VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD
Autonomous institute affiliated to JNTUH

B. TECH - CIVIL ENGINEERING

Department Vision

To be a centre of excellence in civil engineering education, research and consultancy to support the community at large.

Department Mission

1. Providing knowledge-based resources in civil engineering and allied fields.
2. Tandem with industry to facilitate advancement of technology.
3. Promoting consultancy for industrial and societal needs.
4. Inspiring to become an ethical entrepreneur.

Program Educational Objectives (PEOs):

Program Objective 1: Graduates will address the technical challenges as a professional by utilizing and enhancing their analytical skills in real world problems in civil engineering.

Program Objective 2: Graduates will adapt to rapidly changing environment in Design and execution of projects and to achieve a high level of technical expertise through lifelong learning.

Program Objective 3: Graduates will communicate their ideas to be effective in collaborating with industry and R & D centers and working as a team member/leader by upholding their responsibilities with excellence.

Program Objective 4: Graduates will explore and apply multidisciplinary open-ended engineering activities considering the societal and economic impacts of engineering decisions, professional and ethical responsibilities of civil engineers.

Program Specific Outcomes (PSO's)

Graduates will be able to
1. Prepare detailed project reports and execution of industrial projects
2. Provide solutions for irrigation, drainage and rural water supply.

A) PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1. 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.

Course Outcomes for First Year First Semester Course		
Course Title with Code	**#**	**Statement**
Linear Algebra and Ordinary Differential Equations (A4001)	CO1	Solve system of linear equations using rank of a matrix.
	CO2	Examine the nature of Quadratic form using Eigen values and Eigen vectors.
	CO3	Solve the first and higher order linear ordinary differential equations.
	CO4	Make use of ordinary differential equations to solve, Rate of growth/decay, Newton's law of cooling, Electrical circuits and Simple harmonic motion problems.
	CO5	Apply Laplace transforms to solve ordinary differential equations.
Programming for Problem Solving (A4501)	CO1	Select right identifiers, data types and operators for effective computation.
	CO2	Write programs using control statements.
	CO3	Write programs demonstrating use of arrays, strings and their applications.
	CO4	Demonstrate the applications of function and recursion.
	CO5	Write programs for simple real life problems using pointers and structures.
Engineering Graphics and Computer Aided drafting (A4301)	CO1	Construct various types of scales and curves commonly used in engineering practice.
	CO2	Distinguish between first, second, third and fourth angle projections of systems.
	CO3	Estimate sheet metal requirement for making regular solids.
	CO4	Compare isometric and orthographic views of an object.
	CO5	Select CAD tools for modelling regular solids
Programming for Problem Solving Laboratory(A4502)	CO1	Demonstrate use of control statements, arrays and strings.
	CO2	Demonstrate use of functions and recursive functions
	CO3	Design and implement C programs for simple real life problems using pointers and structures.
	CO4	Debug erroneous programs related to the C language.
OSCILLATIONS, WAVES AND OPTICS	CO1	Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator.
	CO2	Construct travelling and standing solutions to the wave equation.
	CO3	Use the geometrical approximation, including Fermat's principle, the ray equation and paraxial matrix formalism for refractive and reflective surfaces.
	CO4	Apply wave optics and diffraction theory to a range of problems.
	CO5	Estimate the properties of various lasers and the propagation of laser beams.
OSCILLATIONS, WAVES AND OPTICS LABORATORY	CO1	Evaluate the rigidity modulus and spring constant of the given materials to interpret the material properties.
	CO2	Estimate the acceleration due to gravity (g) and frequency of AC power supply.
	CO3	Determine the wavelength of a given light source and thickness of a wire by using interference mechanism.
	CO4	Estimate the dispersive power and refractive index of various light sources.
	CO5	Apply the principles of optics to evaluate the characteristics of lasers

		and optical fibres.
Social Innovation (A4021)	CO1	Develop awareness on social issues faced by local regions.
	CO2	Interpret and classify societal issues as simple, complicated and complex problems.
	CO3	Identify the core problem's cause and effect.
	CO4	Propose an innovative idea to solve the identified problem.

Course Outcomes for First Year Second Semester Course		
Course Title with Code	**#**	**Statement**
Advanced Calculus (A4002)	CO1	Evaluate improper integrals and examine the extremum of a function of several variables.
	CO2	Make use of multiple integrals to find the area and volume of a solid.
	CO3	Determine scalar potential function for irrotational force fields.
	CO4	Evaluate line, surface and volume integrals using vector integral theorems.
	CO5	Develop Fourier series and Fourier transforms of a function.
Engineering Chemistry (A4007)	CO1	Apply knowledge of three - dimensional arrangements of atoms, molecules and their effects on chemical reactions.
	CO2	Evaluate the behaviour, and interactions between matter and energy at both the atomic and molecular levels.
	CO3	Identify differences and similarities of the Batteries.
	CO4	Apply major chemical reactions in the synthesis of various drugs.
	CO5	Make use of different methods for softening hardness of water.
ENGINEERING MECHANICS (A4303)	CO1	Apply the laws of mechanics to evaluate resultant force.
	CO2	Solve the problems using equations of equilibrium through free body diagram.
	CO3	Analyze the frictional forces to maintain the equilibrium.
	CO4	Identify the centroid and centre of gravity of a body by using principle of moments and calculate the area moment of inertia and mass moment of inertial of a body
	CO5	Utilize the basic concepts of kinematics and kinetics to solve the problem.
Functional English (A4009)	CO1	Demonstrate an understanding of the significance of humanity, love and service to mankind.
	CO2	Utilize appropriate vocabulary in the given contexts.
	CO3	Build competence in grammar.
	CO4	Develop effective academic reading skills.
	CO5	Develop effective academic writing skills.
Engineering Workshop (A4302)	CO1	Demonstrate the applications of manufacturing tools & joining process.
	CO2	Produce basic components using workshop trades.
	CO3	Identify and apply the tools for different trades of engineering workshop practice.
	CO4	Recognize the circuit and its operational features in house wiring.
	CO5	Explain the different materials that are used in workshop trades.
Engineering Chemistry Laboratory	CO1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.
	CO2	Apply various titrations for the estimation of strengths of solutions

(A4008)		and hardness of water.
	CO3	Identify different samples from a mixture by using various separation techniques.
	CO4	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
	CO5	Evaluate the percentage of yield of chemical substances by organic synthesis.
ENGINEERING MECHANICS LABORATORY (A4304)	CO1	Examine basic laws of Mechanics by using experiment setup.
	CO2	Determine the co-efficient of friction between wood and various surfaces.
	CO3	Apply the basic concepts of mechanics to find the Mechanical Advantage, velocity ratio and mechanical efficiency.
	CO4	Calculate moment of Inertia of an irregular body using Computation method
	CO5	Analyze the different force systems by using graphical method.
English Language Communication Skills Laboratory	CO1	Improve his/her pronunciation.
	CO2	Take part in role-plays and perform effectively in real-life situations.
	CO3	Choose appropriate words and phrases to make effective telephonic conversations
	CO4	Minimize stage fear and make effective presentations.
	CO5	Build sustained conversations.
Engineering Exploration (A4022)	CO1	Compare and contrast the contributions of different types of engineers in the development of a product, process or system.
	CO2	Apply the common engineering design process to solve complex problems and arrive at viable solution.
	CO3	Explore various contemporary software and hardware tools to provide solutions for the problems.
	CO4	Apply skills needed for successful team work including the basics of project management and written and oral communication.
	CO5	Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

