ACS College of Engineering
Approved by AICTE New Delhi, Affiliated to VTU, Belagavi
(A Unit of RajaRajeswari Group of Institutions)

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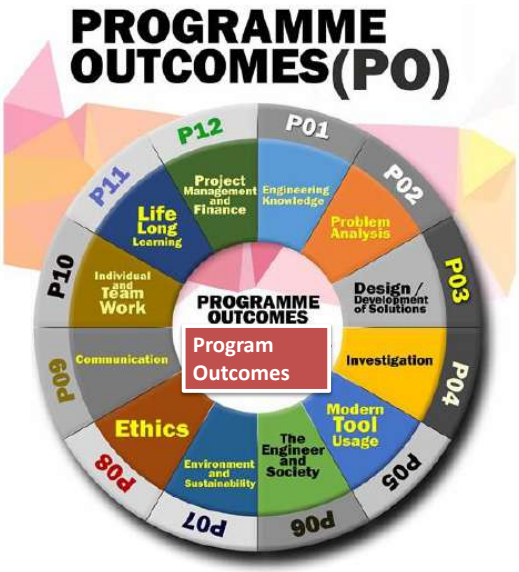
PROGRAMME OUTCOME, PROGRAMME SPECIFIC OUTCOMES AND COURSE OUTCOMES OF ALL DEPARTMENTS - 2019-20 (CRITERIA - 2)

Department of Aeronautical Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes

Program Outcomes:



PO1 - Engineering Knowledge: Apply knowledge of mathematics and science, with fundamentals of Aeronautical Engineering to be able to solve complex engineering problems related to Aeronautical Engineering.

PO2 - Problem Analysis: Identify, Formulate, review research literature and analyze complex

engineering problems related to Aeronautical Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex aircraft problems related to Aeronautical Engineering 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

PO4 - Conduct Investigations of Complex problems: Use research–based knowledge and research methods including design of aircraft structure experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern Tool Usage: Create, Select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to Aeronautical Engineering related complex engineering activities with an understanding of the limitations.

PO6 - 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 Aeronautical professional engineering practice.

PO7 - Environment and Sustainability: Understand the impact of the Aeronautical professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development

PO8 - Ethics: Apply Ethical Principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary Settings.

PO10 -Communication: Communicate effectively on complex engineering activities with the engineering community and with High society and with write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11 -Project Management and Finance: Demonstrate knowledge and understanding of the engineering 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.

PO12 -Life-Long Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning the broadest content of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO-1: AEROMODELLING	Apply their Engineering knowledge of all the fundamental, Core subjects & the Hardware and Software skills in the development (design, fabrication, analysis, testing and flying) of Aero models(RC, UAV & DRONES).
PSO-2: AEROSPACE EXPOSURE	Students will be given additional exposure in advanced development in the fields like AEROSPACE and Helicopter designs.
PSO-3: Career Improvement through NETWORK	Graduates will get quality industrial exposures and career opportunities in the field of aeronautics and aerospace from eminent scientists of ISRO, NAL, and DRDO taking advantage from the department's Strong network.

Course Outcomes:

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: Aero Thermodynamics – 18AE32	
CO1	Apply the concepts and definitions of thermodynamics.
CO2	Differentiate thermodynamic work and heat and apply I law and II law of thermodynamics to different process.
CO3	Apply the principles of various gas cycles.

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: Mechanics of Materials – 18AE33	
CO1	Apply the basic concepts of strength of materials.
CO2	Compute stress, strain under different loadings.
CO3	Distinguish the different failure theories.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Elements of Aeronautics– 18AE34	
CO1	Appreciate and apply the basic principle of aviation
CO2	Apply the concepts of fundaments of flight, basics of aircraft structures, aircraft propulsion and aircraft materials during the development of an aircraft
CO3	Comprehend the complexities involved during development of flight vehicles

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Mechanics of Fluid– 18AE35	
CO1	Evaluate the effect of fluid properties.
CO2	Apply the governing laws of fluid flow.
CO3	Classify different types of fluid flows.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Measurement and Metrology– 18AE36	
CO1	Apply the standards of measurement, system of limits, fits, tolerances and gauging.
CO2	Identify and use appropriate measuring instruments
CO3	Acquire the knowledge on measurement and measurement systems

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Measurement and Metrology Lab– 18AEL37A	
CO1	Identify and classify different measuring tools related to experiments.
CO2	Identify, define, and explain accuracy, precision, and some additional terminology.
CO3	Conduct, Analyze, interpret, and present measurement data from measurements experiments.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Machine Shop Lab– 18AEL38	
CO1	Demonstrate the operation of general purpose machine tools and manufacturing process.
CO2	Identify the special purpose machine tools for specific requirements
CO3	Develop physical models using different manufacturing processes.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Aerodynamics-I– 18AE42	
CO1	Evaluate typical airfoil characteristics and two-dimensional flows over airfoil
CO2	Compute and analyse the incompressible flow over finite wings
CO3	Apply finite wing theory and design high lift systems from the aerodynamics view point

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Aircraft Propulsion– 18AE43	
CO1	Apply the basic principle and theory of aircraft propulsion.
CO2	Explain the functions of centrifugal, axial compressors, axi.al and radial turbines.
CO3	Analyse the performance of nozzles & inlets and combustion chamber.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Mechanisms and Machine Theory – 18AE44	
CO1	Apply the theory of velocity, acceleration and static force analysis to design of mechanisms.
CO2	Design spur gears, gear train, balancing of rotating and reciprocating masses
CO3	Apply governors and gyroscope

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Aircraft Material Science – 18AE45	
CO1	Identify appropriate aircraft materials for a given application.
CO2	Explain the properties of super alloys, ablative materials and high energy material.
CO3	Understand material corrosion process and apply prevention technique.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Turbo machines – 18AE46	
CO1	Compute the energy transfer and energy transformation in turbo machines.
CO2	Analyse the design of turbo machine blades
CO3	Apply hydraulic pumps and turbines for specific requirements

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Material Testing Lab– 18AEL47A	
CO1	Apply the relations among materials and their properties.
CO2	Differentiate the formation, properties and significance of the alloys through different experiments
CO3	Understand the different types, advantages and applications of various NDT methods

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Computer Aided Aircraft Drawing Lab– 18AEL48	
CO1	Distinguish drawings of machine and aircraft components
CO2	Identify assembly drawings either manually or by using standard CAD packages
CO3	Practice with standard components and their assembly of an aircraft

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Management And Entrepreneurship– 17AE51	
CO1	Explain about the management and planning.
CO2	Apply the knowledge on planning, organizing, staffing, directing and controlling.
CO3	Describe the requirements towards the small-scale industries and project preparation

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Introduction To Composite Materials– 17AE52	
CO1	Explain the advantages of using composite materials as an alternative to conventional materials for specific applications
CO2	Describe the advanced fabrication and processing for producing composite parts.
CO3	Evaluate the micro- and macro-mechanical behavior of composite laminates

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Heat & Mass Transfer– 17AE53	
CO1	Describe the fundamental of heat and mass transfer.
CO2	Familiarize the student in the area of conduction, convection and radiation.
CO3	Analyze the problems due to heat transfer in several areas.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Aircraft Structures - I – 17AE54	
CO1	Apply the basic concepts of stress and strain analysis.
CO2	Compute the impact stress.
CO3	Identify appropriate materials for suitable application based on properties

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Gas Dynamics– 17AE552	
CO1	Apply the equations of steady flow.
CO2	Explain the isentropic flow, adiabatic flow and wave phenomena.
CO3	Describe the flames and combustion

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: BASICS OF ROCKETS & MISSILES– 17AE564	
CO1	Identify the types of space launch vehicles and missiles
CO2	Distinguish the solid and liquid propellant motors
CO3	Classify different types of materials used for rockets and missiles

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Aerodynamics Lab– 17AEL57	
CO1	Apply the flow visualization techniques.
CO2	Estimate the pressure distribution over the bodies.
CO3	Calculate the lift and drag

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: Energy Conversion And Fluid Mechanics Lab– 17AEL58	
CO1	Operate the instrument and measure the BP, FP, IP and AF ratio.
CO2	Find the efficiency of the engine and Estimate the calorific value of the given fuel
CO3	Verify the Bernoulli's equation
CO4	Evaluate the viscosity of fluid

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Aerodynamics - II– 17AE61	
CO1	Utilize the concepts of compressible flow and shock phenomenon
CO2	Apply knowledge of oblique shock and expansion wave formation.
CO3	Measure the parameters high speed flow.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Gas Turbine Technology– 17AE62	
CO1	Select the suitable materials for engine manufacturing.
CO2	Evaluate the performance of the engine.
CO3	Test the engine using several types of engine testing methods

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Aircraft Performance -17AE63	
CO1	Apply the basic airplane performance parameters.
CO2	Differentiate the aircraft performance in steady unaccelerated and accelerated flight.
CO3	Explain the aircraft maneuver performance

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Aircraft Structures - II– 17AE64	
CO1	Utilize the concepts of thin walled beams.
CO2	Calculate the buckling of plates.
CO3	Analysis the stress in wings and fuselage frames

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Finite Element Method– 17AE651	
CO1	Apply discretisation technique for domain decomposition.
CO2	Evaluate the effects of different loading and boundary conditions
CO3	Analyze the governing equations of finite element analysis

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Space Mechanics – 17AE653	
CO1	Apply the basic concepts of space mechanics and the general N-body.
CO2	Explain satellite injection and satellite orbit perturbations.
CO3	Distinguish between interplanetary and ballistic missile trajectories.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Unmanned Aerial Vehicles Basics & Applications– 17AE661	
CO1	Apply the basic concepts of UAV systems.
CO2	Explain the basic aerodynamics, performance, stability and control required for UAV.
CO3	Select the propulsion system and materials for structures.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Maintenance, Overhaul &Repair Of Aircraft Systems– 17AE664	
CO1	Maintain the aircraft maintenance manual and logbook.
CO2	Do the quality control and calibration.
CO3	Incorporate the safety regulations and rules

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Aircraft Propulsion Lab– 17AEL67	
CO1	Analyze the cascade testing of axial compressor and axial turbine blade row.
CO2	Evaluate the performance of a jet engine.
CO3	Perform the measurement of a flame and nozzle flow

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Aircraft Structures Lab – 17AEL68	
CO1	Compute the deflection of simply supported beam and cantilever beam.
CO2	Verify the Maxwell's theorem.
CO3	Determine the buckling load, shear failure and shear centre

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Control Engineering– 15AE71	
CO1	Apply the concepts of control systems.
CO2	Reduce the block diagrams and signal flow graphs
CO3	Determine the frequency response analysis by using various types of plots

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Computational Fluid Dynamics – 15AE72	
CO1	Differentiate the FDM, FVM and FEM
CO2	Perform the flow, structural and thermal analysis.
CO3	Utilize the discretization methods according to the application

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Aircraft Stability And Control – 15AE73	
CO1	Apply the basic concepts of aircraft stability and control.
CO2	Differentiate the static longitudinal and static directional stability.
CO3	Estimate the dynamic derivatives

