements of different power transistors and their limitations.
CO5	Discuss different types of Thyristors, their operation, gate characteristics and gate control requirements.
CO6	Explain designing, analysis techniques and characteristics of thyristor controlled rectifiers.
CO7	Discuss the principle of operation of single phase and three phase DC - DC, DC –AC converters and AC voltage controllers.
COURSE CODE	15EE54 SIGNALS AND SYSTEMS
CO1	Classify the signals and systems.
CO2	Explain basic operations on signals and properties of systems.

CO3	Use convolution in both continuous and discrete domain for the analysis of systems given the impulse response of a system.
CO4	Evaluate response of a given linear time invariant system.
CO5	Provide block diagram representation of a linear time invariant system.
CO6	Apply continuous time Fourier transform representation to study signals and linear time invariant systems.
CO7	Apply discrete time Fourier transform representation to study signals and linear time invariant systems.
CO8	Use Z-transform and properties of Z transform for the analysis of discrete time systems.

COURSE CODE	15EE553 ELECTRICAL ESTIMATION AND COSTING
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CO1	Explain the purpose of estimation and costing.
CO2	Discuss market survey, estimates, purchase enquiries, preparation of tenders, comparative statements and payment of bills.
CO3	Discuss Indian Electricity act and Indian Electricity rules.
CO4	Discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories and fittings, fuses and types of fuses.
CO5	Discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
CO6	Discuss types of service mains and estimation of service mains and power circuits.
CO7	Discuss estimation of overhead transmission and distribution system and its components.
CO8	Discuss main components of a substation, preparation of single line diagram of a substation and earthing of a substation.

COURSE CODE	15EE563 RENEWABLE ENERGY RESOURCES
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CO1	Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
CO2	Discuss 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 generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
CO5	Discuss production of energy from biomass, biogas.
CO6	Discuss tidal energy resources, energy availability and power generation.
CO7	Discuss power generation sea wave energy and ocean thermal energy.

COURSE CODE	15EEL57 MICROCONTROLLER LABORATORY - 1
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CO1	Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
CO2	Write ALP for code conversions.

CO3	Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
CO4	Perform interfacing of stepper motor and dc motor for controlling the speed.
CO5	Generate different waveforms using DAC interface.
CO6	Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work.
COURSE CODE	15EEL58 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.
CO6	Perform commutation of SCR by different methods.
COURSE CODE	15EE61 CONTROL SYSTEMS
CO1	Discuss the effects of feedback and types of feedback control systems.
CO2	Evaluate the transfer function of a linear time invariant system.
CO3	Evaluate the stability of linear time invariant systems.
CO4	Apply block diagram manipulation and signal flow graph methods to obtain transfer function of systems.
CO5	Demonstrate the knowledge of mathematical modeling of control systems and components
CO6	Determine transient and steady state time response of a simple control system.
CO7	Investigate the performance of a given system in time and frequency domains.
CO8	Discuss stability analysis using Root locus, Bode plots and Nyquist plots.
CO9	Determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications.
COURSE CODE	15EE62 POWER SYSTEM ANALYSIS – 1
CO1	Show understanding of per unit system, its advantages and computation.
CO2	Show the concept of one line diagram and its implementation in problems
CO3	Perform short circuit analysis on a synchronous machine and simple power system to select a circuit breaker for the system.
CO4	Evaluate symmetrical components of voltages and currents in un-balanced three phase circuits.