Course Outcomes for second year courses		
Course Title with code	**#**	**Course outcomes**
MANAGERIALCONOMICS AND FINANCIAL ANALYSIS (A3011)	CO1	Explain the concepts of Managerial Economics and Financial Accounting
	CO2	Analyze the demand, production, cost and break even to know interrelationship of among variables and their impact
	CO3	Classify the market structure to decide the fixation of suitable price
	CO4	Apply capital budgeting techniques to select best investment opportunity
	CO5	Prepare financial statements and analyze them to assess financial health of business
FLUID MECHANICS (A3101)	CO1	Explain the properties of the fluids
	CO2	Classify the various types of flows
	CO3	Apply the concepts to solve problems on fluid flow
	CO4	Analyze the boundary layer effect on the fluid flows

	CO5	Categorize the various pipe networks.
BUILDING MATERIALS AND CONSTRUCTION A3102	CO1	Identify the different materials used in construction purpose
	CO2	Explain the applications of different building materials
	CO3	Classify the behavior of building components
	CO4	Distinguish between various types of masonry and foundation of buildings
	CO5	Describe the process of construction of formwork and finishing's
SURVEYING – I A3103	CO1	Demonstrate the basic principles of surveying & levelling
	CO2	Apply the principles of surveying & levelling to measure linear angles and measurements
	CO3	Survey an area and prepare contour maps
	CO4	Determine true dimensions of the field by rectifying errors in basic surveying tools
	CO5	Estimate the quantity of earthwork required to level an area
STRENGTH OF MATERIALS-I A3104	CO1	Interpret the engineering properties of the materials
	CO2	Identify shear force and bending moment in a member for different support conditions
	CO3	Apply theory of simple bending on various sections
	CO4	Analyze slope and deflection of beams using classical and analytical methods
	CO5	Estimate the principal stresses using graphical method
ENVIRONMENTAL SCIENCE A3010	CO1	Identify the important components of environment
	CO2	Identify global environmental problems and come out with best possible solutions
	CO3	Apply environmental laws for the protection of forest and wildlife
	CO4	Apply the knowledge of Environmental ethics to maintain harmonious relation between nature and human being
	CO5	Illustrate the major environmental effects of exploiting natural resources
STRENGTH OF MATERIALS LAB A3105	CO1	Estimate young's modulus of different determinate beams experimentally
	CO2	Evaluate Direct and indirect stress tests on different materials
	CO3	Test for basic mechanical properties of materials
	CO4	Apply Maxwell's reciprocal theorem on beams
	CO5	Experiment with spring with different loading conditions and identify performance
SURVEYING – I LAB A3106	CO1	Demonstrate the use of basic surveying tools
	CO2	Apply the procedures involved in field work and to work as a surveyor in a team
	CO3	Identify types & sources of errors in all basic surveying tools
	CO4	Determine the location and levels of points on field & plotting using various methods
	CO5	Interpret survey data and compute areas and volumes
CONCRETE TECHNOLOGY A3107	CO1	CO1.Evaluate the properties of concrete manufacturing materials to check their quality
	CO2	Measure the properties of fresh and hardened state of concrete for a given condition.
	CO3	Identify properties of various types of Admixtures and their

		applications to field
	CO4	Assess various Concrete Mixes for field applications depending on environment
	CO5	Interpret various types of special concrete and their adaptability to field condition.
STRENGTH OF MATERIALS-II A3108	CO1	CO1.Solve the problems in various structural members subjected to combined loading, a combination of axial load, torsion and bending
	CO2	CO2. Determine the stresses developed in various structural members
	CO3	Apply classical theories of columns and failures
	CO4	Evaluate the deflection of structural members.
	CO5	Estimate the stress distribution of pressure vessels.
STRUCTURAL ANALYSIS – 1 A3109	CO1	Identify determinate and indeterminate structures.
	CO2	Solve perfect frames and three hinged arches under different loading conditions
	CO3	Apply energy theorems to beams and axially loaded structures
	CO4	Analyze determinate structures under different kinematic loading conditions
	CO5	Evaluate final moments for statically indeterminate flexural members using various methods
HYDRAULICS AND HYDRAULIC MACHINES A3110	CO1	Design of hydraulic channels for different flows
	CO2	Evaluate the model and prototype relations by similarity laws
	CO3	Apply Impulse momentum equation to calculate impact of jets on plates
	CO4	Distinguish between the types of turbines based on heads, discharge and efficiencies
	CO5	Analyze the possible problems, performance and installation techniques of centrifugal pumps
BUILDING PLANNING AND DRAWING A3111	CO1	Infer the Bye laws and Principles of Planning for residential and other public buildings
	CO2	Plan, schedule and monitor the project effectively.
	CO3	Develop parts of building such as doors and windows.
	CO4	Model Plan, elevation and section for sloped and flat buildings
SURVEYING – II A3112	CO1	Illustrate the importance& applications of remote sensing, GIS & GPS in surveying
	CO2	Measure linear angles and measurements of ground features
	CO3	Determine the elevation and depression of ground features on, above or beneath the surface of the earth
	CO4	Survey and prepare plan for bridges, tunnels, buildings, dams, culverts etc
	CO5	Interpret the characteristics of horizontal & vertical curves
FLUID MECHANICS AND HYDRAULIC MACHINERY LAB	CO1	Apply the Conservation of mass, momentum, energy Equations to the fluids
	CO2	Analyze flow measuring devices and their efficiency

A3113	CO3	Examine the working principles, components, Operating characteristics of hydraulic machinery
	CO4	Choose suitable pumps and turbines for different working conditions
	CO5	Evaluate the force impacted on plates by water jets
SURVEYING – II Lab A3112	CO1	Illustrate the importance& applications of remote sensing, GIS & GPS in surveying
	CO2	Measure linear angles and measurements of ground features
	CO3	Determine the elevation and depression of ground features on,above or beneath the surface of the earth
	CO4	Survey and prepare plan for bridges, tunnels, buildings, dams, culverts etc
	CO5	Interpret the characteristics of horizontal & vertical curves

Course Outcomes for third year courses		
Course Title with code	**#**	**Course outcomes**
DESIGN OF REINFORCED CONCRETE STRUCTURES A3115	CO1	Identify and compute the properties of concrete and steel
	CO2	Classify the behaviour and inter relationship between the structural elements
	CO3	Analyse design loads and their action according to different field conditions
	CO4	Design reinforced concrete members according to code provisions
	CO5	Evaluate the compression members and flexural members according to the given conditions
STRUCTURAL ANALYSIS II A3116	CO1	Classify two hinged arches and indeterminacies
	CO2	Apply matrix methods in analysing the structures
	CO3	Determine bending moments using distribution methods
	CO4	Evaluate slope/rotation using displacement methods
	CO5	Analyse frames, arches and deformation profiles of moving loads
GEOTECHNICAL ENGINEERING – I A3117	CO1	CO1. Demonstrate various classical theories of soil mechanics
	CO2	CO2. Classify the soil based on index properties
	CO3	CO3. Evaluate the engineering properties of soil
	CO4	CO4. Minimize the stress distributions in the founded soil with the theories of stress distribution
	CO5	CO5. Analyze the compressibility of soils and evaluate various design parameters
ENGINEERING GEOLOGY A3118	CO1	Outline the importance of geology in civil engineering
	CO2	Identify the rocks and minerals based on their physical properties
	CO3	Distinguish between weathered rocks and fresh rocks
	CO4	Analyse the effects of weathering on structures
	CO5	Interpret geophysical investigations based on geophysical studies
WATER RESOURCES ENGINEERING-1 A3119	CO1	Analyse the components of hydrologic cycle
	CO2	Develop Hydrographs for unknown storm durations and catchments
	CO3	Evaluate aquifer characteristics using aquifer parameters
	CO4	Apply various techniques to know the water requirements of the crop
	CO5	Design irrigation canals by using various theories
ESTIMATING AND	CO1	CO1. Identify various items of work in project and materials for