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Helicopter Dynamics– 15AE743	
CO1	Apply the basic concepts of helicopter dynamics.
CO2	Compute the critical speed by using various methods.
CO3	Distinguish the turbo rotor system stability by using transfer matrix and finite element formulation

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Wind Tunnel Techniques– 15AE752	
CO1	Apply the principles and procedures for model testing in the wind tunnel.
CO2	Classify the types and functions of wind tunnel.
CO3	Distinguish the conventional measurement techniques and special wind tunnel techniques

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Flight Simulation Lab– 15AEL76	
CO1	Apply the dynamics of aerospace vehicles for mathematically modelling.
CO2	Calculate the dynamics response of aircraft.
CO3	Use computational tools to model aircraft

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: Modeling & Analysis Lab – 15AEL77	
CO1	Draw the geometric models of symmetric, cambered aerofoil, nozzle, wing and other structures.
CO2	Apply different types of meshing.
CO3	Perform the flow and stress analysis

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: Avionics Systems– 15AE81	
CO1	Select the suitable data bus based on the application.
CO2	Identify the suitable navigation systems.
CO3	Distinguish the avionics system architecture

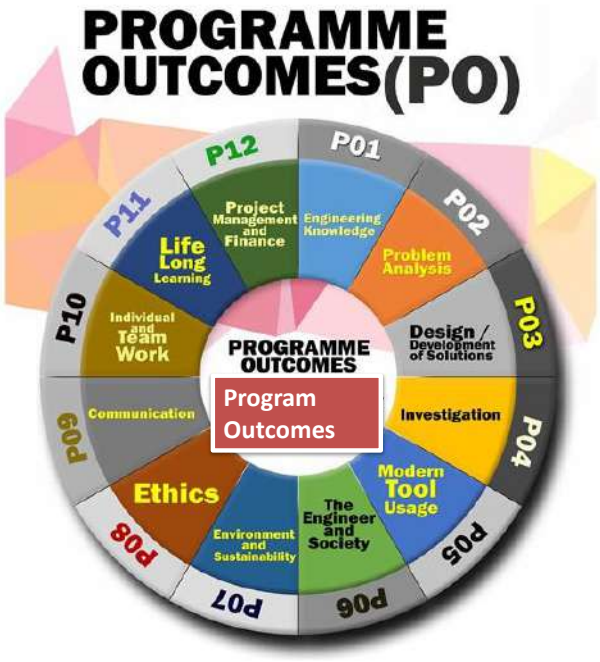
Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: Flight Vehicle Design – 15AE82	
CO1	Calculate the thrust to weight ratio and wing loading.
CO2	Compute the flight vehicle performance.
CO3	Select the subsystems as per vehicle design

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: Flight Testing – 15AE831	
CO1	Measure The Flight Parameters.
CO2	Estimate The Performance Of Flight.
CO3	Apply The FAR Regulations

Department of Aerospace Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes

Program Outcomes:



PO1 - Engineering Knowledge: Apply knowledge of mathematics and science, with fundamentals of Aerospace Engineering and able to solve complex engineering problems related to Aerospace Engineering.

PO2 - Problem Analysis: Identify, Formulate, review research literature and analyze complex engineering problems related to Aerospace Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex problems related to Aerospace Engineering 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

PO4 - Conduct Investigations of Complex problems: Use research–based knowledge and research methods including design of space vehicle structure experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern Tool Usage: Create, Select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to Aerospace Engineering related complex engineering activities with an understanding of the limitations.

PO6 - 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 Aerospace professional engineering practice.

PO7 - Environment and Sustainability: Understand the impact of the Aerospace professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development

PO8 - Ethics: Apply Ethical Principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary Settings.

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with High society and with write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11 - Project Management and Finance: Demonstrate knowledge and understanding of the engineering 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.

PO12 - Life-Long Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning the broadest content of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO-1: **Professional Knowledge**	Apply the knowledge of aerospace engineering in innovative, dynamic and challenging environment for design and development of flight or space vehicles through simulation, Programming skills and general purpose CAE packages.
PSO-2: **Leadership Skills**	Providing different types of in house training and industry practice to fabricate, test and develop the products with more innovative technologies.
PSO-3: **Attitude Development**	To prepare students to become technocrats with broad aerospace knowledge for design and development of systems and subsystems for aerospace and associated fields.

Course Outcomes:

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: Engineering Mathematics - III– 18MAT31	
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 behavior 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.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: AERO-THERMODYNAMICS– 18AS32	
CO1	Apply the concepts and definitions of thermodynamics.
CO2	Differentiate thermodynamic work and heat and apply I law and II law of thermodynamics to different process.
CO3	Apply the principles of various gas cycles.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Mechanics of Materials– 18AS33	
CO1	Apply the basic concepts of strength of materials.
CO2	Compute stress, strain under different loading.
CO3	Distinguish the different failure theories.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: INTRODUCTION TO AEROSPACE ENGINEERING– 18AS34	
CO1	Apply the basic knowledge & principles of aviation & spaceflight.
CO2	Apply the concepts of fundaments of flight, basics of aircraft structures, aircraft & rocket propulsion and aircraft materials during the development of an aircraft
CO3	Appreciate the complexities involved during development of flight vehicles.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Mechanics of Fluid– 18AS35	
CO1	Evaluate the effect of fluid properties.
CO2	Apply the governing laws of fluid flow.
CO3	Classify different types of fluid flows.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: AEROSPACE MATERIALS– 18AS36	

CO1	Apply the knowledge about the mechanical behaviour of different aircraft & aerospace materials.
CO2	Explain the applications of Aluminium alloys, Ceramics and Composites Materials.
CO3	Evaluate the importance of high temperature materials and their characterization.

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: MATERIAL TESTING LAB– 18ASL38	
CO1	Apply the relations among materials properties.
CO2	Differentiate the formation, properties and significance of the alloys through different Experiments.
CO3	Differentiate the types, advantages and applications of various NDT methods

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: MEASUREMENTS AND METROLOGY LAB– 18ASL37	
CO1	Identify and classify different measuring tools related to experiments.
CO2	Identify, define, and explain accuracy, precision, and some additional terminology.
CO3	Conduct, Analyze, interpret, and present measurement data from measurements experiments.

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: ENGINEERING MATHEMATICS - IV– 18MAT41	
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.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Aerodynamics-I– 18AS42	
CO1	Evaluate typical airfoil characteristics and two-dimensional flows over airfoil
CO2	Compute and analyse the in-compressible flow over finite wings
CO3	Apply finite wing theory and design high lift systems from the aerodynamics view point

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: AEROSPACE STRUCTURES – I– 18AS43	
CO1	Apply the basic concepts of stress and strain analysis.
CO2	Compute the impact stress.
CO3	Identify appropriate materials for suitable application based on properties.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Mechanisms and Machine Theory – 18AS44	
CO1	Apply the theory of velocity, acceleration and static force analysis to design of mechanisms.
CO2	Design spur gears, gear train, balancing of rotating and reciprocating masses
CO3	Apply governors and gyroscope

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Introduction to Space Technology– 18AS45	
CO1	Distinguish the types of aerospace propulsion
CO2	Determine the attitude of the satellites.
CO3	Support the space mission operations.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: COMPOSITE MATERIALS – 18AS46	
CO1	Explain the advantages of using composite materials as an alternative to conventional materials for specific applications.
CO2	Describe the advanced fabrication and processing for producing composite parts.
CO3	Evaluate the micro- and macro-mechanical behavior of composite laminates.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: ENERGY CONVERSION AND FLUID MECHANICS LAB– 18ASL47	
CO1	Operate the instrument and measure the BP, FP, IP and AF ratio.
CO2	Find the efficiency of the engine and Estimate the calorific value of the given fuel.
CO3	Verify the Bernoulli's equation.
CO4	Evaluate the viscosity of fluid.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Computer Aided Aircraft Drawing Lab– 18ASL48	
CO1	Distinguish drawings of machine and aircraft components
CO2	Identify assembly drawings either manually or by using standard CAD packages
CO3	Practice with standard components and their assembly of an aircraft

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: AEROSPACE STRUCTURES - II– 17AS51	
CO1	Compute the shear flow in open and closed section
CO2	Analyze the stability problems of thin walled structures.
CO3	Distinguish the mini and micro structures.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: AEROSPACE PROPULSION– 17AS52	
CO1	Analyze the engineering concepts of air breathing propulsion systems
CO2	Distinguish the different types of compressors.
CO3	Choose the propellant based on the application.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: AERODYNAMICS - II– 17AS53	
CO1	Utilize the concepts of compressible flow and shock phenomenon
CO2	Apply knowledge of oblique shock and expansion wave formation.
CO3	Measure the parameters high speed flow.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: INTRODUCTION TO SPACE TECHNOLOGY-17AS54	
CO1	Distinguish the types of aerospace propulsion
CO2	Determine the attitude of the satellites.
CO3	Support the space mission operations.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: INTRODUCTION TOASTROPHYSICS AND SPACEENVIRONMENT– 17AS563	
CO1	Evaluate the Black body radiation, specific intensity, flux density. etc.
CO2	Apply the relativistic quantum mechanics.
CO3	Identify and sun and the solar system.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: AIRCRAFT ELECTRICAL SYSTEMS &INSTRUMENTATION– 17AS554	
CO1	Distinguish the conventional and modern control systems
CO2	Classify the aircraft systems
CO3	Categorize different types of aircraft instruments.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: AERODYNAMICS LAB– 17ASL57	
CO1	Apply the flow visualization techniques.
CO2	Estimate the pressure distribution over the bodies.
CO3	. Calculate the lift and drag.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: PROPULSION LAB– 17ASL58	
CO1	Analyze the performance of jet engine.
CO2	Evaluate the performance of a propellant.
CO3	Differentiate among different equipments required for study of propulsion.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: FINITE ELEMENT METHOD– 17AS61	
CO1	Apply discretisation technique for domain decomposition.
CO2	Evaluate the effects of different loading and boundary conditions
CO3	Analyze the governing equations of finite element analysis

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: SPACE MECHANICS-17AS62	
CO1	Apply the basic concepts of space mechanics and the general N- body.
CO2	Explain satellite injection and satellite orbit perturbations.
CO3	Distinguish between interplanetary and ballistic missile trajectories

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: CONTROL ENGINEERING– 17AS63	
CO1	Apply the concepts of open loop, closed loop systems and types of controllers.
CO2	Develop signal flow diagram from the Blocks and signal flow graphs
CO3	Interpret the Bode plot, Nyquist plot, polar plot and Root locus method

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: MISSILES AND LAUNCH VEHICLES– 17AS64	
CO1	Identify the types of space launch vehicles and missiles.
CO2	Distinguish the solid and liquid propellant motors.
CO3	Classify different types of materials used for rockets and missies

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: Unmanned Aerial Vehicles Basics & Applications– 17AS661	
CO1	Apply the basic concepts of UAV systems.
CO2	Explain the basic aerodynamics, performance, stability and control required for UAV.
CO3	Select the propulsion system and materials for structures.