CO5	Explain the concept of sequence impedance and sequence networks of power system components and power system.
CO6	Analyze three phase synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components.
CO7	Discuss the dynamics of synchronous machine, stability and types of stability.
CO8	Discuss equal area criterion for the evaluation of stability of a simple system under different fault conditions.
COURSE CODE	15EE63 DIGITAL SIGNAL PROCESSING
CO1	Compute the DFT of various signals using its properties and linear filtering of two sequences.
CO2	Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
CO3	Design infinite impulse response Butterworth digital filters using impulse invariant / bilinear transformation technique.
CO4	Design infinite impulse response Chebyshev digital filters using impulse invariant or bilinear transformation technique.
CO5	Realize a digital IIR filter by direct, cascade, parallel and ladder methods of realization.
CO6	Discuss different window functions and frequency sampling method used for design of FIR filters.
CO7	Design FIR filters by use of window function or by frequency sampling method.
CO8	Realize a digital FIR filter by direct, cascade, and linear phase form.
COURSE CODE	15EE64 ELECTRICAL MACHINE DESIGN
CO1	Discuss design factors, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
CO2	Derive the output equations of transformer, DC machines and AC machines.
CO3	Discuss selection of specific loadings and magnetic circuits of different electrical machines
CO4	Design the field windings of DC machine and Synchronous machine.
CO5	Design stator and rotor circuits of a DC and AC machines.
CO6	Estimate the number of cooling tubes, no load current and leakage reactance of core type transformer.
CO7	Discuss short circuit ratio and its effects on performance of synchronous machines.
CO8	Design salient pole and non-salient pole alternators for given specifications.
COURSE CODE	15EE653 ENERGY AUDIT AND DEMAND SIDE MANAGEMENT
CO1	Understand the need of energy audit and energy audit methodology.
CO2	Explain audit parameters and working principles of measuring instruments used to measure the parameters.

CO3	Conduct energy audit of boilers, furnaces, power plant, steam distribution system and compressed air systems.
CO4	Conduct energy audit HVAC systems, motors, pumps, blowers and cooling towers.
CO5	Explain load management techniques, effects of harmonics, electricity tariff, improvement of power factor and losses in transmission.
CO6	Conduct energy audit of lighting systems and buildings.
CO7	Show an understanding of demand side management and energy conservation.
COURSE CODE	15EE662SENSORS AND TRANSDUCERS
CO1	Discuss need of transducers, their classification, advantages and disadvantages.
CO2	Show an understanding of working of various transducers and sensors.
CO3	Discuss recent trends in sensor technology and their selection.
CO4	Discuss basics of signal conditioning and signal conditioning equipment.
CO5	Discuss 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	15EEL67 CONTROL SYSTEM LABORATORY
CO1	Use software package or discrete components in assessing the time and frequency domain responses of a
CO2	given second order system.
CO3	Design and analyze Lead, Lag and Lag – Lead compensators for given specifications.
CO4	Determine the performance characteristics of ac and dc servomotors and synchro-transmitter receiver pair used in control systems .
CO5	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.
CO6	Write a script files to plot root locus, Bode plot, Nyquist plots to study the stability of the system using a software package.
CO7	Work with a small team to carryout experiments and prepare reports that present lab work.
COURSE CODE	15EEL68 DIGITAL SIGNAL PROCESSING LABORATORY
CO1	Give 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
CO7	Conduct experiments using software and prepare reports that present lab work
COURSE CODE	15EE71 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	Suggest a method to control voltage profile.
CO4	Show knowledge of optimal operation of generators on a bus bar, optimal unit commitment,
CO5	Discuss optimal scheduling for hydro-thermal system, power system security and reliability.
CO6	Analyze short circuit faults in power system networks using bus impedance matrix.
CO7	Perform numerical solution of swing equation for multi-machine stability ■
COURSE CODE	15EE72 POWER SYSTEM PROTECTION
CO1	Discuss performance of protective relays, components of protection scheme and relay terminology overcurrent 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; wire pilot relaying and carrier pilot relaying.
CO4	Discuss construction, operating principles and performance of differential relays for differential protection.
CO5	Discuss protection of generators, motors, Transformer and Bus Zone Protection.
CO6	Explain the principle of circuit interruption in different types of circuit breakers.
CO7	Describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse.
CO8	Discuss protection against Overvoltages and Gas Insulated Substation (GIS).
COURSE CODE	15EE73 HIGH VOLTAGE ENGINEERING
CO1	Explain conduction and breakdown phenomenon in gases, liquid dielectrics.
CO2	Explain breakdown phenomenon in solid dielectrics.
CO3	Explain generation of high voltages and currents
CO4	Discuss measurement techniques for high voltages and currents.
CO5	Discuss overvoltage phenomenon and insulation coordination in electric power systems.