COSTING A3120		given specifications
	CO2	Develop estimates of building and bar bending schedules
	CO3	Analyze the various types of contract documents
	CO4	Evaluate the quantity of earthwork for roads and canals and perform rate analysis
	CO5	Assess actual value of any property.
ENGINEERING GEOLOGY LAB A3121	CO1	Identify the minerals based on their physical properties by simple tests
	CO2	Solve various geological problems
	CO3	Classify rocks using basic geologic classification systems
	CO4	Interpret the geological structures in the geological maps and models
GEOTECHNICAL ENGINEERING LAB A3122	CO1	Classify the soil based on index properties
	CO2	Evaluate the field quality control of embankments and subgrades
	CO3	Determine the engineering properties of soil
	CO4	Estimate the shear strength of soil under controlled drainage conditions
DESIGN OF STEEL STRUCTURES A3123	CO1	Classify the different design philosophies
	CO2	Examine the different types connections
	CO3	Design the compression and tension members
	CO4	Design the members of roof truss
	CO5	Design the Plate girders
GEOTECHNICAL ENGINEERING – II A3124	CO1	Compare the classical soil mechanics theories to new age techniques
	CO2	Summarize the need and importance of field reconnaissance in the design of major projects
	CO3	Determine the magnitude and direction of earth pressures
	CO4	Estimate the parameters for the design of foundations, earth retaining walls and hydraulic Structures
	CO5	Analyse complex geotechnical engineering problems
ENVIRONMENTAL ENGINEERING A3125	CO1	Identify water supply schemes, water demands and water quality parameters
	CO2	Design water treatment units along with water distribution systems
	CO3	Examine sewage, sewerage and house drainage system components
	CO4	Discuss primary and biological wastewater treatment processes and design its units
	CO5	Propose treatment and disposal methods of sewage and sludge
ENTREPRENEURSHIP DEVELOPMENT A3076	CO1	Understand the role, characteristics, qualities and functions of entrepreneur and use this knowledge to become future entrepreneurs.
	CO2	Interpret various Institutional support for setting up a business enterprise and apply this knowledge while approaching these institutions for financial support
	CO3	Illustrate role, importance and functions of women entrepreneur and use this knowledge to become future women entrepreneurs
	CO4	Infer the concept of Project Management and steps in Project development and analyse while taking future project assignments
	CO5	Indicate training programs and different training institutions to impart training and apply this knowledge to train existing and future

		entrepreneurs
ENVIRONMENTAL IMPACT ASSESSMENT A3151	CO1	Explain the basic concepts and methodologies of environmental impact assessment
	CO2	Identify the impact of developmental activities on air, water, soil, biological, vegetation andwildlife
	CO3	Predict the impacts on air, water, soil, biological, vegetation and wildlife
	CO4	Assess the impacts on air, water, soil, biological, vegetation and wildlife and select appropriate mitigation measures
	CO5	Develop environmental audit report by using environmental legislation to safeguard the society in relation to environmental impact assessment
AIR POLLUTION AND CONTROL A3157	CO1	Decide and Inspect the ambient air quality based on the analysis of air pollutants
	CO2	Apply and Compute the various techniques learnt, to remove high pollutant gases in the atmosphere
	CO3	Judge the plume behavior and its controlling parameters in a prevailing environmental condition
	CO4	Estimate carbon emissions and its consequences for various day to day activities
	CO5	Demonstrate the air pollution standards and laws
ENVIRONMENTAL ENGINEERING LAB A3126	CO1	Determine physical, chemical and biological characteristics of water and wastewater
	CO2	Estimate optimum dosage of coagulant
	CO3	Evaluate the quantity of Chlorine demand
	CO4	Analyze the quality of water and wastewater
	CO5	Interpret laboratorial results according to water quality standards
COMPUTER AIDED DRAFTING LAB A3127	CO1	Interpret and decide how to apply computer software to prepare civil engineering drawing
	CO2	Design typical reinforced concrete structural and steel members detailing
	CO3	Plan architectural floor plan
	CO4	Build geometric, multi view, dimensioning and detail drawings of typical 2-D engineered objects

Course Outcomes final year courses		
Course Title with code	**#**	**Course outcomes**
TRANSPORTATION ENGINEERING A3128	CO1	Classify different modes of transportation and planning stages for highways
	CO2	Design various highway geometric elements using the knowledge of mechanics
	CO3	Identify the rules, regulations and different signal systems based on traffic flow
	CO4	Build knowledge on different types of intersections and their advantages
	CO5	Create awareness on highway construction material and maintenance
WATER RESOURCES	CO1	Evaluate the failure criteria of Hydraulic Structures

ENGINEERING-II A3129	CO2	Estimate the reservoir capacity
	CO3	Design various diversion head works and spill ways
	CO4	Analyze various cross drainage works
	CO5	Solve the exit gradient problems under different flow conditions prone to seepage
REMOTE SENSING AND GIS APPLICATIONS A3130	CO1	Identify basic concepts, processes and components of remote sensing
	CO2	Classify the photogrammetry, GIS methods and their applications
	CO3	Select different types of GIS data collection, data entry and data representation methods
	CO4	Analyse spatial and attribute data using GIS
	CO5	Solve water resources related problems by using remote sensing & GIS techniques
ENGINEERING OPTIMIZATION A3379	CO1	Apply optimization techniques to various Engineering problems involving single variable and multi-variables with constraints and without constraints
	CO2	Determine optimum solution to linear programming problems using various techniques such as Simplex method, Revised Simplex method and Duality
	CO3	Evaluate the impact of various variables, constraints, resources, cost coefficients etc using Sensitivity (post-optimality) analysis
	CO4	Solve non-linear programming problems using various methods and techniques
	CO5	Analyze various systems / problems involving multi-stage decision-making processes using Dynamic programming technique based on the principle of optimality
CONSTRUCTION MANAGEMENT A3159	CO1	Apply different construction management techniques and practices
	CO2	Design construction project from begins to end of work with respect to budget, schedule, and safety specifications.
	CO3	Develop problem solving skills and decision making skills in construction management.
	CO4	Adapt the principles of leadership in business and management including complex project decision making, and associated risk management.
	CO5	Create a schedule for a construction project from start to completion within budget.
PAVEMENT ANALYSIS AND DESIGN A3163	CO1	Classify the pavement types and materials used for construction
	CO2	Apply different theories in designing of pavements
	CO3	Analyze the problems related to structural design of the flexible and the rigid runway pavements
	CO4	Discuss the necessity and introduce various ground improvement methods
	CO5	Evaluate the failures of rigid and flexible pavements
CONCRETE AND HIGHWAY ENGINEERING LABORATORY A3131	CO1	Experiment with highway materials and interpret results
	CO2	Examine the properties of bitumen
	CO3	Find the fresh and hardened properties of concrete