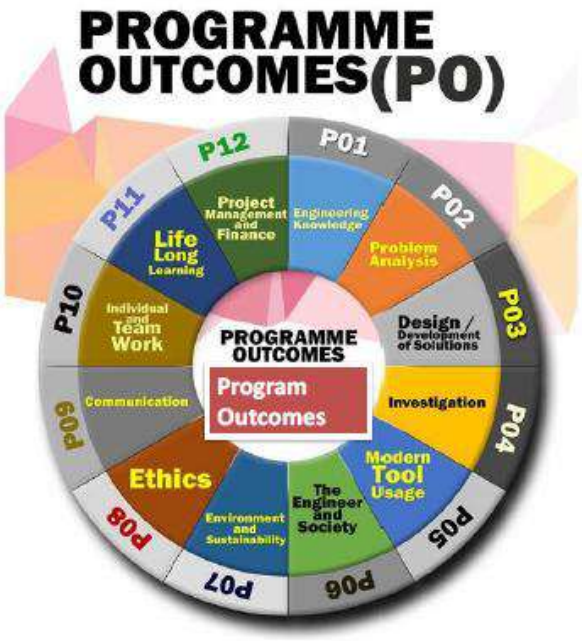
Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: SATELLITE COMMUNICATION– 17AS654	
CO1	Apply of concepts of orbital mechanics.
CO2	Classify the modulation and Multiplexing Schemes.
CO3	Identify the applications of satellites

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: DESIGN, MODELLING & ANALYSIS LAB– 17ASL67	
CO1	Draw the geometric models of symmetric, cambered aerofoil, nozzle, wing and other structures.
CO2	Apply different types of meshing.
CO3	Perform the flow and stress analysis

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: STRUCTURES AND VIBRATION LAB– 17ASL68	
CO1	Use different equipments to study deflection and vibration
CO2	Utilize the equipments to measure deflections and vibration of structures.
CO3	Determine the vibration characteristics

Department of Biomedical Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes



Program Outcomes:

PO1 - Engineering Knowledge: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - 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.

PO3 - 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.

PO4. 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.

PO5 - 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.

PO6- 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.

PO7- 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.

PO8- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9- Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10-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.

PO11- 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.

PO12-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 (PSOs):

Engineering Graduates will be able to:

PSO-1:	An ability to apply mathematical knowledge to design, develop, and analyze Bio-medical problems and applications
PSO-2:	Impart basic and advanced Bio-medical knowledge needed for the student relevant to excel as Bio-medical engineer

Course Outcomes:

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Electronic Instrumentation – 18BM32	
CO1	Analyze instrument characteristics, errors and generalized measurement system.
CO2	Analyze and use the circuit for the measurement of R, L, C, F, I, V etc
CO3	Use of Ammeters, Voltmeter and Multimeters and CRO for measurement
CO4	Analyze and interpret different signal generator circuits for the generation of various waveforms
CO5	Understand and use different display devices and recorders

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Analog Electronics Circuits – 18BM33	
CO1	Explain the biasing of BJT and FET
CO2	Model BJT/FET for ac/dc analysis
CO3	Design Single stage, Multistage amplifier, with and without feedback
CO4	Analyze Frequency response of BJT and FET.
CO5	Acquire the knowledge of classifications of Power amplifier, operation, and able to design power amplifier
CO6	Apply the knowledge gained in designing of BJT/FET/UJT based Oscillators.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Digital Design and HDL– 18BM34	
CO1	Simplify Boolean functions using K-map and Quine-McCluskey minimization technique
CO2	Analyze, design and write verilog code for combinational logic circuits. (MUX, De-MUX, adderandsubtractor, and comparator circuits)
CO3	Analyze the concepts of Latches and Flip Flops. (SR, D, T and JK).
CO4	Analyze and design of synchronous sequential circuits
CO5	Implement Combinational circuits (adders, subtractors, multiplexers) using Verilog descriptions

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name:Human Anatomy and Physiology– 18BM35	
CO1	Describe internal environment of human body and explain the fundamental concept of Homeostasis
CO2	Explain the structure and functioning of various types of tissues.
CO3	Describe the structure and explain the functioning of various nervous system, cardiovascular system, respiratory system, digestive system and musculoskeletal system
CO4	Demonstrate and analyze various physiological parameters in normal and abnormal conditions

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Network Analysis– 18BM36	
CO1	Apply the basic concepts (Laws, theorems) of networks to obtain solution.
CO2	Choose the Appropriate/specific technique to analyze the networks.
CO3	Realize and Analyze the network behavior

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Analog Electronics Lab– 18BML37	
CO1	Able to design Single stage, Multistage amplifier, with and without feedback
CO2	Able to analyze Frequency response of BJT and FET
CO3	Acquire the knowledge of Power amplifiers, operation, and able to design power amplifier
CO4	Apply the knowledge gained in the design of BJT/FET circuits in Oscillators
CO5	Knowledge of UJT characteristics and its application
CO6	Applications of theorems in various practical fields.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: Digital Design and HDL Lab– 18BML38	
CO1	Realize Boolean expression using Universal gates / basic gates using ICs and Verilog
CO2	Demonstrate the function of adder/subtractor circuits using gates/ICs & Verilog.
CO3	Design and analyze the Comparator, Multiplexers Decoders, Encoders circuits using ICs and verilog
CO4	Design and analysis of different Flip-flops and counters using gates and FFs
CO5	Able to use FPGA/CPLD kits for down loading Verilog codes for shift registers and counters andcheck output

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: SC &DAC– 18BM42	
CO1	Understand the basic principles and operation of op-amp.
CO2	Design and develop circuits to meet the practical applications
CO3	Implement and integrate the op-amp circuits in electronic gadgets

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Embedded Microcontrollers– 18BM43	
CO1	Learn architecture of 8051 and MSP 430.
CO2	Learn programming skills using Assembly language and C
CO3	Design and interfacing of microcontroller based embedded systems.
CO4	Build projects

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name:Control system– 18BM44	
CO1	Apply modeling knowledge in implementation physical systems.
CO2	Understand the reduction of block diagram &analyze using Signal flow graph.
CO3	Comment on performance of a system by evaluating various parameters.
CO4	Model a system by applying the concept of State Space analysis

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Biomedical Transducers & Measurements– 18BM45	
CO1	Understand the working principle and construction details of Transducers.
CO2	Improve the measurement techniques through different approach.
CO3	Practically can implement the technology in measurement field.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: Scientific Analytical Insrumentation– 18BM46	
CO1	The students get well versed with the principle, construction and working of various analytical Instrumentation
CO2	Students get detailed information about the application of analytical techniques in medicine,industry etc.

Year / SEM : 2nd year / 4th sem	Year of Study :2019-20
Course Name: Embedded Controllers Lab– 18BML47	
CO1	Get hands-on exposure in 8051 and MSB 430 platform
CO2	Enhance programming skills using Assembly language and C.
CO3	Design and interfacing of microcontroller based embedded systems.
CO4	Build projects

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name:Biomedical Transducers & Measurements Lab– 18BML48	
CO1	Analyze the response and plot the characteristics of temperature measurement transducers such as RTD, Thermistor, and Thermocouple & AD590.
CO2	Analyze the response and plot the characteristics of displacement measuring transducers such as LVDT and Potentiometric transducer.
CO3	Analyze the response and plot the characteristics of strain gauge type load cell

CO4	Analyze the response and plot the characteristics of pressure transducer
CO5	Measure unknown values of resistance, capacitance and Inductance using different bridges
CO6	Design , build and test the circuits for practical applications using transducers
CO7	Measure BP, solution concentration, pH and conductivity for different biomedical applications.

Year / SEM : 3rd year / 5thsem	**Year of Study : 2019-20**
Course Name: Management And Entrepreneurship– 17ES51	
CO1	Learn and explain basic is management and acquire basic managerial skills.
CO2	Analyze the nature, purpose & objectives of Planning, Organizing & Staffing.
CO3	Develop the factual leadership qualities for development of organizations
CO4	Learn and build the qualities and characteristics of business ethics and entrepreneurs.
CO5	Describe the importance of small scale industries in economic development and institutional support to start a small scale industry and implement.
CO6	Demonstrate the project management, product planning, project design and network analysis.

Year / SEM : 3rd year / 5thsem	**Year of Study : 2019-20**
Course Name: Fundamentals Signals &DSP– 17BM52	
CO1	Visualize, Classify and perform computation on discrete time signals, systems and properties
CO2	Perform the transformation techniques from time domain to other and vice versa, and analyze the system and properties (Z-Transform, DFT etc.)
CO3	Realize / implement the Direct/ cascade/ parallel/ lattice forms of the given digital system (IIR/ FIR)
CO4	Compute DFT by FFT algorithms
CO5	Develop transformation from analog system to digital system and design and implement IIR and FIR filters
CO6	Demonstrate the advanced concepts of signal processing (Multirate and Adaptive filtering) and architecture of DSP processor

Year / SEM : 3rd year / 5thsem	Year of Study : 2019-20
Course Name: Clinical Instrumentation-1– 17BM53	
CO1	Analyze and interpret the types of heart abnormalities.
CO2	Describe the constructional details of equipment's used in cardiology.
CO3	Explain the basic principles of ophthalmology instruments.
CO4	Discuss the clinical methods and surgical procedures in ophthalmology.
CO5	Use few of the ophthalmological instruments for diagnostic purpose.

Year / SEM : 3rd year / 5thsem	Year of Study : 2019-20
Course Name: Biomedical Equipment's– 17BM54	
CO1	Define and analyze the ECG, EEG and BP signals.
CO2	Discuss the factors to be considered in the measurements of respiratory and audiometric signals.
CO3	Describe the principle and working of cardiac pacemakers, defibrillators and surgical devices.
CO4	Describe the principle and working of therapeutic instruments like Dialysis, heart-lung, ventilator, lithotripter and incubators.
CO5	Interpret the concepts involved with the measurement of man and instruments.
CO6	Discuss the physiological effects from electric shocks and maintenance of medical equipment's as per standard.

Year / SEM : 3rd year / 5thsem	Year of Study : 2019-20
Course Name: Rehabilitation Engineering– 17BM552	
CO1	Define rehabilitation and explain the composition of rehabilitation team.
CO2	Discuss the engineering principles of rehabilitation engineering.
CO3	Apply engineering skills in the development of prosthetic and orthotic devices.
CO4	Evaluate the orthopaedic design and applications. Approved
CO5	Apply the principles of engineering in the development of mobility aids for physically handicap

Year / SEM : 3rd year / 5thsem	Year of Study : 2019-20
Course Name: Virtual Bioinstrumentation– 17BM562	
CO1	Describe the Graphical System Design approach & basic features and techniques of LabVIEW.
CO2	Use the Modular Programming concepts for creation of VIs & employ DAQ assistant for configuration of hardware devices.
CO3	Discuss the basic concepts of DAQ Systems, LabVIEW , and BioBench software.
CO4	Describe the LabVIEW and BioBench software for EMG, ECG, and Cardiopulmonary system analysis.
CO5	Discuss the Medical Device Development Applications for Surgical Video Systems and IV Pumps.
CO6	Explain the Healthcare Information Management Systems using Information Science and Technology

Year / SEM : 3rd year / 5thsem	Year of Study : 2019-20
Course Name: Signal Conditioning Circuits and Data Acquisition Lab– 17BML57	
CO1	Sketch/draw circuit schematics, construct circuits on breadboards, analyze and troubleshoot circuits containing Op-amps, resistors, diodes, capacitors and independent sources.
CO2	Memorize and reproduce the manufacturer's data sheets of IC 555 timer, IC µa741 op-amp and data converters like IC ADC 0800 and IC DAC 0809.
CO3	Design and evaluate analog integrated circuits like Amplifiers, Oscillators, Active filters, Precision Rectifiers and Voltage level detectors, and compare the experimental results with theoretical values.
CO4	Demonstrate and analyze the working of Sample-Hold, Programmable gain amplifier and Analog Multiplexer circuits in data acquisition system.
CO5	Design and evaluate different resolution data converters using discrete components and ICs.