CO6	Discuss non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus
COURSE CODE	15EE742 UTILIZATION OF ELECTRICAL POWER
CO1	Discuss electric heating, air-conditioning and electric welding.
CO2	Explain laws of electrolysis, extraction and refining of metals and electro deposition.
CO3	Explain the terminology of illumination, laws of illumination, construction and working of electric lamps.
CO4	Design interior and exterior lighting systems- illumination levels for factory lighting- flood lighting-street lighting.
CO5	Discuss systems of electric traction, speed time curves and mechanics of train movement.
CO6	Explain the motors used for electric traction and their control.
CO7	Discuss braking of electric motors, traction systems and power supply and other traction systems.
CO8	Explain the working of electric and hybrid electric vehicles.
COURSE CODE	15EE752 TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS
CO1	Describe the process to plan, control and implement commissioning of electrical equipment's.
CO2	Differentiate the performance specifications of transformer and induction motor.
CO3	Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
CO4	Describe corrective and preventive maintenance of electrical equipment's.
CO5	Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines
COURSE CODE	15EEL76 POWER SYSTEM SIMULATION LABORATORY
CO1	Develop a program in MATLAB to assess the performance of medium and long transmission lines.
CO2	Develop a program in MATLAB to obtain the power angle characteristics of salient and non-salient pole alternator.
CO3	Develop a program in MATLAB to assess the transient stability under three phase fault at different locations in a of radial power systems.
CO4	Develop programs in MATLAB to formulate bus admittance and bus impedance matrices of interconnected power systems.
CO5	Use Mi-Power package to solve power flow problem for simple power systems.
CO6	Use Mi-Power package to study unsymmetrical faults at different locations in radial power systems
CO7	Use of Mi-Power package to study optimal generation scheduling problems for thermal power plants.
COURSE CODE	15EEL77 RELY AND HIGH VOLTAGE LABORATORY

CO1	Experimentally verify the characteristics of over current, over voltage, under voltage and negative sequence relays both electromagnetic and static type.
CO2	Experimentally 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 AC 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	15EE81 POWER SYSTEM OPERATION AND CONTROL
CO1	Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA.
CO2	Solve unit commitment problems
CO3	Explain issues of hydrothermal scheduling and solutions to hydro thermal problems
CO4	Explain basic generator control loops, functions of Automatic generation control, speed governors
CO5	Develop and analyze mathematical models of Automatic Load Frequency Control
CO6	Explain automatic generation control, voltage and reactive power control in an interconnected power System
CO7	Explain reliability, security, contingency analysis, state estimation and related issues of power systems
COURSE CODE	15EE82 INDUSTRIAL DRIVES AND APPLICATIONS
CO1	Explain the advantages and choice of electric drive.
CO2	Explain dynamics and different modes of operation of electric drives.
CO3	Suggest a motor for a drive and control of dc motor using controlled rectifiers.
CO4	Analyze the performance of induction motor drives under different conditions.
CO5	Control induction motor, synchronous motor and stepper motor drives.
CO6	Suggest a suitable electrical drive for specific application in the industry
COURSE CODE	15EE833 INTEGRATION OF DISTRIBUTED GENERATION
CO1	Explain energy generation by wind power and solar power
CO2	Discuss the variation in production capacity at different timescales, the size of individual units
CO3	Explain the performance of the system when distributed generation is integrated to the system.