	CO4	Analyze the mechanical properties of concrete
	CO5	Apply the non-destructive testing methods on RC structures
GEOGRAPHICAL INFORMATION SYSTEMS LAB	CO1	Choose different types of data inputs and data correction methods in GIS
	CO2	Design various spatial layers to produce thematic maps and base maps
	CO3	Select suitable data conversion methods
	CO4	Analyze spatial and attribute data using arcgis software
	CO5	Apply GIS in Water Resources Engineering & Transportation Engineering related problems
MANAGEMENT SCIENCE A3014	CO1	Explain and infer the concepts and aspects of management
	CO2	Analyze the different organizational structures, plant layouts, work study tools for enhancement of productivity in an organization
	CO3	Apply the project management techniques to decide the optimum time and cost for completion of a project
	CO4	Apply statistical quality control techniques to know quality of product with in control limits
	CO5	Use Human resource management techniques for better people management
REHABILITATION AND RETROFITTING STRUCTURES A3167	CO1	Develop various maintenance and repair strategies
	CO2	Categorize the causes and prevention mechanisms of corrosion in steel reinforcement and fire induced damages
	CO3	Estimate the structural damage and recommend suitable repair and strengthening methods
	CO4	Understand the usage of different techniques for structural retrofitting
	CO5	Apply various methods and techniques for damage assessment and diagnosis.
SOLAR ENERGY AND APPLICATIONS A3278	CO1	Extrapolate the available solar energy, solar energy conversion and utilization processes
	CO2	Analyze the development of advanced storage solutions in thermal solar systems
	CO3	Identify and analyze the suitability of solar systems in different environmental conditions
	CO4	Explore the design of standalone PV system and investigate the applications of solar PV cells
	CO5	Explore the cost analysis and environmental issues of solar system

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Academic Year (2018-19)

Department Vision:

To be a leading source of competent computer engineers, meeting the needs of industry and society at large.

Department Mission:

- Facilitate learning in advanced technologies adopting innovative methods
- Associate continuously with industry, to design and implement experiential curriculum
- Promote Research and Development through Special Interest Groups (SIGs)
- Provide platform for harnessing entrepreneurial and leadership qualities.

Program Educational Objectives (PEOs)

PEO1: Graduate will establish himself/herself as effective professionals by solving real world problems using investigative and analytical skills along with the knowledge acquired in the field of Computer Science and Engineering.

PEO2: Graduate will demonstrate his/her ability to adapt to rapidly changing environment in advanced areas of Computer Science and scale new height in their profession through lifelong learning.

PEO3: Graduate will prove his/her ability to work and communicate effectively as a team member and /or leader to complete the task with minimal resources, meeting deadlines.

PEO4: Graduate will embrace professional code of ethics in the profession while deliberately being part of projects which contributes to the society at large without disturbing the ecological balance.

Program Outcomes (POs):

PO1: Engineering Knowledge: Apply 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 specified needs with appropriate consideration for the public health and safety, and 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 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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of 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 multi-disciplinary 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 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)

PSO1: To collect requirements, analyze, design, implement and test software Systems.

PSO2: To analyze the errors and debug them accordingly.

Course Outcomes for Second Year First Semester Course		
Course Title with Code	**#**	**Statement**
DESIGN AND ANALYSIS OF ALGORITHMS (A3506)	CO1	Demonstrate the importance various algorithmic notations and their usage to give asymptotic upper, lower bounds on time and space complexity of algorithms.
	CO2	Apply divide and conquer strategy to solve various computing problems.
	CO3	Estimate all feasible solutions using greedy strategy and recite an algorithm that employs this strategy.
	CO4	Construct algorithms for solving real world problems using dynamic programming
	CO5	Apply fundamental graph traversal techniques to solve various applications using backtracking.
	CO6	Analyze Branch and Bound techniques and explain the significance of NP Completeness.
COMPUTER ORGANIZATION AND MICROPROCESSORS (A3507)	CO1	Comprehend the basic organization of modern computer systems.
	CO2	Analyze an instruction-set architecture, propose a suitable data path and control unit implementation.
	CO3	Analyze the operation of fixed and floating point arithmetic units.
	CO4	Understand and apply the internal working flow of 8086microprocessor.
	CO5	Apply assembly language programming in design of microprocessor based system.
	CO6	Design and analyze the memory, I/ O peripheral interfacing process with 8086.
OBJECT ORIENTED PROGRAMMING (A3509)	CO1	Use various programming constructs of object oriented language.
	CO2	Apply principles of object oriented programming to model/design real world problems.
	CO3	Use exception handling mechanism to develop fault tolerant applications.
	CO4	Analyze the concepts of multi threaded programming and synchronization.
	CO5	Use GUI controls and event handling mechanism to develop interactive window/desktop applications.
	CO6	Analyze need of applets, swings to develop simple web application.
COMPUTER	CO1	Show the interaction between CPU, memory and I/O

ORGANIZATION AND MICROPROCESSORS LAB (A3510)		ports by implementing programs.
	CO2	Program a microprocessor using instruction set of 8086.
	CO3	Master the assembly level programming using 8086 instruction set.
	CO4	Distinguish how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
	CO5	Demonstrate is clear understanding of the interaction for data transfer between CPU, memory and I/O ports
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (A3511)	CO1	Use various constructs of object orient programming
	CO2	Write programs using string API.
	CO3	Analyze the need of object oriented programming principles.
	CO4	Apply exception handling mechanism to overcome run-time errors.
	CO5	Prepare for writing multi threaded applications.
	CO6	Use event handling and AWT to design GUI applications.

Course Outcomes for Second Year Second Semester Course		
PRINCIPLES OF PROGRAMMING LANGUAGES (A3512)	CO1	Analyze the designing criteria of different programming languages to choose appropriate language for implementation of real time applications.
	CO2	Identify appropriate primitive/user defined data types for increasing program efficiency.
	CO3	Apply sub program concepts to improve the readability of the program.
	CO4	Analyze different object oriented programming features and to apply in developing efficient web programs with concurrent ability.
	CO5	Apply exception handling techniques to develop robust programs to sustain against all runtime exceptions.
FORMAL LANGUAGES AND AUTOMATA THEORY (A3513)	CO1	Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
	CO2	Design grammars and automata (recognizers) for different language classes.
	CO3	Identify formal language classes and prove language membership properties.
	CO4	Prove and disprove theorems establishing key properties of formal languages and automata.
	CO5	Acquire a fundamental understanding of core concepts relating to the theory of computation and computational models including (but not limited to) decidability and intractability.