Year / SEM : 3rd year / 5thsem	Year of Study : 2019-20
Course Name: Clinical Instrumentation Lab– 17BML58	
CO1	Measure the Op-amp parameters and design the circuits using opamp for various applications.
CO2	Design and verify the different bio amplifiers & filters.
CO3	Acquire and analyze the ECG, EEG and respiratory signals
CO4	Analyze the visual ability and audibility using appropriate instruments.
CO5	Demonstrate the working of different diagnostic and therapeutic hospital equipment‟s.
CO6	Install and operate different types of hospital instruments.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: Analog and digital Communication– 17BM61	
CO1	Explain the basics concepts of analog modulation techniques.
CO2	Discuss the basic concepts of digital modulation techniques.
CO3	Describe the basic concepts of digital data and pulse communication.
CO4	Explain and analyze different digital modulation techniques.
CO5	Describe different wireless area networks and their applications

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: Medical Image Processing– 17BM62	
CO1	Define the general terminology of digital image processing.
CO2	Identify the need for image transforms and their types both in spatial and frequency domain.
CO3	Identify different types of image degradation and apply restoration techniques.
CO4	Describe image compression models and learn image compression techniques.
CO5	Explain and apply various methodologies for image segmentation
CO6	Implement image processing and analysis algorithms

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: (OOPS with C++)-17BM63	
CO1	Explain the basic concepts of OOPS.
CO2	Apply the concept of OOPS to realize the existing algorithms.
CO3	Analyse the given program for debugging to obtain correct output
CO4	Create suitable application programs to solve real world problems

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: Clinical Instrumentation-II-17BM64	
CO1	Analyze the principles of clinical examinations in Neurology.
CO2	Explain the constructional details of Anaesthetic machine and Anaesthetic room.
CO3	Discuss electronic control of anaesthetic gases and vapours with servo control.
CO4	Describe the non-invasive gas monitoring techniques.
CO5	Evaluate the type of fracture and its treatment in Orthopedics.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: Biosensors and Smart Sensors -17BM651	
CO1	Describe the basics of biosensors used in biomedical engineering and their fabrication techniques.
CO2	Discuss the working principles enzyme sensors, enzyme electrodes and applications of biosensors in healthcare.
CO3	Discuss the basic concepts of smart sensors and principles of micromachining techniques.
CO4	Design the smart sensors with different controls, interfacing circuits and software tools.
CO5	Develop the smart sensor technology for automation and networking.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: Embedded System Design and Programming -17BM663	
CO1	Explain different embedded systems and their design metrics.
CO2	Discuss the 8051 microcontroller architecture and instruction set

CO3	Write ALP for implementation of mathematical and logical operations.
CO4	Illustrate accessing I/O devices, direct memory access, buses, and interface circuits.
CO5	Evaluate interrupt latency, context switching and different interrupt handling mechanisms.
CO6	Design an embedded system based on real-time specifications.

Year / SEM : 3rd year / 6thsem	**Year of Study:2019-20**
Course Name: MIP Lab -17BML68	
CO1	Implement and analyze image enhancement techniques.
CO2	Implement and analyze Image segmentation and image compression techniques.
CO3	Develop and analyze Image processing algorithms in practical applications/case studies

Year / SEM : 3rd year / 6thsem	**Year of Study:2019-20**
Course Name:OOPS with C++ Lab -17BML68	
CO1	Write C++ program to solve simple and complex problems
CO2	Apply and implement major object oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems
CO3	Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set.
CO4	Analyze, design and develop solutions to real-world problems applying OOP concepts of C++

Year / SEM : 3rd year / 7thsem	Year of Study : 2019-20
Course Name: Biomedical Digital Signal Processing -15BM71	
CO1	Analyze the nature of Biomedical signals and related concepts
CO2	Apply filters to remove noise from biomedical signals.
CO3	Apply averaging technique on biomedical signals and extract the features of EEG signals.
CO4	Analyze event detection techniques for EEG and ECG signals.
CO5	Apply signal compression techniques on biomedical signals.

Year / SEM : 4th year / 7thsem	Year of Study : 2019-20
Course Name: computer communication Networks in healthcare – 15BM72	
CO1	Explain the different formats of data generated in clinical field or Medical field.
CO2	Discriminate the functionality between the layers in OSI model and TCP/IP suite.
CO3	Discuss the concept of physical and data link layer.
CO4	Distinguish the IEEE standards designed to understand the interconnectivity between different LANs.
CO5	Apply different algorithms to route a packet to the destination for process to process delivery.
CO6	Discuss the concepts of Bluetooth technology, and transport & application layer.

Year / SEM : 4th year / 7thsem	Year of Study : 2019-20
Course Name: ARM Processor– 15BM73	
CO1	Depict the organization, architecture, bus technology, memory and operation of the ARM microprocessors
CO2	Employ the knowledge of Instruction set of ARM processors to develop basic Assembly Language Programs
CO3	Recognize the importance of the Thumb mode of operation of ARM processors and develop C programs for ARM processors
CO4	Describe the techniques involved in Exception and Interrupt handling in ARM Processors and understand the fundamental concepts of Embedded Operating Systems
CO5	Develop embedded C programs to interact with Built in Peripherals
CO6	Design, analyze and write programs using RTOS (Micro C/OS) on ARM based development boards.

Year / SEM : 4th year / 7thsem	Year of Study : 2019-20
Course Name: Biometric systems – 15BM744	
CO1	Explain the general principles of designing biometric-based systems.
CO2	Analyze various biometric systems, their characteristics and performance.
CO3	Discuss the online identification biometric techniques.
CO4	Recognize some of the personal privacy and security implications of biometrics based identification technology.
CO5	Analyze the privacy and security issues of biometrics.

Year / SEM : 4th year / 7thsem	Year of Study : 2019-20
Course Name: Lasers & Optical fibers in medicine – 15BM752	
CO1	Explain the basics and principles of LASERS in Medicine.
CO2	Discuss the fundamentals and properties of optical fibers for UV, IR, power transmission and advancement.
CO3	Describe the working of optical fibre bundles for imaging devices applying the light guided fundamentals & principles.
CO4	Explain and demonstrate the working of endoscopic therapy, diagnostic & imaging principles.
CO5	Outline the clinical applications of fiber optic Lasers systems.

Year / SEM : 4th year / 7thsem	Year of Study : 2019-20
Course Name:Biomedical DSP Lab –15BML76	
CO1	1. Apply the signal processing techniques on biomedical signals and evaluate their performance.
CO2	2. Develop/Write signal processing algorithms for the analysis of biomedical signals
Year / SEM : 4th year / 7thsem	**Year of Study :2019-20**
Course Name:ARM Processor Lab –15BML77	
CO1	Write ALP for implementation of specific arithmetic or logical operations.
CO2	Write programs to demonstrate functioning of various devices interfaced to ARM processor.
CO3	Develop programs for ARM processors to implement real world problems.
CO4	Design and develop mini projects.

Year / SEM : 4th year / 7thsem	Year of Study : 2019-20
Course Name:Project Work Phase- I + Project Work Seminar –15BMP78	
CO1	Collect the literature and materials in the proposed project work
CO2	Analyze the current state of art work in the proposed project work
CO3	Prepare synopsis with objectives and methodology
CO4	Justify the proposed project and its probable outcome in the seminar presentation.
CO5	Communicate the concepts by effective presentation 6. Participate effectively as an individual and member of project team.

Year / SEM : 4th year / 8thsem	Year of Study : 2019-20
Course Name: Medical Imaging system – 15BM81	
CO1	Describe the fundamentals of x-ray radiography and computed tomography, and analyze the system requirements.
CO2	Explain principles of ultrasound imaging and diagnostic methods and analyze the system requirements.
CO3	Discuss the fundamentals of radionuclide imaging, MRI, thermal imaging and analyze the system requirements.
CO4	Describe the concepts of image Guided Intervention and image guided surgery.
CO5	Design and develop prototype of simple medical imaging system.

Year / SEM : 4th year / 8thsem	Year of Study : 2019-20
Course Name: Biomaterials and artificial organs– 15BM82	
CO1	Explain the principle and biology underlying the design of implants and artificial organs.
CO2	Differentiate classes of materials used in medicine.
CO3	Discuss the application of biomaterials in medicine.
CO4	Discuss concept of biocompatibility and the methods of biomaterial testing.
CO5	Discuss the design process in some of the prominent artificial organs.

Year / SEM : 4th year / 8thsem	Year of Study : 2019-20
Course Name: Flight Testing– 15BM831	
CO1	Discuss MEMS with current and potential markets for types of Microsystems.
CO2	Identify the suitable material to develop a microsystem.
CO3	Explain the principles of emerging Bio-MEMS technology.
CO4	Apply the principles of microsensors and microactuators to design microsystem.

Year / SEM : 4th year / 8thsem	Year of Study : 2019-20
Course Name: Internship– 15BM84	
CO1	Acquire practical experience within industry in which the internship is done.
CO2	Apply knowledge and skills learned to classroom work.
CO3	Experience the activities and functions of professionals.
CO4	Develop and refine oral and written communication skills.
CO5	Recognize the areas for future knowledge and skill development.

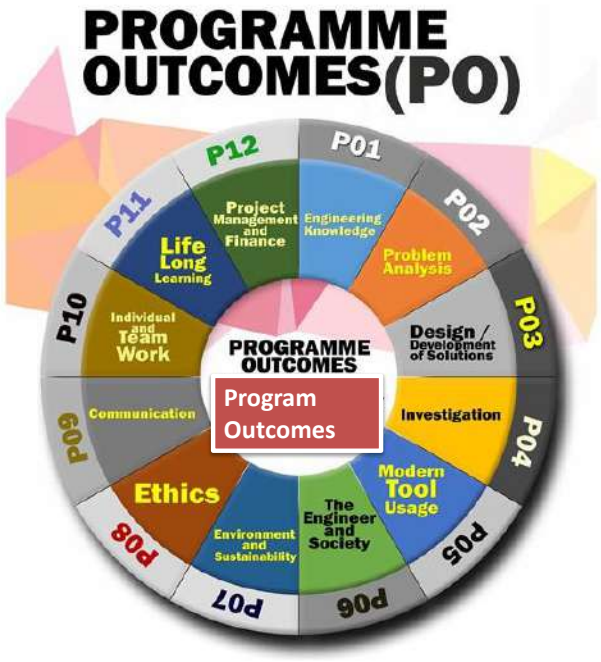
Year / SEM : 4th year / 8thsem	Year of Study : 2019-20
Course Name: Technical Seminar– 15BMS86	
CO1	Develop knowledge in the field of Biomedical Engineering and other disciplines through independent learning and collaborative study.
CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology.
CO3	Develop written and oral communication skills.
CO4	Explore concepts in larger diverse social and academic contexts.
CO5	Apply principles of ethics and respect in interaction with others.
CO6	Develop the skills to enable life-long learning.