CO4	Discuss effects of the integration of DG: the increased risk of overload and increased losses.
CO5	Discuss effects of the integration of DG: increased risk of overvoltages, increased levels of power quality disturbances
CO6	Discuss effects of the integration of DG: incorrect operation of the protection□
CO7	Discuss the impact the integration of DG on power system stability and operation.

PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2018-19(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

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.

MECHANICAL ENGINEERING	
Course Code	17CED14/17CED24 - COMPUTER AIDED ENGINEERING DRAWING
CO1	Students will be able to demonstrate the usage of CAD software.
CO2	Students will be able to visualize and draw Orthographic projections, Sections of solids and Isometric views of solids.
CO3	Students are evaluated for their ability in applying various concepts to solve practical problems related to engineering drawing.
Course Code	17EME14/17EME24- ELEMENTS OF MECHANICAL ENGINEERING
CO1	Various Energy sources, Boilers, Prime movers such as turbines and IC engines, refrigeration and air-conditioning systems
CO2	Metal removal process using Lathe, drilling, Milling Robotics and Automation.
CO3	Fair understanding of application and usage of various engineering
Course Code	17WSL16/17WSL26 - WORKSHOP PRACTICE
CO1	Demonstrate and produce different types of fitting models.
CO2	Gain knowledge of development of sheet metal models with an understanding of their applications.
CO3	Perform soldering and welding of different sheet metal & welded joints.
CO4	Understand the Basics of Workshop practices
Course Code	17ME32 - Material Science
CO1	The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering.
CO2	Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics ,smart materials and composites.
CO3	The means of modifying such properties, as well as the processing and failure of materials.
CO4	Concepts of use of materials for various applications are highlighted.
Course Code	17ME33- Basic Thermodynamics
CO1	Learn about thermodynamic systems and boundaries
CO2	Study the basic laws of thermodynamics including, conservation of mass, conservation of energy or first law , second law and Zeroth law.
CO3	Understand various forms of energy including heat transfer and work
CO4	Identify various types of properties (e.g., extensive and intensive properties)
CO5	Use tables, equations, and charts, in evaluation of thermodynamic properties
CO6	Apply conservation of mass, first law, and second law in thermodynamic analysis of systems (e.g., turbines, pumps, compressors, heat exchangers,etc.)
CO7	Enhance their problem solving skills in thermal engineering
Course Code	17ME34 - Mechanics of Materials
CO1	Classify the stresses into various categories and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes.
CO2	Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle.
CO3	Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads.

	MECHANICAL ENGINEERING
CO4	Explain the structural behavior of members subjected to torque, Calculate twist and stress induced in shafts subjected to bending and torsion.
CO5	Understand the concept of stability and derive crippling loads for columns.
CO6	Understand the concept of strain energy and compute strain energy for applied loads.
Course Code	17ME35B - Machine tools & operations
CO1	To introduce students to different machine tools in order to produce components having different shapes and sizes.
CO2	To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
CO3	To develop the knowledge on mechanics of machining process and effect of various parameters on economics of machining.
Course Code	17ME36B-MECHANICAL MEASUREMENTS AND METROLOGY
CO1	Understand metrology, its advancements & measuring instruments,
CO2	Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators.
CO3	Equip with knowledge of limits, fits, tolerances and gauging.
CO4	Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.
CO5	Understand the measurement of Force, Torque, Pressure, Temperature and Strain.
Course Code	17MEL37B - MECHANICAL MEASUREMENTS AND METROLOGY LAB
CO1	To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
CO2	To illustrate the use of various measuring tools measuring techniques.
CO3	To understand calibration techniques of various measuring devices.
Course Code	17MEL38B - MACHINE SHOP
CO1	To provide an insight to different machine tools, accessories and attachments
CO2	To train students into machining operations to enrich their practical skills
CO3	To inculcate team qualities and expose students to shop floor activities
CO4	To educate students about ethical , environmental and safety standards
Course Code	17ME42 - KINEMATICS OF MACHINES
CO1	Identify mechanisms with basic understanding of motion.
CO2	Comprehend motion analysis of planar mechanisms, gears, gear trains and cams.
CO3	Carry out motion analysis of planar mechanisms, gears, gear trains and cams.
Course Code	17ME43 - APPLIED THERMODYNAMICS
CO1	Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.
CO2	Evaluate the performance of steam turbine components.
CO3	Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment.
CO4	Apply thermodynamic concepts to analyze turbo machines.
CO5	Determine performance parameters of refrigeration and air-conditioning systems.
CO6	Understand the principles and applications of refrigeration systems.