SOFTWARE ENGINEERING (A3514)	CO1	Identify the right process model to develop a software system.
	CO2	Gather requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements document.
	CO3	Propose design as per functional and non-functional requirements using design principles.
	CO4	Propose testing strategies for application being developed.
	CO5	Identify right set of umbrella activities for quality management and assurance.
OPERATING SYSTEMS (A3515)	CO1	Analyze the concept of Process management, Synchronization and Concurrency control.
	CO2	Examine Deadlock handling methods.
	CO3	Apply the concepts of Memory management techniques.
	CO4	Use File and Disk Management Schemes for effective Storage.
	CO5	Examine different Protection and Security principles associated with Operating Systems.
	CO6	Use simple utilities and system calls for accessing Operating System Services.
DATABASE MANAGEMENT SYSTEMS (A3516)	CO1	CO1.Design and implement a database schema for a given problem domain.
	CO2	CO2.Construct Queries in Relational algebra, relational calculus and SQL.
	CO3	CO3.Apply Normalization techniques to reduce data redundancy in data base.
	CO4	CO4.Analyze various transaction control and recovery methods to keep data base consistent.
	CO5	CO5.Construct the file of data records by using appropriate storage and access structure.
OPERATING SYSTEMS LAB (A3517)	CO1	Use file handling utilities / commands of UNIX operating system.
	CO2	Apply inter process communication mechanisms of UNIX.
	CO3	Compare various CPU scheduling algorithms performance.
	CO4	Analyze whether a system is in safe state or not using deadlock avoidance algorithm.
	CO5	Apply memory management strategies.
	CO6	Use file management system calls to simulate UNIX commands.
DATABASE	CO1	Design and implement a database schema for a given

MANAGEMENT SYSTEMS LAB (A3518)		problem domain.
	CO2	Formulate a query to retrieve information from database.
	CO3	To implement database security and maintenance.
	CO4	Normalize a database.
	CO5	Applying enforce integrity constraints on a database.

Course Outcomes for Third Year Second Semester Course		
COMPUTER GRAPHICS (A3602)	CO1	Identify computer graphics applications, computer graphics Hardware and software.
	CO2	Extend basic geometric primitives algorithms for producing custom shapes and Compute 2D or 3D transformations for doing manipulations on objects.
	CO3	Combine basic transformations to produce composite transformations and compare the 2D, 3D viewing process and can select the appropriate clipping techniques for producing view of objects.
	CO4	Analyze the curve generation techniques and Illustrate 3D rendering process, various types of projection methods available.
	CO5	Utilize the efficient visible surface detection algorithms, projection concepts in rendering a view of scene of objects.
WEB TECHNOLOGIES (A3601)	CO1	CO1.Apply various HTML tags used to design static web pages.
	CO2	CO2.Apply CSS and JavaScript Constructs to perform Client side validation and designing of dynamic web pages.
	CO3	CO3.Apply various PHP construct to develop server side applications and also familiar of transporting data among applications using XML.
	CO4	CO4.Understand how to configure Web servers and deployment of applications.
	CO5	CO5.Design server side; Database and MVC based applications using Servlet, JSP and JDBC.
	CO6	CO6. Understand Handling of asynchronous requests using AJAX programming.
SOFTWARE TESTING METHODOLOGIES (A3612)	CO1	To understand the purpose of testing, types of errors, fault models and various test process.
	CO2	To understand adequacy assessment using control flow and path testing techniques.
	CO3	Analyze various transactions, data and domain test strategies to work with various functionalities and various paths and path expressions to reduce the

		computational cost.
	CO4	Analyze various states, transitions and graph matrices regarding to state and graph matrices.
	CO5	Design test cases for the real world problems effectively by following standards. CO6. Apply appropriate software testing tools, techniques and methods for more effective systems during test planning and execution phases of software development project and risk analysis.
	CO6	To understand the purpose of testing, types of errors, fault models and various test process.
COMPUTER NETWORKS (A3519)	CO1	To understands the terminology and concepts of OSI reference model and the TCP/IP reference model and functions of each layer.
	CO2	To identify the different types of network topologies, protocols, network devices and their functions within a network
	CO3	To master the concepts of protocols, networks interfaces, and design/performance issues in LAN and WAN
	CO4	To understand and building the skills of sub netting and routing mechanisms, familiarity with basic protocols of computer networks and how they can be used to assist in network design and implementation
	CO5	Specify and identify deficiencies in existing protocols, and then go on to formulate new and better protocols.
COMPILER DESIGN (A3520)	CO1	Design and implement lexical Analyzer for a simple programming language.
	CO2	Design and implement syntax Analyzer using top down or bottom up techniques. CO3.Analyze semantic analyzer for a simple programming language.
	CO3	Compare different intermediate code generation forms.
	CO4	Analyze machine dependent and independent code optimizer techniques.
	CO5	Design and implement lexical Analyzer for a simple programming language.
OBJECT ORIENTED ANALYSIS AND DESIGN (A3607)	CO1	Possess an ability to practically apply knowledge software engineering methods, such as object - oriented analysis and design methods with a clear emphasis on UML
	CO2	Have a working ability and grasping attitude to design and conduct object oriented analysis and design experiments using UML, as well as to analyze and evaluate their models
	CO3	Have a capacity to analyze and design software systems, components to meet desired needs
	CO4	Show ability to form and work on multi-disciplinary teams that are able to perform multiple - faceted tasks

		from domain analysis and understanding to design and develop software systems based on object-oriented thinking
	CO5	Display an ability to identify, formulate and solve software development problems: software requirements, specification (problem space), software design, and implementation (solution space)
WEB TECHNOLOGIES LAB (A3603)	CO1	Analyze and create web pages using languages like HTML, DHTML, CSS, PHP and JavaScript
	CO2	Design XML Schema and create XML documents and Java Beans
	CO3	Use server side components like Servlets to build dynamic websites
	CO4	Create websites using server-side components using JSP
	CO5	Design and construct various data base tables using JDBC and produce various results based on given query
CASE TOOLS LAB (A3609)	CO1	Master key principles in OO analysis design and development
	CO2	Be familiar with the application of the Unified Modeling Language (UML) towards analysis and design
	CO3	Be familiar with alternative development processes
	CO4	Apply design principles
	CO5	Identify and apply key principles, rules, and heuristics in OO analysis and design apply UML 2.0
	CO6	Have a deep knowledge of the principles of object-oriented design

Course Outcomes for Third Year Second Semester Course		
WIRELESS AND MOBILE COMPUTING (A3521)	CO1	Demonstrate the basic concepts and principles in mobile computing
	CO2	Distinguish the structure and components for Mobile IP and Mobility Management
	CO3	Compare the positioning techniques and location-based services and applications
	CO4	Analyze the technical challenges posed by current mobile devices and wireless communications
	CO5	Identify software tools and APIs for mobile applications and hence be aware of their scope and limitations
INFORMATION SECURITY (A3608)	CO1	Analyze the different Security Attacks, Services, and Mechanisms work security models
	CO2	Apply classical encryption algorithms (Substitution and Transposition ciphers) and DES algorithms to encrypt plaintext (Apply)
	CO3	Distinguish the modern Cryptography algorithm such as DES, AES, double DES, Triple DES, RC4 algorithm and analyze modern cryptanalysis techniques
	CO4	Solve the problem on Number theory, public key