Year / SEM : 4th year / 8thsem	Year of Study : 2019-20
Course Name: Project – 15BMP85	
CO1	Describe the project and be able to defend it.
CO2	Develop critical thinking and problem solving skills.
CO3	Learn to use modern tools and techniques.
CO4	Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
CO5	Develop skills to work in a team to achieve common goal.
CO6	Develop skills of project management and finance.
CO7	Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
CO8	Prepare themselves for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Department of Civil Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes

Program Outcomes:



Program Outcomes (POs)
At the end of the B.E program, students are expected to have developed the following outcomes.
1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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.
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.
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.
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.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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 (PSOs)
At the end of the B.E Civil Engineering program, the students are expected to have developed the following program specific outcomes.
PSO1 The graduates will have the ability to plan, analyze, design, execute and maintain cost effective civil engineering structures without overexploitation of natural resources.
PSO2 The graduates of civil engineering program will have the ability to take up employment, entrepreneurship, research and development for sustainable civil society.
PSO3 The graduates will be able to pursue opportunities for personal and professional growth, higher studies, demonstrate leadership skills and engage in lifelong learning by active participation in the civil engineering profession.
PSO4 The graduates will be able to demonstrate professional integrity and an appreciation of ethical, environmental, regulatory and issues related to civil engineering projects.

Course outcomes (COs)

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: STRENGTH OF MATERIALS – 18CV32	
CO1	To evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements
CO2	To evaluate the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements
CO3	To analyse different internal forces and stresses induced due to representative loads on structural elements
CO4	To evaluate slope and deflections of beams
CO5	To evaluate the behaviour of torsion members, columns and struts

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: – FLUIDS MECHANICS - 18CV33	
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

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: – BUILDING MATERIALS AND CONSTRUCTION – 18CV34	
CO1	Select suitable materials for buildings and adopt suitable construction techniques
CO2	Decide suitable type of foundation based on soil parameters
CO3	Supervise the construction of different building elements based on suitability
CO4	Exhibit the knowledge of building finishes and form work requirements

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: BASIC SURVEYING – 18CV35	
CO1	Posses a sound knowledge of fundamental principles Geodetics
CO2	Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems
CO3	Capture geodetic data to process and perform analysis for survey problems
CO4	Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: ENGINEERING GEOLOGY – 18CV36	
CO1	Apply geological knowledge in different civil engineering practice
CO2	Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials
CO3	Civil Engineers are competent enough for the safety, stability, economy and life of the structures that they construct
CO4	Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems
CO5	Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering construction

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: COMPUTER AIDED BUILDING PLANNING AND DRAWING LABORATORY – 18CVL37	
CO1	Prepare, read and interpret the drawings in a professional set up
CO2	Know the procedures of submission of drawings and Develop working and submission drawings for building
CO3	Plan and design a residential or public building as per the given requirements

Year / SEM: 2nd year / 3rd sem	Year of Study: 2019-20
Course Name: BUILDING MATERIALS TESTING LABORATORY– 18CVL38	
CO1	Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion
CO2	Identify, formulate and solve engineering problems of structural elements subjected to flexure
CO3	Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials

Year / SEM: 3rd year / 5th sem	Year of Study: 2019-20
Course Name: 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

Year / SEM: 3rd year / 5th sem	Year of Study: 2019-20
Course Name: Analysis of Indeterminate Structures – 17CV52	
CO1	Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection 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.
Year / SEM: 3rd year / 5th sem	**Year of Study: 2019-20**
Course Name: 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

Year / SEM: 3rd year / 5th sem	**Year of Study: 2019-20**
Course Name: 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

Year / SEM: 3rd year / 5th sem	**Year of Study: 2019-20**
Course Name: 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.

Year / SEM: 3rd year / 5th sem	**Year of Study: 2019-20**
Course Name: 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

Year / SEM: 3rd year / 5th sem	**Year of Study: 2019-20**
Course Name: 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)

Year / SEM: 3rd year / 5th sem	**Year of Study: 2019-20**
Course Name: 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.

Year / SEM: 3rd year / 7th sem	**Year of Study: 2019-20**
Course Name: Municipal and Industrial Waste Water Engineering – 15CV71	
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.

Year / SEM: 3rd year / 7th sem	Year of Study: 2019-20
Course Name: 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.

Year / SEM: 3rd year / 7th sem	Year of Study: 2019-20
Course Name: 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.

Year / SEM : 3rd year / 7th sem	Year of Study : 2018-19
Course Name: Ground Water & Hydraulics – 15CV742	
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.

Year / SEM: 3rd year / 7th sem	Year of Study: 2019-20
Course Name: Rehabilitation and Retrofitting of Structures – 15CV753	
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

Year / SEM: 3rd year / 7th sem	Year of Study: 2019-20
Course Name: 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

Year / SEM: 3rd year / 7th sem	Year of Study: 2019-20
Course Name: Computer Aided Detailing of Structures – 15CVL77	
CO1	Prepare detailed working drawings

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: Analysis of Determinate Structures – 18CV42	
CO1	Identify different forms of structural systems
CO2	Construct ILD and analyse the beams and trusses subjected to moving load
CO3	Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and beams
CO4	Determine the stress resultants in arches and cables

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: Applied Hydraulics - 18CV43	
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

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: Concrete Technology - 18CV44	
CO1	Relate material characteristics and their influence on microstructure of concrete.
CO2	Distinguish concrete behavior 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.
CO4	Adopt suitable concreting methods to place the concrete based on requirement
CO5	Select a suitable type of concrete based on specific application

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: ADVANCED SURVEYING - 18CV45	
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 instrument
CO4	Design and implement the different types of curves for deviating type of alignments

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: WATER SUPPLY AND TREATMENT ENGINEERING - 18CV46	
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

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: ENGINEERING GEOLOGY LABORATORY - 18CVL47	
CO1	The students able to identify the minerals, rocks and utilize them effectively in civil engineering practices
CO2	The students will interpret and understand the geological conditions of the area for 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 lineaments and other structural features for the given area
CO5	The students will be able to identify the different structures in the field

Year / SEM: 2nd year / 4th sem	Year of Study: 2019-20
Course Name: FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY - 18CVL48	
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

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: 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

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: Design of Steel Structural Elements – 17CV62	
CO1	Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behavior 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.

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: 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.

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: 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.

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: Solid Waste Management - 17CV651	
CO1	Analyze 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.

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: 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
CO4	Understand the legal issues of water policy.
CO5	Select the method for water harvesting based on the area

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: 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

Year / SEM: 3rd year / 6th sem	Year of Study: 2019-20
Course Name: Extensive Survey Project /Camp – 17CVP68	
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

Year / SEM: 4th year / 8th sem	Year of Study: 2019-20
Course Name: Quantity Surveying and Contracts Management – 15CV81	
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

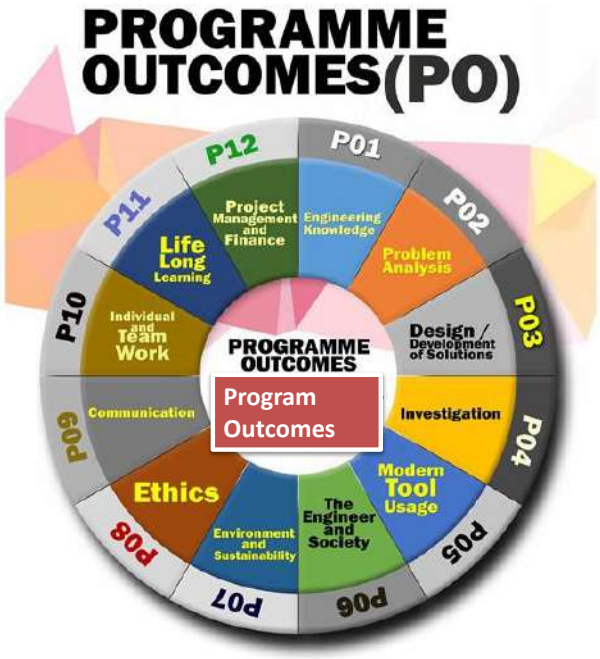
Year / SEM: 4th year / 8th sem	Year of Study: 2019-20
Course Name: Design of Pre Stressed Concrete Elements – 15CV82	
CO1	Understand the requirement of PSC members for present scenario
CO2	Analyze the stresses encountered in PSC element during transfer and at working
CO3	Understand the effectiveness 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

Year / SEM: 4th year / 8th sem	Year of Study: 2019-20
Course Name: 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

Department of Computer Science and Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes

Program Outcomes:



PO1. Apply knowledge of mathematics and science, with fundamentals of Computer Science & Engineering to be able to solve complex engineering problems related to CSE.

PO2. Apply mathematical foundations, algorithmic principles, and computer Science theory in the modelling and design of computer based systems in a way that demonstrates comprehension of tradeoffs involved in design choices.

PO3. Analyze a problem, and identify and define the computing requirements appropriate to its solution

PO4. Design and development principles in the construction of software systems of varying complexity

PO5. Design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints such as memory, runtime efficiency, as

well as appropriate constraints related to economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability considerations;

PO6. Use the techniques, skills, and modern engineering tools necessary for practice as a CSE professional;

PO7. Work effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary environment

PO8. Demonstrate knowledge of contemporary issues and understand professional, ethical, legal, security and social issues and responsibilities

PO9. Analyze the local and global impact of computing on individuals, organizations, and society;

PO10. Demonstrate knowledge and understanding of the engineering and management principles including financial implications and apply these to his/her work, as a member and leader in a team, and to manage project work as part of a multidisciplinary team

PO11. Communicate effectively in both verbal and written forms;

PO12. Recognize the need for, and be motivated to engage in life-long learning and continuing professional development

PROGRAM SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO-1:	Foundation of mathematical concepts: To use mathematical methodologies to crack problem using suitable mathematical analysis, data structure and suitable algorithm.
PSO-2:	Foundation of Computer System: the ability to interpret the fundamental concepts and methodology of computer systems. Students can understand the functionality of hardware and software aspects of computer systems.
PSO-3:	Foundations of Software development: the ability to grasp the software development lifecycle and methodologies of software systems. Possess competent skills and knowledge of software design process. Familiarity and practical proficiency with a broad area of programming concepts and provide new ideas and innovations towards research

Course Outcomes:

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: --DATA STRUCTURES AND APPLICATIONS-18CS32	
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.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: ANALOG AND DIGITAL ELECTRONICS – 18CS33	
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

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: COMPUTER ORGANIZATION – 18CS34	
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.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: SOFTWARE ENGINEERING– **18CS35**	
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

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: DISCRETE MATHEMATICAL STRUCTURES – 18CS36	
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.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: ANALOG AND DIGITAL ELECTRONICS LABORATORY – 18CSL37	
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.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: DATA STRUCTURES LABORATORY – 18CSL38	
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
Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: DESIGN AND ANALYSIS OF ALGORITHMS – 18CS42	
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.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: OPERATING SYSTEMS – 18CS43	
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

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: MICROCONTROLLER AND EMBEDDED SYSTEMS – 18CS44	
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

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: OBJECT ORIENTED CONCEPTS – 18CS45	
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.