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CO7	Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an airconditioning system.
CO8	Understand the working, applications, relevance of air and identify methods for performance improvement.
Course Code	17ME44 - FLUID MECHANICS
CO1	Identify and calculate the key fluid properties used in the analysis of fluid behavior.
CO2	Understand and apply 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	Understand and apply the principles of fluid kinematics and dynamics.
CO5	Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.
CO6	Understand the basic concept of compressible flow and CFD
Course Code	17ME45A - METAL CASTING AND WELDING
CO1	Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.
CO2	Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.
CO3	Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
CO4	Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.
CO5	Explain the Solidification process and Casting of Non-Ferrous Metals.
CO6	Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.
CO7	Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing.
CO8	Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process.
Course Code	17ME46A - COMPUTER AIDED MACHINE DRAWING
CO1	Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D
CO2	Orthographic views of machine parts with and without sectioning in 2D.
CO3	Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
CO4	Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D
CO5	Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D
CO6	Single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D
CO7	Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D
CO8	assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D
Course Code	17MEL47A - MATERIALS TESTING LAB

	MECHANICAL ENGINEERING
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	Know how to improve structure/behavior of materials for various industrial applications.
Course Code	17MEL48A- FOUNDRY AND FORGING LAB
CO1	Demonstrate various skills of sand preparation, molding.
CO2	Demonstrate various skills of forging operations.
CO3	Work as a team keeping up ethical principles.

MECHANICAL ENGINEERING	
Course Code	15CED14/15CED24 - COMPUTER AIDED ENGINEERING DRAWING
CO1	Engineering drawing is an important tool for all Engineers and for many others professionals. It is the language of Engineers. Engineering Drawing communicates all needed information from the engineer who designed a part to the workers who will manufacture it.
CO2	The aim of the subject is to equip students with the fundamentals of Computer Aided Engineering Drawing and to further the ability to communicate information by graphical means.
Course Code	15EME14/15EME24 - ELEMENTS OF MECHANICAL ENGINEERING
CO1	Students belonging to all branches of Engineering are made to learn certain fundamental topics related to mechanical engineering so that they will have a minimum understanding of mechanical systems, equipment and process.
Course Code	15ME32 - Material Science
CO1	Describe the mechanical properties of metals, their alloys and various modes of failure.
CO2	Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.
CO3	Explain the processes of heat treatment of various alloys.
CO4	Understand the properties and potentialities of various materials available and material selection procedures.
CO5	Know about composite materials and their processing as well as applications.
Course Code	15ME33- Basic Thermodynamics
CO1	Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions.
CO2	Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics.
CO3	Interpret behavior of pure substances and its applications to practical problems.
CO4	Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases.
CO5	Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-Bridgeman equation.
Course Code	15ME34 - Mechanics of Materials
CO1	Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.
CO2	Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads.
CO3	Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle.
CO4	Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders.
CO5	Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples.
CO6	Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL.
CO7	Determine slopes and deflections at various points on beams subjected to UDL, UVL, Point loads and couples.
CO8	Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory.