		cryptography techniques (RSA) and key management algorithms (Diffie-Hellman)
	CO5	Compare and contrast message authentication algorithms (SHA-512, MAC, and HMAC), symmetric and asymmetric encryption and authentication standards and protocols
DATA WAREHOUSING AND DATA MINING (A3522)	CO1	Apply preprocessing techniques on various data sets
	CO2	Develop data warehouse using various schemas for enterprise applications
	CO3	Apply supervised learning techniques on various data sets
	CO4	Apply unsupervised techniques on various data type
	CO5	Analyze various web mining technique
SOFTWARE ARCHITECTURE(A3652) (Professional Elective - I)	CO1	Demonstrate the importance and role of software architecture in large-scale software systems
	CO2	Design and Integrate software architecture for large-scale software systems
	CO3	Recognize major software architectural styles, design patterns, and frameworks
	CO4	Generate architectural alternatives for a problem and selection among them
	CO5	Identify and assess the quality attributes of a system at the architectural level
ADVANCED COMPUTER ARCHITECTURE (A3551) (Professional Elective - I)	CO1	Describe the principles of computer design
	CO2	Classify instruction set architectures
	CO3	Analyze the operation of performance enhancements such as pipelines, caches, shared memory
	CO4	Describe modern architectures such as RISC, VLIW (very large instruction word) and multi-cpu systems
	CO5	Compare the performance of different architectures
DISTRIBUTED DATABASES (A3552) (Professional Elective - I)	CO1	Apply Top-Down Design Process, Distributed Database Design Issues, Fragmentation, Allocation, and Database Integration-Bottom-up approach
	CO2	Analysis of Query Decomposition Normalization, Primary Horizontal, Vertical, derived and Hybrid Fragmentation
	CO3	Examine of Query optimization, Concurrency Control and Deadlock Management
	CO4	Use Query Parallelism, Parallel Query Optimization and Load Balancing
	CO5	Interpret Distributed Object Storage, Object

		Query Processing and Transaction Management
ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS (A3553) (Professional Elective - I)	CO1	Analyze and apply the basic the concepts of artificial intelligence and the use of agents into the real world scenario
	CO2	Identify, analyze, formulate and solve complex problems by using various search techniques
	CO3	Explore with a better understanding of logic programming skills and resolve problems related to reasoning
	CO4	Design, construct and evaluate a neural network based system, with various learning process models
	CO5	Plan and design an expert system
IMAGE PROCESSING (A3554)(Professional Elective - II)	CO1	Know and understand the basics and fundamentals of digital signal and image processing, such as digitization, sampling, quantization, and 2D-transforms
	CO2	Operate on images using the processing techniques of smoothing, sharpening, enhancing, reconstructing geometrical alterations, filtering, restoration, segmentation, features extraction, compression, encoding and color /multichannel
	CO3	Manipulate images using the computer: reading, writing, printing, and operating on them
	CO4	Apply and relate the basic imaging techniques to practical cases, such as, multimedia, videoconferencing, pattern and object recognition
	CO5	Aware of the ethical and legal issues related to image processing, such as, copyright, security, privacy, pornography, electronic distribution, etc
STRUTS AND SPRING FRAMEWORK (A3555) (Professional Elective - II)	CO1	Build struts frame work and struts2 XML based validation application
	CO2	Develop spring applications using IDE, IOC Container
	CO3	Develop spring applications using JDBC
	CO4	Develop web applications using MVC architecture
	CO5	Use DAO design patterns in developing applications
HUMAN COMPUTER INTERACTION (A3556) (Professional Elective - II)	CO1	Identify the elements of good user interface design and effective GUI
	CO2	Identify the importance of human characteristics and understanding business functions
	CO3	Analyze screen design principles for making good decisions based on technological Considerations in interface design.
	CO4	Select the window, device and screen based controls through navigation schemes

	CO5	Identify the basic components and interaction devices to interact with the computers
SEMANTIC WEB AND SOCIAL NETWORKS (A3557) (Professional Elective - II)	CO1	Able to understand the basics of Intelligent Web Applications and limitations
	CO2	Able to be proficient with Ontology's and their role in the semantic web and Ontology Languages like Resource Description Framework, RDF schema, Ontology Web Language (OWL)XML schema
	CO3	Able to understand and design current Semantic Web Applications, Services and Technologies to meet desired needs within realistic constraints
	CO4	Able to analyze and identify web searching problems and apply the semantic searching techniques and applications for obtaining its solution
	CO5	Demonstrate knowledge of professional, ethical, legal, security and social issues and responsibilities in designing Semantic web and social Networks
NETWORK SIMULATION LAB (A3523)	CO1	Develop their own commands and systems calls in UNIX
	CO2	Use modeling and simulation as a tool for the evaluation of communication protocols and networks
	CO3	Build various simulation models
	CO4	Create and analyze the network traffic between two systems
	CO5	Become proficient in network simulation tools
DATA WAREHOUSING AND DATA MINING LAB (A3524)	CO1	Apply various preprocessing Techniques using WEKA tool for the given datasets
	CO2	Develop various data integration and transformations using Kettle Pentaho tool
	CO3	Build data Cubes and perform OLAP Operations
	CO4	Apply appropriate association and classification techniques to interpret data and provide valid conclusions
	CO5	Apply clustering techniques, compare the results and write effective reports
Course Outcomes for Fourth Year First Semester Course		
OPEN SOURCE TECHNOLOGIES (A3604)	CO1	Solve computer software problems by using PHP and MySQL
	CO2	Familiarize and define the programming syntax and constructs of different open source programming languages
	CO3	Analyze and implement Scripting applications using Python
	CO4	Demonstrate ability to exhibit knowledge of developing applications using Python
	CO5	Ability to write scripts using AngularJS and

		Jquery
CLOUD COMPUTING (A3525)	CO1	Know and understand the basic ideas of Cloud Computing
	CO2	Understand the architecture, deployment models, and infrastructure models of Cloud Computing
	CO3	Ability to understand distributed storage and performance
	CO4	Familiarity with the cloud computing security, federation, presence, identity, and privacy
	CO5	Be familiar with disaster recovery in cloud computing
	CO6	Be familiar with open source cloud computing software, and free/commercial cloud services
MOBILE APPLICATION DEVELOPMENT (A3611)	CO1	Analyze architecture, the ecosystem, features and tools to design mobile applications
	CO2	Create effective user interfaces that leverage evolving mobile device capabilities
	CO3	Design, customize and enhance mobile applications with various widgets
	CO4	Experiment with different application components to design various user friendly mobile applications
	CO5	Build database and server-side applications to provide complete mobile development solutions
DESIGN PATTERNS (A3655) (Professional Elective - III)	CO1	Identify the appropriate design patterns to solve object oriented design problems
	CO2	Apply design solutions using creational patterns
	CO3	Apply structural patterns to solve design problems
	CO4	Apply design solutions by using behavioural patterns
DISTRIBUTED OPERATING SYSTEMS (A3558) (Professional Elective - III)	CO1	Comprehend the issues of terms of scheduling for user level processes/threads
	CO2	Understand the concepts of deadlock in operating systems and how they can be managed / avoided. Design and implement network computational techniques using distributed operating system
	CO3	Classify the types of security problems faced by operating systems and how to minimize these problems
	CO4	Understand the organization and synchronization of distributed operating systems
	CO5	Apply the knowledge of communication in distributed systems and how it can be used in remote procedure calls, remote objects and message-oriented communication
	CO6	Understand organizing principles for distributed