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: DATA COMMUNICATION – 18CS46	
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

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: DESIGN AND ANALYSIS OF ALGORITHM LABORATORY– 18CSL47	
CO1	Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
CO2	Implement a variety of algorithms such assorting, 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 structuresto solve real-world problems.

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: MICROCONTROLLER AND EMBEDDED SYSTEMS LABORATORY – 18CSL48	
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.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY – 17CS51	
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

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: COMPUTER NETWORKS – 17CS52	
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	Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard
CO5	Describe Multimedia Networking and Network Management

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: DATABASE MANAGEMENT SYSTEM – 17CS53	
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 and build simple database systems
CO4	Develop application to interact with databases.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: AUTOMATA THEORY AND COMPUTABILITY – 17CS54	
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.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: ADVANCED JAVA AND J2EE– 17CS553	
CO1	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
CO2	Build client-server applications and TCP/IP socket programs
CO3	Illustrate database access and details for managing information using the JDBC API
CO4	Describe how servlets fit into Java-based web application architecture
CO5	Develop reusable software components using Java Beans

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: ARTIFICIAL INTELLIGENCE– 17CS562	
CO1	Identify the AI based problems.
CO2	Apply techniques to solve the AI problems
CO3	Define learning and explain various learning techniques
CO4	Discuss expert systems

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: COMPUTER NETWORK LABORATORY– 17CSL57	
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

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: DBMS LABORATORY WITH MINI PROJECT – 15CSL58	
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.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW – 17CS61	
CO1	Discuss cryptography and its need to various applications
CO2	Design and develop simple cryptography algorithms
CO3	Understand cyber security and need cyber Law

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: COMPUTER GRAPHICS AND VISUALIZATION – 17CS62	
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	Discussabout suitable hardware and software for developing graphics packages using OpenGL.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: SYSTEM SOFTWARE AND COMPILER DESIGN-17CS63	
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

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: OPERATING SYSTEMS – 17CS64	
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

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: OPERATION RESEARCH– 17CS653	
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.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: PYTHON APPLICATION PROGRAMMING– 17CS664	
CO1	Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO2	Demonstrate proficiency in handling Strings and File Systems.
CO3	Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
CO4	Interpret the concepts of Object-Oriented Programming as used in Python.

CO5	Implement exemplary applications related to Network Programming, Web Services and Databases in Python

Year / SEM : 3rd year / 6th sem	**Year of Study : 2019-20**
Course Name: SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY – 17CSL67	
CO1	Implement and demonstrate Lexer's and Parser's
CO2	Implement different algorithms required for management, scheduling, allocation and communication used in operating system..

Year / SEM : 3rd year / 6th sem	**Year of Study : 2019-20**
Course Name: COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT – 17CSL68	
CO1	Apply the concepts of computer graphics
CO2	Implement computer graphics applications using OpenGL
CO3	Implement real world problems using OpenGL

Year / SEM : 4th year / 7th sem	**Year of Study : 2019-20**
Course Name: TECHNOLOGY AND ITS APPLICATIONS – 15CS71	
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

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: ADVANCED COMPUTER ARCHITECTURES– 15CS72	
CO1	Explain the concepts of parallel computing and hardware technologies
CO2	Compare and contrast the parallel architectures
CO3	Illustrate parallel programming concepts

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: MACHINE LEARNING– 15CS73	
CO1	Identify the problems for machine learning. And select the either supervised, unsupersvised 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,

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: UNIX SYSTEM PROGRAMMING– 15CS744	
CO1	Ability to understand and reason out the working of Unix Systems
CO2	Build an application/service over a Unix system.

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: STORAGE AREA NETWORKS– 15CS754	
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	Ilustrate the storage infrastructure and management activities

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: MACHINE LEARNING LABORATORY– 15CSL76	
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.

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: WEB TECHNOLOGY LABORATORY WITH MINI PROJECT– 15CSL77	
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

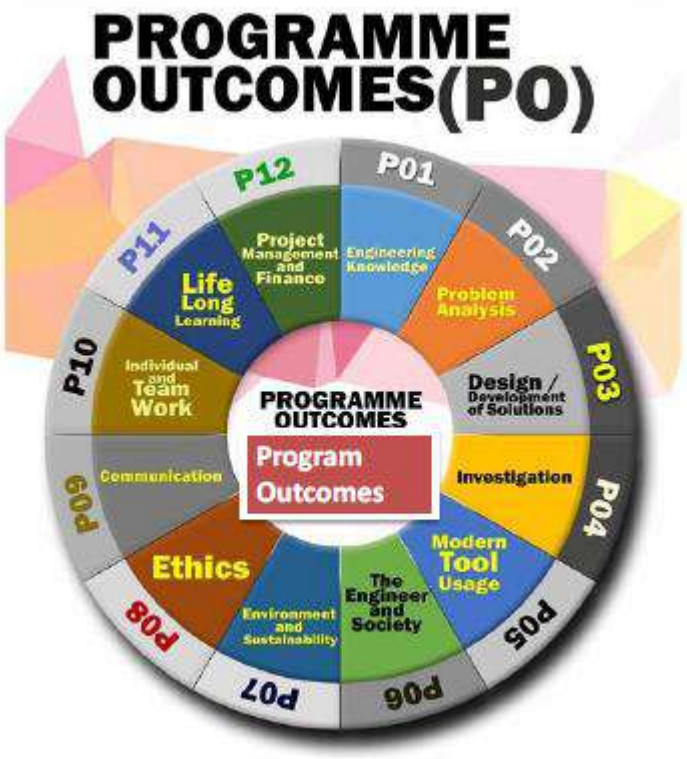
Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: IOT TECHNOLOGY– 15CS81	
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
CO3	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.

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: BIG DATA ANALYTICS– 15CS82	
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

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: MODERN INTERFACE DESIGN – 15CS832	
CO1	Design the user interface, design, menu creation and windows creation and connection between menu and windows

Department of Electronics & Communication Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes



PO1. Apply knowledge of mathematics and science, with fundamentals of Computer Science & Engineering to be able to solve complex engineering problems related to CSE.

PO2. Apply mathematical foundations, algorithmic principles, and computer Science theory in the modelling and design of computer based systems in a way that demonstrates comprehension of tradeoffs involved in design choices.

PO3. Analyze a problem, and identify and define the computing requirements appropriate to its solution

PO4. Design and development principles in the construction of software systems of varying complexity

PO5. Design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints such as memory, runtime efficiency, as well as appropriate constraints related to economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability considerations;

PO6. Use the techniques, skills, and modern engineering tools necessary for practice as a CSE professional;

PO7. Work effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary environment

PO8. Demonstrate knowledge of contemporary issues and understand professional, ethical, legal, security and social issues and responsibilities

PO9. Analyze the local and global impact of computing on individuals, organizations, and society;

PO10. Demonstrate knowledge and understanding of the engineering and management principles including financial implications and apply these to his/her work, as a member and leader in a team, and to manage project work as part of a multidisciplinary team

PO11. Communicate effectively in both verbal and written forms;

PO12. Recognize the need for, and be motivated to engage in life-long learning and continuing professional development

PROGRAM SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO-1:	Specify, design, build and test analog, digital and embedded systems for signal processing.
PSO-2:	Understand and architect wired and wireless Analog and Digital communication systems as per specifications and determine their performance.

Course Outcomes:

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: -- NETWORK THEORY-18EC32	
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. _ 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.

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: ELECTRONIC DEVICES -18EC33	
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.

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: DIGITAL SYSTEM DESIGN --- 18EC34	
CO1	Explain the concept of combinational and sequential logic circuits.
CO2	Design the combinational logic circuits
CO3	Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines
CO4	Design applications of Combinational & Sequential Circuits

Year / SEM : 2nd year / 3rd sem	**Year of Study : 2019-20**
Course Name: COMPUTER ORGANIZATION AND ARCHITECTURE —18EC35	
CO1	Explain the basic organization of a computer system
CO2	Explain different ways of accessing an input / output device including interrupts.
CO3	Illustrate the organization of different types of semiconductor and other secondary storage memories.
CO4	Illustrate simple processor organization based on hardwired control and micro programmed control.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: POWER ELECTRONICS AND INSTRUMENTATION —18EC36	
CO1	Build and test circuits using power electronic devices.
CO2	Analyse and design-controlled rectifier, DC to DC converters, DC to AC inverters and SMPS.
CO3	Define instrument errors.
CO4	Develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency
CO5	Describe the principle of operation of Digital instruments and PLCs.
CO6	Use Instrumentation amplifier for measuring physical parameters

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: ELECTRONIC DEVICES AND INSTRUMENTATION LABORATORY 18ECL37	
CO1	Understand the characteristics of various electronic devices and measurement of parameters.
CO2	Design and test simple electronic circuits.
CO3	Use of circuit simulation software for the implementation and characterization of electronic circuits and devices.

Year / SEM : 2nd year / 3rd sem	Year of Study : 2019-20
Course Name: DIGITAL SYSTEM DESIGN LABORATORY —18ECL38	
CO1	Demonstrate the truth table of various expressions and combinational circuits using logic gates.
CO2	Design various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
CO3	Construct flips-flops, counters, and shift registers
CO4	Simulate Serial adder and Binary Multiplier.
CO5	Construct and test flips-flops, counters and shift registers.
CO6	Simulate full adder and up/down counters
Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: ANALOG CIRCUITS—18EC42	
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.

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: CONTROL SYSTEMS ---18EC43	
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 the time domain specification s for first and second order systems.
CO4	Deter mine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
CO5	Determine the s stability of a system in the frequency domain u sing Nyquist and bode plots.

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: ENGINEERING STATISTICS and LINEAR ALGEBRA--18EC44	
CO1	Identify and associate Random Variables and Random Processes in Communication events.
CO2	Analyze and model the Random events in typical communication events to extract quantitative statistical parameters
CO3	Analyze and model typical signal sets in terms of a basis function set of Amplitude, phase, and frequency.
CO4	Demonstrate by way of simulation or emulation the ease of analysis employing basis functions, statistical representation, and Eigen values.

Year / SEM : 2nd year / 4th sem	**Year of Study : 2019-20**
Course Name: SIGNALS AND SYSTEMS--18EC45	
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	Represent continuous and discrete systems in time and frequency domain using

	different transforms Test whether the system is stable.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: MICROCONTROLLER--18EC46	
CO1	Explain the difference between Microprocessors & Microcontrollers, Architecture 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 program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch.
CO5	Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.
CO6	Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: MICROCONTROLLER LABORATORY--18ECL47	
CO1	Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051.
CO2	Interface different input and output devices to 8051 and control them using Assembly language programs.
CO3	Interface the serial devices to 8051 and do the serial transfer using C programming.