MECHANICAL ENGINEERING	
Course Code	15ME35B - Machine tools & operations
CO1	Explain the construction & specification of various machine tools.
CO2	Describe various machining processes pertaining to relative motions between tool & work piece
CO3	Discuss different cutting tool materials, tool nomenclature & surface finish
CO4	Apply mechanics of machining process to evaluate machining time
CO5	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.
Course Code	15ME36A / 46A - Computer Aided Machine Drawing
CO1	Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D.
CO2	Orthographic views of machine parts with and without sectioning in 2D.
CO3	Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
CO4	Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D.
CO5	Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D.
CO6	single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D.
CO7	Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D.
CO8	assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D.
Course Code	15ME36B/46B - Mechanical Measurements & metrology
CO1	Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.
CO2	Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.
CO3	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.
CO4	Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter.
CO5	Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.
CO6	Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile.
CO7	Understand laser interferometers and Coordinate measuring machines.
CO8	Explain measurement systems, transducers, intermediate modifying devices and terminating devices.
CO9	Describe functioning of force, torque, pressure, strain and temperature measuring devices.
Course Code	15MEL37A/47A - Materials testing lab
CO1	Acquire experimentation skills in the field of material testing

MECHANICAL ENGINEERING	
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	Know how to improve structure/behavior of materials for various industrial applications
Course Code	15MEL38B - Machine shop
CO1	Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations.
CO2	Perform keyways / slots , grooves etc using shaper.
CO3	Perform gear tooth cutting using milling machine.
CO4	Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder.
CO5	Understand Surface Milling/Slot Milling.
CO6	Demonstrate precautions and safety norms followed in Machine Shop.
CO7	Exhibit interpersonal skills towards working in a team.
Course Code	15ME42 - Kinematics of Machines
CO1	Familiarize with mechanisms and motion analysis of mechanisms
CO2	Understand methods of mechanism motion analysis and their characteristics
CO3	Analyse motion of planar mechanisms, gears, gear trains and cams.
Course Code	15ME43 - Applied Thermodynamics
CO1	Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.
CO2	Evaluate the performance of steam turbine components
CO3	Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment
CO4	Apply thermodynamic concepts to analyze turbo machines
CO5	Determine performance parameters of refrigeration and air-conditioning systems.
CO6	Understand the principles and applications of refrigeration systems.
CO7	Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an air-conditioning system
CO8	Understand the working, applications, relevance of air and identify methods for performance improvement.
Course Code	15ME44 - Fluid Mechanics
CO1	Identify and calculate the key fluid properties used in the analysis of fluid behavior.
CO2	Understand and apply 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	Understand and apply the principles of fluid kinematics and dynamics.
CO5	Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.
CO6	Understand the basic concept of compressible flow and CFD
Course Code	15ME45A - Metal casting and welding
CO1	Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.
CO2	Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.
CO3	Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
CO4	Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.

MECHANICAL ENGINEERING	
CO5	Explain the Solidification process and Casting of Non-Ferrous Metals.
CO6	Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.
CO7	Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing. U PO1
CO8	Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process. U PO1
Course Code	15MEL47A / MEL47B - Mechanical Measurement & Metrology Laboratory
CO1	To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer.
CO2	To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
CO3	To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
CO4	To measure cutting tool forces using Lathe/Drill tool dynamometer.
CO5	To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.
CO6	To measure surface roughness using Tally Surf/ Mechanical Comparator.
Course Code	15MEL48A / MEL48B - Foundry & Forging
CO1	Demonstrate various skills of sand preparation, molding.
CO2	Demonstrate various skills of forging operations
CO3	Work as a team keeping up ethical principles.
Course Code	15ME51 - Management and Engineering Economics
CO1	Understand needs, functions, roles, scope and evolution of Management
CO2	Understand importance, purpose of Planning and hierarchy of planning and also analyze 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	15ME52 - Dynamics of Machinery
CO1	Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
CO2	Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
CO3	Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
CO4	Determine sensitiveness, isochronism, effort and power of porter and hartnell governors
CO5	Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
CO6	Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
CO7	Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems
CO8	Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
CO9	Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.
Course Code	15ME53 - Turbo Machines
CO1	Able to give precise definition of turbomachinery
CO2	Identify various types of turbo machinery