		systems through selection algorithms
INFORMATION RETRIEVAL SYSTEMS (A3559) (Professional Elective - III)	CO1	Implements algorithms like clustering, pattern searching, stemming algorithms and etc
	CO2	Understand the internal architecture of search engine
	CO3	Generate classification among the web pages using clustering techniques
	CO4	Help the student to understand the challenges over information retrieval systems by exploring functional difficulties over multimedia search and based rapid growing web content
	CO5	Design new algorithms based on existing challenges over web search and can able to develop modern digital libraries
AD-HOC AND SENSOR NETWORKS (A3560) (Professional Elective - III)	CO1	Explain the concepts, network architectures and applications of ad hoc and wireless Sensor networks
	CO2	Analyze the protocol design issues of ad hoc and sensor networks
	CO3	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
	CO4	Evaluate the QoS related performance measurements of ad hoc and sensor networks
COMPUTER VISION (A3561) (Professional Elective - IV)	CO1	Implement fundamental image processing techniques required for computer vision
	CO2	Perform shape analysis and implement boundary tracking techniques
	CO3	Chain codes and other region descriptors
	CO4	Apply Hough Transform for line, circle, and ellipse detections
	CO5	Adopt 3D vision techniques and implement motion related techniques
	CO6	Develop applications using computer vision techniques
HIBERNATE FRAMEWORK (A3562) (Professional Elective - IV)	CO1	Object-relational mapping concepts and the various issues and options available in Java to address Object persistence
	CO2	Details of Hibernate mapping, queries, transactions, and concurrency
	CO3	Problem of storing and retrieving objects to a relational database has its own name – impedance mismatch
	CO4	To build faster, more flexible and easier to maintain application persistence layers
USER EXPERIENCE ENGINEERING (A3563)(Professional Elective - IV)	CO1	Understand importance of User Experience (UX)
	CO2	Gain and apply knowledge of the theoretical frameworks, methodological approaches, and problems solving techniques related to user experience design

	CO3	Criticize existing interface designs, and improve them
	CO4	Design complete application with end-to-end understanding of current UXE best practices and processes
WEB SERVICES(A3654) (Professional Elective - IV)	CO1	Understand and write well-formed xml documents
	CO2	Format xml data to the desired format
	CO3	Develop web service enabled applications using soap, wsdl & udder
	CO4	Create, deploy, and call web services using java
	CO5	Understand the importance of distributed client-server applications
MOBILE APPLICATION DEVELOPMENT LAB (A3614)	CO1	Install and configure Android application development tools, Apply Java programming concepts to Android application development
	CO2	Design and develop user Interfaces for the Android platform
	CO3	Understand the technical challenges posed by current mobile devices and wireless communications; be able to evaluate and select appropriate solutions
	CO4	Select and evaluate suitable software tools and APIs for the development of a particular mobile application and understand their strengths, scope and limitations
	CO5	The students will be able to develop mobile applications with underlying database supports
	CO6	Develop and apply current standard-compliant scripting/programming techniques for the successful deployment of mobile applications targeting a variety of android supported devices
OPEN SOURCE TECHNOLOGIES LAB (A3606)	CO1	Demonstrate an ability to design and develop Web based programs, analyze, and interpret object oriented data and report results
	CO2	Develop confidence for self-education and ability for life-long learning needed for other open source languages and can participate and succeed in competitive examinations like Engineering services, exit interviews etc
	CO3	Solve computer software problems by writing customized programs in an efficient way using python Language
	CO4	Demonstrate an ability to design and develop PHP based novel products
	CO5	Exhibit profound knowledge to create, debug, and execute scripting programs using JQuery, AngularJS
Course Outcomes for Fourth Year Second Semester Course		
SOFTWARE PROJECT	CO1	Develop Strategy to achieve the concurrence

MANAGEMENT(A3661) (Professional Elective - V)		among stakeholders at every stage in the life cycle known by the student
	CO2	Capability to reach company goals and customer strategic objectives in every possible way
	CO3	Ability to approval the necessary management and executive review and approval points and practices per type of project
	CO4	Ability to organize the software lifecycle such that it will assure the predictability of the project
BIG DATA ANALYTICS(A3564) (Professional Elective - V)	CO1	Apply the statistical analysis methods
	CO2	Compare and contrast various soft computing frameworks
	CO3	Design distributed file systems
	CO4	Apply Stream data model
	CO5	Use visualization techniques
CYBER SECURITY(A3656) (Professional Elective - IV)	CO1	Analyze cyber-attack on different online web applications
	CO2	Apply different techniques to classify different types of cybercrimes
	CO3	Get an understanding over different government cyber laws and cyber for ensics techniques
	CO4	Understand how to protect them self and ultimately society from cyber-attacks
	CO5	Understanding cybercrime investigating methods using previous case studies
PATTERN RECOGNITION(A3565) (Professional Elective - V)	CO1	Classify the data and identify the patterns
	CO2	Extract feature set and select the features from given data set
	CO3	Explore different classification models
	CO4	Use concepts fuzzy pattern classifiers and perception
FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS(A3576) (Open Elective)	CO1	Design a model for database base on given problem
	CO2	Formulate a query to retrieve information from database
	CO3	Implement security and maintenance using consistency and recovery mechanism
	CO4	Normalize a database
FUNDAMENTALS OF IMAGE PROCESSING(A3577)(Open Elective)	CO1	Have an appreciation of the fundamentals of digital image processing and pattern recognition including the topics such as filtering, transforms, morphology, image analysis, compression, clustering, etc
	CO2	Be able to implement basic image processing algorithms in MATLAB and/or OpenCV (Python)
	CO3	Have the skill base necessary to further explore advanced topics of digital image processing and pattern recognition

	CO4	Be in a position to make a positive professional contribution in the field of digital image processing and pattern recognition
OPERATING SYSTEM FUNDAMENTALS(A3578) (Open Elective)	CO1	Understand the basic concepts of operating systems, Process Management and Synchronization
	CO2	Use Deadlock handling methods
	CO3	Understand the concepts of Memory and Storage management
	CO4	Apply File, Directory and disk management methods
	CO5	Understand Protection and Security principles and methods to handle
JAVA PROGRAMMING(A3579) (Open Elective)	CO1	Use various programming constructs of object oriented language
	CO2	Apply principles of object oriented programming to model/design real world problems
	CO3	Use exception handling mechanism to develop fault tolerant applications
	CO4	Analyze the concepts of multi-threaded programming and synchronization
	CO5	Use GUI controls and event handling mechanism to develop interactive window/desktop applications
	CO6	Analyze need of applets, swings to develop simple web application
CYBER LAWS(A3676) (Open Elective)	CO1	Analyze cyber-attack on different online web applications
	CO2	Apply different techniques to classify different types of cyber crimes
	CO3	Understand different government cyber laws and cyber forensics techniques and how to protect themselves and society from cyber-attacks
	CO4	Describe and analyze the hardware, software, components of a network and the interrelations
	CO5	Illustrate the concepts of confidentiality, availability and integrity in Information Assurance, including physical, software, devices, policies and people
E-COMMERCE TRENDS(A3677) (Open Elective)	CO1	Elaborate the components and roles of the E-Commerce environment
	CO2	Explain how to sell products and services on the web as well as to meet the needs of web site visitors
	CO3	Analyze e-commerce payment systems
	CO4	Identify and reach customers on the web
	CO5	Understand legal and ethical issues related to E-Commerce and web marketing approaches