Year / SEM : 2nd year / 4th sem	Year of Study : 2019-20
Course Name: ANALOG CIRCUITS LABORATORY--18ECL48	
CO1	Design analog circuits using BJT/FETs and evaluate their performance characteristics
CO2	Design analog circuits using OPAMPs for different applications
CO3	Simulate and analyze analog circuits that uses ICs for different electronic applications.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT—17ES51	
CO1	After studying this course, students will be able to: Understand the fundamental concepts of Management and Entrepreneurship.
CO2	Select a best Entrepreneurship model for the required domain of establishment.
CO3	Describe the functions of Managers, Entrepreneurs, and their social responsibilities.
CO4	Compare various types of Entrepreneurs.
CO5	Construct and test flips-flops, counters, and shift registers.
CO6	Analyse the Institutional support by various state and central government agencies.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: DIGITAL SIGNAL PROCESSING—17EC52	
CO1	Determine response of LTI systems using time domain and DFT techniques.
CO2	Compute DFT of real and complex discrete time signals.
CO3	Computation of DFT using FFT algorithms and linear filtering approach
CO4	Solve problems on digital filter design and realize using digital computations.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: VERILOG HDL—17EC53	
CO1	Write Verilog programs in gate, dataflow (RTL), behavioral and switch modelling 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 digital design.
CO5	Write the programs more effectively using Verilog tasks and directives. Perform timing and delay Simulation.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: INFORMATION THEORY & CODING-17EC54	
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.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: OPERATING SYSTEM—17EC553	
CO1	Explain the goals, structure, operation and types of operating systems.
CO2	Apply scheduling techniques to find performance factors. Explain organization of file systems and IOCS
CO3	Apply suitable techniques for contiguous and non-contiguous memory allocation.
CO4	Describe message passing, deadlock detection and prevention methods.

Year / SEM : 3rd year / 5th sem	Year of Study : 2019-20
Course Name: 8051 MICROCONTROLLERS—17EC563	
CO1	Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
CO2	Write 8051 Assembly level programs using 8051 instruction set. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.
CO3	Write 8051 Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and

	to generate an external interrupt using a switch.
CO4	Write 8051 C programs to generate square wave on 8051 I/O port pin using interrupt and to send & 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

Year / SEM : 3rd year / 5th sem	**Year of Study : 2019-20**
Course Name: DSP LAB---17ECL57	
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 a DSP processor and verify the frequency and phase response.

Year / SEM : 3rd year / 5th sem	**Year of Study : 2019-20**
Course Name: HDL LAB—17ECL5	
CO1	Write the Verilog/VHDL programs to simulate Combinational circuits in
CO2	Dataflow, Behavioural and Gate level Abstractions.
CO3	Describe sequential circuits like flip flops and counters in Behavioural description and obtain simulation waveforms.
CO4	Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.

Year / SEM : 3rd year / 6th sem	Year of Study : 2019-20
Course Name: DIGITAL COMMUNICATION—17EC61	
CO1	Identify Associate and apply the concepts of Bandpass sampling to well specified signals and channels.
CO2	Analyze and compute performance parameters and transfer rates for low pas and bandpass 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 bandlimited channels.
CO4	Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: ARM MICROCONTROLLER & EMBEDDED SYSTEMS—17EC62	
CO1	Describe the architectural features and instructions of 32-bit microcontroller ARMCortex 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 onthe 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.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: VLSI DESIGN—17EC63	
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flowand 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	Analyse CMOS subsystems and architectural issues with the design constraints.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: COMPUTER COMMUNICATION NETWORKS—17EC64	
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.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: CELLULAR MOBILE COMMUNICATIONS—17EC651	
CO1	Apply the understanding of statistical characterization of urban mobile channels to compute the performance for simple modulation schemes.
CO2	Demonstrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed.
CO3	Analyse the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems.
CO4	Test and validate voice and data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: EMBEDDED CONTROLLER LAB—17ECL67	
CO1	Understand the instruction set of 32-bit microcontroller ARM Cortex M3, and thesoftware 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.

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: COMPUTER NETWORKS LAB—17ECL68	
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.

OPEN ELECTIVE

Year / SEM : 3rd year / 6thsem	Year of Study : 2019-20
Course Name: DIGITAL SYSTEM DESIGN USING VERILOG—17EC663	
CO1	Construct the combinational circuits, using discrete gates and programmable logic devices.
CO2	Describe Verilog model for sequential circuits and test pattern generation.Design a semiconductor memory for specific chip design.
CO3	Design embedded systems using small microcontrollers, larger CPUs/DSPs,or hard or soft processor cores..
CO4	Synthesize different types of processor and I/O controllers that are used in embedded system.

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: MICROWAVES AND ANTENNAS—15EC71	
CO1	Describe the use and advantages of microwave transmission
CO2	Analyse various parameters related to microwave transmission lines and waveguides
CO3	Identify microwave devices for several applications

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: DIGITAL IMAGE PROCESSING—15EC72	
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 Conduct independent study and analysis of Image Enhancement techniques.

Year / SEM : 4th year / 7th sem	**Year of Study : 2019-20**
Course Name: POWER ELECTRONICS—15EC73	
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.

Year / SEM : 4th year / 7th sem	**Year of Study : 2019-20**
Course Name: MULTIMEDIA COMMUNICATION—15EC741	
CO1	Understand basics of different multimedia networks and applications.
CO2	Understand different compression techniques to compress audio and video.
CO3	Describe multimedia Communication across Networks.
CO4	Analyse different media types to represent them in digital form.
CO5	Compress different types of text and images using different compression

Year / SEM : 4th year / 7th sem	**Year of Study : 2019-20**
Course Name: IoT & WIRELESS SENSOR NETWORKS—15EC752	
CO1	Describe the OSI Model for the IoT/M2M Systems.
CO2	Understand the architecture and design principles for IoT.
CO3	Learn the programming for IoT Applications.
CO4	Identify the communication protocols which best suits the WSNs.

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: ADVANCED COMMUNICATION LAB—15ECL7	
CO1	Determine the characteristics and response of microwave devices and optical
CO2	waveguide.
CO3	Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
CO4	Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters
CO5	Design and test the digital modulation circuits/systems and display the

Year / SEM : 4th year / 7th sem	Year of Study : 2019-20
Course Name: VLSI LAB—15ECL78	
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.

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: WIRELESS CELLULAR and LTE 4G BROADBAND—15EC81	
CO1	Understand the system architecture and the functional standard specified in LTE 4G.
CO2	Analyse the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
CO3	Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
CO4	Test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: FIBER OPTICS and NETWORKS—15EC82	
CO1	Classification and working of optical fiber with different modes of signal propagation.
CO2	Describe the transmission characteristics and losses in optical fiber communication.
CO3	Describe the construction and working principle of optical connectors, multiplexers, and amplifiers.
CO4	Describe the constructional features and the characteristics of optical sources and detectors
CO5	Illustrate standards associated with it the networking aspects of optical fiber

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: RADAR ENGINEERING—15EC833	
CO1	Understand the radar fundamentals and radar signals.
CO2	Explain the working principle of pulse Doppler radars, their applications, and limitations
CO3	Describe the working of various radar transmitters and receivers.
CO4	Analyze the range parameters of pulse radar system which affect the system Performance.

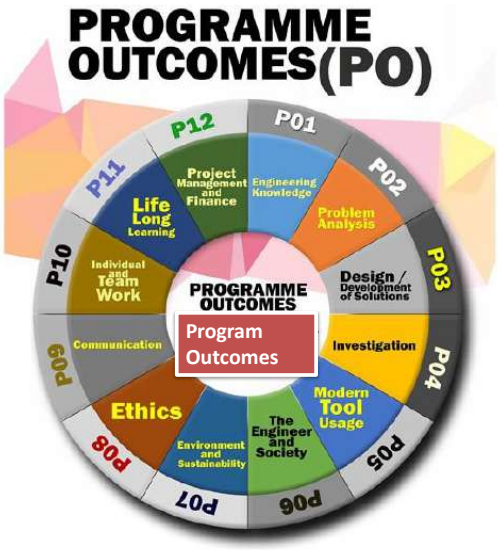
Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: Internship– 15EC84	
CO1	Acquire practical experience within industry in which the internship is done.
CO2	Apply knowledge and skills learned to classroom work.
CO3	Experience the activities and functions of professionals.
CO4	Develop and refine oral and written communication skills.
CO5	Recognize the areas for future knowledge and skill development.

Year / SEM : 4th year / 8th sem	Year of Study : 2019-20
Course Name: Technical Seminar– 15ECS86	
CO1	Develop knowledge in the field of Biomedical Engineering and other disciplines through independent learning and collaborative study.
CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology.
CO3	Develop written and oral communication skills.
CO4	Explore concepts in larger diverse social and academic contexts.
CO5	Apply principles of ethics and respect in interaction with others.
Year / SEM : 4th year / 8th sem	**Year of Study : 2019-20**
Course Name: Project – 15ECP85	
CO1	Describe the project and be able to defend it.
CO2	Develop critical thinking and problem solving skills.
CO3	Learn to use modern tools and techniques.
CO4	Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
CO5	Develop skills to work in a team to achieve common goal.
CO6	Develop skills of project management and finance.
CO7	Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
CO8	Prepare themselves for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Department of Mechanical Engineering

2.6.1 Program outcomes, program specific outcomes and course outcomes

Program Outcomes:



PO1 - Engineering Knowledge: Apply knowledge of mathematics and science, with fundamentals of Mechanical Engineering to be able to solve complex engineering problems related to Mechanical Engineering.

PO2 - Problem Analysis: Identify, Formulate, review research literature and analyze complex engineering problems related to Mechanical Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex aircraft problems related to Mechanical Engineering 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

PO4 - Conduct Investigations of Complex problems: Use research–based knowledge and research methods including design of aircraft structure experiments, analysis and

interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern Tool Usage: Create, Select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to Mechanical Engineering related complex engineering activities with an understanding of the limitations.

PO6 - 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 Mechanical professional engineering practice.

PO7 - Environment and Sustainability: Understand the impact of the Mechanical professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development

PO8 - Ethics: Apply Ethical Principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary Settings.

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with High society and with write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11 - Project Management and Finance: Demonstrate knowledge and understanding of the engineering 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.

PO12 - Life-Long Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning the broadest content of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO-1: Knowledge:	Mechanical Graduates will have strong fundamental technical knowledge and are capable to develop core competency in diversified areas such as Production, Design, Thermal, Industrial and allied fields with the use of software tools to expand their knowledge horizon and inculcate lifelong learning.

PSO-2: Skill:	Graduates will have effective communication, leadership, team building, problem solving, decision making skills, and software and creative skills by understanding contemporary issues there by contributing to their overall personality and career development.
PSO-3: Attitude	Graduates will practice ethical responsibilities and service towards their peers, employers, society and follow these percepts in their daily life.

Course Outcomes:

3rd Semester CO Details

Mechanics of Materials	**Sub Code: 18ME32**
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.

Basic Thermodynamics	**Sub Code: 18ME33**
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.

Material Science	**Sub Code: 18ME34**
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
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

Metal Cutting and Forming	Sub Code: 18ME35A
CO1	Describe the casting process and prepare different types of cast products.
CO2	Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, Sand Slinger moulding machines.
CO3	Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
CO4	CO4: Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mould castings.
CO5	Understand the Solidification process and Casting of Non-Ferrous Metals.
CO6	Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing.
CO7	Describe methods for the quality assurance of components made of casting and joining process Explain the construction & specification of various machine tools. Discuss different cutting tool materials, tool nomenclature & surface finish

Computer Aided Machine Drawing	Sub Code: 18ME36A
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.