MECHANICAL ENGINEERING	
CO3	Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines
CO4	Understand the principle of operation of pumps, fans, compressors and turbines.
CO5	Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)
CO6	Analyze the performance of turbo machinery.
Course Code	15ME54 - Design of Machine Elements - 1
CO1	Describe the design process, choose materials.
CO2	Apply the codes and standards in design process.
CO3	Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
CO4	Design shafts, joints, couplings
CO5	Design of riveted and welded joints
CO6	Design of threaded fasteners and power screws
Course Code	15ME553 - Human Resource Management
CO1	Understand the importance, functions and principles Human Resource Management and process of Job analysis
CO2	Summarize the objectives of Human Resource planning, Recruitment and selection process
CO3	Understand the process involved in Placement, Training and development activities
CO4	Understand the characteristics of an effective appraisal system and compensation planning.
CO5	Understand the issues related to employee welfare, grievances and discipline.
Course Code	15ME563 - Automation & Robotics
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.
CO4	Explain the working of transducers, sensors and machine vision systems.
CO5	Discuss the future capabilities of sensors, mobility systems and Artificial Intelligence in the field of robotics.
Course Code	15MEL57 - Fluid Mechanics & Machinery 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	15MEL58 - Energy Lab
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 report the remedies.
CO5	Determine the energy flow pattern through the I C Engine
CO6	Exhibit his competency towards preventive maintenance of IC engines
Course Code	15ME61-Finite Element Method
CO1	Understand the concepts behind formulation methods in FEM.

MECHANICAL ENGINEERING	
CO2	Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
CO3	Develop element characteristic equation and generation of global equation.
CO4	Able to apply suitable boundary conditions to a global equation for bars, trusses, beams,
	circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.
Course Code	15ME62-Computer Integrated Manufacturing
CO1	Able to 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 analyze different types of automated flow lines.
CO3	Analyze the automated flow lines to reduce down 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	15ME63-Heat Transfer
CO1	Compute temperature distribution in steady-state and unsteady-state heat conduction
CO2	Understand and interpret heat transfer through extended surfaces.
CO3	Interpret and compute forced and free convective heat transfer.
CO4	Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.
CO5	Design heat exchangers using LMTD and NTU methods.
Course Code	15ME64-Design of Machine Elements-II
CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs, belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.
CO6	Select Anti friction bearings for different applications using the manufacturers,catalogue.
CO7	Develop proficiency to generate production drawings using CAD software.
CO8	Become good design engineers through learning the art of working in a team
Course Code	15ME653-Metal Forming
CO1	Able to understand the concept of different metal forming process.
CO2	Able to approach metal forming processes both analytically and numerically
CO3	Able to design metal forming processes
CO4	Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws
Course Code	15ME664-Total Quality Management
CO1	Explain the various approaches of TQM
CO2	Infer the customer perception of quality
CO3	Analyze 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.

MECHANICAL ENGINEERING	
Course Code	15MEL67-Heat Transfer lab
CO1	Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
CO2	Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
CO3	Determine surface emissivity of a test plate
CO4	Estimate performance of a refrigerator and effectiveness of fin
CO5	Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.
Course Code	15MEL68-Modeling & Analysis lab
CO1	Use the modern tools to formulate the problem, and able to create geometry, descritize, Apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions.
CO2	Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
CO3	Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
CO4	Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.
Course Code	15ME71- Energy Engineerng