Materials Testing Lab	Sub Code: 18MEL37 A
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.

Foundry and Forging Lab	Sub Code: 18MEL38 A
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.

4th Semester CO Details

Applied Thermodynamics	Sub Code: 18ME42
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

Fluid Mechanics	Sub Code: 18ME43
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

Kinematics of Machines	Sub Code: 18ME44
CO1	Knowledge of mechanisms and their motion.
CO2	Understand the inversions of four bar mechanisms.
CO3	Analyse the velocity, acceleration of links and joints of mechanisms.
CO4	Analysis of cam follower motion for the motion specifications.
CO5	Understand the working of the spur gears.
CO6	Analyse the gear trains speed ratio and torque

Metal Cutting and Forming	Sub Code: 18ME45A
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

Mechanical Measurements and Metrology	Sub Code: 18ME46B
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 device

Mechanical Measurements and Metrology Lab	**Sub Code: 18ME47B**
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 micrometer
CO6	Understand the concepts of measurement of surface roughness

Machine Shop	**Sub Code: 18ME48B**
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

5th Semester CO Details

Management And Engineering Economics	**Sub Code: 17ME51**
CO1	Explain the development of management and the role it plays at different levels in an organization.
CO2	Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.
CO3	Understand the necessity of good leadership, communication and coordination for establishing effective control in an Organization.
CO4	Understand engineering economics demand supply and its importance in economics decision making and problem solving.

CO5	Calculate present worth, annual worth and IRR for different alternatives in economic decision making.
CO6	Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods

Dynamics of Machinery	**Sub Code: 17ME52**
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, isochronisms, effort and power of porter and hartnell governors
CO5	Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aero planes
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

Turbo Machines	**Sub Code: 17ME53**
CO1	Able to give precise definition of turbo machinery
CO2	Identify various types of turbo machinery
CO3	Apply the Euler's equation for turbo machinery to analyses energy transfer in turbo machines
CO4	Understand the principle of operation of pumps, fans, compressors and turbines
CO5	Perform the preliminary design of turbo machines (pumps, rotary compressors and turbines)
CO6	Analyze the performance of turbo machinery

Design of Machine Elements-I	**Sub Code: 17ME54**
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

Non Traditional Machining	Sub Code: 17ME554
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

Energy And Environment	Sub Code: 17ME562
CO1	Summarize the basic concepts of energy, its distribution and general Scenario
CO2	Explain different energy storage systems, energy management, audit and economic analysis
CO3	Summarize the environment eco system and its need for awareness
CO4	Identify the various types of environment pollution and their effects
CO5	Discuss the social issues of the environment with associated acts

Fluid Mechanics & Machinery Lab	Sub Code: 17MEL57
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

Energy Conversion Lab	Sub Code: 17MEL58
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

6th Semester CO Details

Finite Element Analysis	Sub Code: 17ME61
CO1	Understand the concepts behind formulation methods in FEM
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

Computer Integrated Manufacturing	Sub Code: 17ME62
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 linesto 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

Heat Transfer	Sub Code: 17ME63
CO1	Understand the basic modes of heat transfer
CO2	Compute temperature distribution in steady-state and unsteady-state heat conduction
CO3	Understand and interpret heat transfer through extended surfaces
CO4	Interpret and compute forced and free convective heat transfer
CO5	Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems
CO6	Design heat exchangers using LMTD and NTU methods

Design of Machine Elements II	Sub Code: 17ME64
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 with morality and ethics

Metal Forming	Sub Code: 17ME653
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

Automobile Engineering	Sub Code: 17ME655
CO1	To identify the different parts of an automobile and it's working
CO2	To understand the working of transmission and braking systems
CO3	To comprehend the working of steering and suspension systems
CO4	To learn various types of fuels and injection systems
CO5	To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions

INDUSTRIAL SAFETY	Sub Code: 17ME662
CO1	Understand the basic safety terms
CO2	Identify the hazards around the work environment and industries
CO3	Use the safe measures while performing work in and around the work area of the available laboratories
CO4	Able to recognize the sign boards and its application
CO5	Able to demonstrate the portable extinguishers used for different class of fires
CO6	Able to write the case studies by sharing experience of the employees working in housekeeping, laboratories like workshops, electrical labs, machine shops, electronics and computer laboratories
CO7	Able to understand and report the case studies from various references (text books, news report, journals, visiting industries like power stations, manufacturing and maintenance)

Total Quality Management	Sub Code: 17ME664
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

Heat Transfer Lab	Sub Code: 17MEL67
CO1	Perform experiments to determine the thermal conductivity of a metal rod
CO2	Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values
CO3	Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
CO4	Determine surface emissivity of a test plate

CO5	Estimate performance of a refrigerator and effectiveness of fin
CO6	Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach

Modeling and Analysis Lab	**Sub Code: 17ME664**
CO1	Demonstrate the basic features of an analysis package
CO2	Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions
CO3	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
CO4	Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions
CO5	Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function

7th Semester CO Details

Energy Engineering	**SUB Code: 15ME71**
CO1	Discuss the layout of thermal power plant and working principle of various types of boilers.
CO2	Explain the working of diesel and gas turbine power plant along with optimization technique
CO3	Discuss the various types of nuclear reactors used in nuclear power plant .Summarize the principles and working of various renewable energy power plants.
CO4	Explain the energy, economic and environmental issues of power plants Paraphrase the different types of power plant, its function and issues related

Fluid Power Systems	**SUB Code: 15ME72**
CO1	Describe the construction, structure & working Principle of various Hydraulic pumps, motors and Actuators and their Performance Characteristics
CO2	Comprehend &Analyze Single& Double Acting Hydraulic Cylinder circuits and their Control Components and Maintenance of Hydraulic Systems
CO3	Describe the construction, structure & working Principle of various Pneumatic Actuators, Pneumatic Control Valves Applications
CO4	Recall the Signal Processing Elements such as OR & AND gates in pneumatic applications and Multi cylinder applications and Electro-Pneumatic Control

Control Engineering	**SUB Code: 15ME73**
CO1	Identify the type of control system, their applications, limitations, Concepts of feedback, Types of controllers and also arrive at the transfer functions of the given physical system (i.e. Mechanical , Electrical , Thermal, Hydraulic) models by writing Differential

	Equations using Laplace Transformation
CO2	Produce the Transfer Function by Block Reduction Technique and also using Mason's Formula for Signal Flow Graph and also Interpret the S-plane with the terms like settling time, rise-time and overshoot to step-response. Apply Routh-Hurwitz criterion to determine the stability of time- invariant systems
CO3	Apply frequency domain analysis techniques, and design control systems to achieve specific dynamic characteristics, Possess knowledge of stability and controls, Determine the stability of control systems using Nyquist methods and also by using Bode Attenuation diagrams
CO4	Determine the stability of control systems using Root-Locus Technique and feedback control systems using frequency domain and state-variable methods. Possess knowledge of stability and controls

Tribology	**SUB Code: 15ME742**
CO1	Identify the type of control system, their applications, limitations, Concepts of feedback, Types of controllers and also arrive at the transfer functions of the given physical system (i.e. Mechanical , Electrical , Thermal, Hydraulic) models by writing Differential Equations using Laplace Transformation
CO2	Produce the Transfer Function by Block Reduction Technique and also using Mason's Formula for Signal Flow Graph and also Interpret the S-plane with the terms like settling time, rise-time and overshoot to step-response. Apply Routh-Hurwitz criterion to determine the stability of time- invariant systems
CO3	Apply frequency domain analysis techniques, and design control systems to achieve specific dynamic characteristics, Possess knowledge of stability and controls, Determine the stability of control systems using Nyquist methods and also by using Bode Attenuation diagrams
CO4	Determine the stability of control systems using Root-Locus Technique and feedback control systems using frequency domain and state-variable methods. Possess knowledge of stability and controls

Mechatronics	**SUB Code: 15ME753**
CO1	Identify the type of control system, their applications, limitations, Concepts of feedback, Types of controllers and also arrive at the transfer functions of the given physical system (i.e. Mechanical , Electrical , Thermal, Hydraulic) models by writing Differential Equations using Laplace Transformation
CO2	Produce the Transfer Function by Block Reduction Technique and also using Mason's Formula for Signal Flow Graph and also Interpret the S-plane with the terms like settling time, rise-time and overshoot to step-response. Apply Routh-Hurwitz criterion to determine the stability of time- invariant systems
CO3	Apply frequency domain analysis techniques, and design control systems to achieve specific dynamic characteristics, Possess knowledge of stability and controls, Determine the stability of control systems using Nyquist methods and also by using Bode Attenuation diagrams

CO4	Determine the stability of control systems using Root-Locus Technique and feedback control systems using frequency domain and state-variable methods. Possess knowledge of stability and controls

DESIGN LAB	**SUB Code: 15MEL76**
CO1	Understand the concept of natural frequency and damping coefficient in a single DOF vibrating system
CO2	Students are able analyze the balancing of rotating and reciprocating masses by using static and dynamic balance
CO3	Ability to demonstrate the concept of stress concentration for different photo- elastic materials
CO4	Students are able to determine pressure distribution in journal bearings

CIM & AUTOMOTAION LAB	**SUB Code: 15MEL77**
CO1	Ability to identify the type of machining center for the geometry given (cylindrical or prismatic), write the part program, explain the instructions, examine for the error in theprogram and choose right G and M codes to optimize the program and construct the final geometry by running the simulation using the software
CO2	To practically relate to concepts discussed in Computer Integrated Manufacturing course to write CNC part programs using SWAN SOFT CNC simulation package for simulationof machining operations such as Turning, Drilling & Milling. To understand & write programs for Flexible Manufacturing Systems &Robotics

8th Semester CO Details

Operation Research	**Sub Code: 15ME81**
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-3machines,n jobs-m machinesand 2 jobs-n machines using Johnson's algorithm.

Additive Manufacturing	**Sub Code: 15ME82**
CO1	Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
CO2	Analyse the different characterization techniques.
CO3	Describe the various NC, CNC machine programing and Automation techniques.

Experimental Stress Analysis	**SUB Code: 15832**
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

Internship/ Professional Practice	**SUB Code: 15ME84**
CO1	Acquire practical experience within industry in which the internship is done.
CO2	Apply knowledge and skills learned to classroom work.
CO3	Experience the activities and functions of professionals.
CO4	Develop and refine oral and written communication skills.

Project Work, Phase II	**SUB Code:** 15MEP85
CO1	Describe the project and be able to defend it.
CO2	Develop critical thinking and problem solving skills.
CO3	Learn to use modern tools and techniques.
CO4	Communicate effectively and to present ideas clearly and coherently both in written and oral forms.

Seminar	**SUB Code:** 15MES86
CO1	Develop knowledge in the field of Biomedical Engineering and other disciplines through independent learning and collaborative study.
CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology.
CO3	Develop written and oral communication skills.
CO4	Explore concepts in larger diverse social and academic contexts.