MECHANICAL ENGINEERING	
CO1	Summarize the basic concepts of thermal energy systems,
CO2	Identify renewable energy sources and their utilization.
CO3	Understand the basic concepts of solar radiation and analyze the working of sthermal systems.
CO4	Understand principles of energy conversion from alternate sources inclugeothermal, ocean, biomass, biogas.
CO5	Understand the concepts and applications of fuel cells, thermoelectric coMHD generator.
CO6	Identify methods of energy storage for specific applications
Course Code	15ME72-Fluid Power Systems
CO1	Identify and analyse the functional requirements of a flfor 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 forthe given application.
Course Code	15ME73- Control Engineering
CO1	Recognize control system and its types , control actions
CO2	Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)
CO3	Calculate the gain of the system using block diagram and signal flow graph
CO4	Illustrate the response of 1st and 2nd order systems
CO5	Determine the stability of transfer functions in complex domain and frequency domain
CO6	Employ state equations to study the controllability and observability
Course Code	15ME742-Tribology
CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of componentsexperiencing relative motion
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearingfor 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
Course Code	15ME754 - Mechatronics
CO1	Illustrate various components of Mechatronics systems.
CO2	Assess various control systems used in automation.
CO3	Develop mechanical, hydraulic, pneumatic and electrical control systems.
Course Code	15MEL76 - Design Laboratory
CO1	To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
CO2	To identify forces and couples in rotating mechanical system components.
CO3	To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft
CO4	To measure strain in various machine elements using strain gauges.
CO5	To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
CO6	To determine strain induced in a structural member using the principle of photo-elasticity.
Course Code	15MEL77 - CIM Laboratory

MECHANICAL ENGINEERING	
CO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time
CO6	Understand & write programs for Robot control; understand the operating principles of hydraulics, pneumatics and electro pneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.
Course Code	15ME81 - 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
CO7	Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm
Course Code	15ME82 - ADDITIVE MANUFACTURING
CO1	Understand the additive manufacturing process, polymerization and powder metallurgy process
CO2	Understand characterisation techniques in additive manufacturing
CO3	Acquire knowledge on CNC and Automation.

MECHANICAL ENGINEERING	
Course Code	15ME832 - EXPERIMENTAL STRESS ANALYSIS
CO1	Explain characterize the elastic behavior of solid bodies.
CO2	Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.
CO3	Discuss skills for experimental investigations an accompanying laboratory course is desirable
CO4	Discuss experimental investigations by predictions by other methods.
CO5	Describe various coating techniques.

DEPARTMENT OF PHYSICS

2018 Scheme

Course Code	18PHY12/22 – ENGINEERING PHYSICS
CO1	Understand various types of oscillations and their implications, the role of Shockwaves in various fields and Recognize the elastic properties of materials for engineering applications
CO2	Realize the interrelation between time varying electric field and magnetic field the transverse nature of the EM waves and their role in optical fiber communication
CO3	Compute Eigen values Eigen function, momentum of Atomic and subatomic particles using Time independent 1-D Schrodinger's wave equation
CO4	Apprehend theoretical background of laser, construction and working of different types of laser and its applications in different fields
CO5	Understand various electrical and thermal properties of materials like conductors, semiconductors and dielectrics using different theoretical models
Course Code	18PHYL16/26 – ENGINEERING PHYSICS LABORATORY
CO1	Apprehend the concepts of interference of light, diffraction of light, Fermi energy and magnetic effect of current
CO2	Understand the principles of operations of optical fibers and semiconductor devices such as Photodiode and NPN transistor using simple circuits
CO3	Determine elastic moduli and moment of inertia of given materials with the help of suggested procedures
CO4	Recognize the resonance concept its practical applications
CO5	Understand the importance of measurement procedure, honest recording and representing the data, reproduction of final results

DEPARTMENT OF CHEMISTRY**2018 Scheme**

Course Code	18CHE12/22 – ENGINEERING CHEMISTRY
CO1	Use of free energy in equilibria, rationalize bulk properties and processes using thermodynamic considerations, electrochemical energy systems
CO2	Causes & 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	18CHEL16/26 – ENGINEERING CHEMISTRY LABORATORY
CO1	Handling different Types of instruments for analysis of materials 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.