PRINCIPLES OF SOFTWARE ENGINEERING (A3678)(Open Elective)	CO1	Identify the right process model to develop the right software system
	CO2	Gather requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements document
	CO3	Propose design as per functional and non-functional requirements using design principles
	CO4	Apply testing strategies for application being developed
	CO5	Find right set of umbrella activities for quality management and assurance
	CO6	Understand metrics in the process and projects domains
SCRIPTING LANGUAGES(A3679) (Open Elective)	CO1	Demonstrate knowledge about the advanced concepts of Linux OS like scheduling, cloning, signals
	CO2	Show skills to write PHP based GUI applications connecting to MYSQL
	CO3	Familiarize and define the programming syntax and constructs of LDAP connectivity in MySQL
	CO4	Analyze and implement Scripting applications using tuples, dictionaries and lists using Python
	CO5	Develop the ability to exhibit knowledge of writing packages and modules using Perl
DIGITAL ELECTRONICS(A3476) (Open Elective)	CO1	Perform arithmetic operations on different number systems and to apply the principles of Boolean algebra to minimize logic expressions
	CO2	Use K-map and Tabulation method to minimize and optimize two-level logic functions up to five variables
	CO3	Analyze some basic components used in digital systems such as adder and subtractor, decoder, encoder, multiplexer, flip-flops
	CO4	Design various combinational PLDs such as ROMs, PALs, PALs and PROMs
	CO5	Develop digital systems using registers and counters such as shift registers, Ripple counters, synchronous counters
PRINCIPLES OF ANALOG AND DIGITAL COMMUNICATIONS(A3477) (Open Elective)	CO1	Analyze linear and non - linear modulators and demodulators in time as well as frequency domain
	CO2	Design a linear and non linear modulators and demodulators for the analog signals
	CO3	Outline the basic concepts of digital communications with an insight into practical applications and Differentiate between PCM and DM and identify the applications of these modulation schemes in base band transmission
	CO4	Estimate overall digital communication system

		for the improvement of the system performance
	CO5	Analyze the performance of a digital communication system by introducing various spread spectrum modulation techniques
TRANSDUCERS AND MEASUREMENTS(A3478) (Open Elective)	CO1	Aware the basic concepts of measurement parameters as well as instrument standards, characteristics and errors
	CO2	Construct and design various measuring devices like voltmeters, Ammeters, Ohmmeters, analog, digital multi-meters and analyze different types of cathode ray oscilloscopes
	CO3	Design different bridge networks and analyze balanced condition for finding out values of resistance, capacitance and inductance
	CO4	Analyze different physical parameters like pressure, force, velocity, acceleration, sound, torque, strain and stress etc
	CO5	Apply the principles and practice for instrument design and develop for real world problems
INTERNET OF THINGS(A3479) (Open Elective)	CO1	Explain the definition and usage of the term “The Internet of Things” in different contexts
	CO2	Understand where the IoT concept fits within the broader ICT industry and possible future trends
	CO3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
	CO4	Design a simple IoT system comprising sensors, edge devices, wireless network connections and data analytics capabilities
	CO5	Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
NANO TECHNOLOGY APPLICATIONS TO ELECTRICAL ENGINEERING(A3276) (OpenElective)	CO1	Analyze the different forms of energy conversion methods conventional energy sources and sustainable renewable energy sources
	CO2	Investigate different Nano materials and characteristics and applications in electrical energy storage and electrical energy applications
	CO3	Evaluate micro fluid devices, Nano-engines, and energy conversion systems
	CO4	Explore hydrogen storage systems
INDUSTRIAL ELECTRONICS(A3277) (Open Elective)	CO1	Apply the knowledge of electronics in developing the controllers for industrial applications
	CO2	Interpret system drawings, and design simple systems for sequential control systems involving valves and cylinders

	CO3	Evaluate the operational characteristics the electrical and mechanical actuation systems CO4
SOLAR ENERGY AND APPLICATIONS(A3278) (Open Elective)	CO1	Compare the present and future available electrical power from solar energy in the world based on the knowledge of global solar horizontal irradiation
	CO2	Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems
	CO3	Identify simple to complex problems involved in solar thermal energy conversion technique used in the liquid based solar heating and cooling systems for buildings/societal needs
	CO4	Examine a solar PV(Photo Voltaic) system components and their function by utilizing the previous literature knowledge on different Photovoltaic solar cells like crystalline, Multi-Crystalline, Amorphous and thin film
	CO5	Analyze the techno economics interaction of developments in the solar energy systems
ENERGY MANAGEMENT AND AUDIT(A3279) (Open Elective)	CO1	Analyze the influence of energy availability on the development of Industries and various other organizations
	CO2	Discuss the concepts and technologies used for energy conservation
	CO3	Develop methods for evaluating worth of project
	CO4	Investigate the schemes for demand side management
	CO5	Evaluate the VAR requirements for effective voltage control
ELEMENTS OF MECHANICAL ENGINEERING(A3376) (Open Elective)	CO1	Distinguish renewable and non-renewable energy sources and the associated environmental issues
	CO2	Classify hydraulic turbines and gas turbines based on working principles
	CO3	Apply metal removal and joining processes to get the designed shape and size of products in manufacturing
	CO4	Make use of engineering materials such as ferrous & non-ferrous metals, alloys, composite for different applications
	CO5	Explain the basic concepts of refrigerants, refrigeration, air-condition system
BASIC THERMODYNAMICS AND HEAT TRANSFER(A3377) (Open Elective)	CO1	Define the laws of thermodynamics and heat transfer
	CO2	Explain the basic concepts of thermodynamics and heat transfer
	CO3	Solve the problems by applying the knowledge of thermodynamic and heat transfer laws
	CO4	Evaluate the performance of thermodynamic

		cycles, heat engines and heat pumps
	CO5	Analyze heat transfer due to conduction, convection and radiation
MECHANICAL MEASUREMENTS AND INSTRUMENTATION(A3378) (Open Elective)	CO1	Identify the functional elements of generalized measuring system and the errors occurring in Instrumentation and provide the remedial measures
	CO2	List various pressure measuring instruments and applications in real life
	CO3	Evaluate the measuring instruments and to trace the standards used to the ultimate standards
	CO4	Analyze the measuring system for the measurement of Displacement, Temperature, Flow, Liquid level, Stress, Strain and humidity
	CO5	Classify the various types of humidity, acceleration and vibration measurements
ENGINEERING OPTIMIZATION(A3379) (Open Elective)	CO1	Explain various optimization techniques
	CO2	Solve problems involving single variable and multi variables under constrained or unconstrained environments
	CO3	Examine the impact of various factors affecting the Linear programming problem and solution using sensitivity (Post Optimality) analysis, with the aid of Simplex Method, Revised Simplex Method, Dual Simplex Method etc
	CO4	Apply dynamic programming technique to find optimum solution for inventory, capital budgeting, resource allocation, Production planning and control problems etc
	CO5	Solve quadratic, geometric and non-linear programming problems using different methods
ENVIRONMENTAL POLLUTION AND MANAGEMENT(A3176) (Open Elective)	CO1	Distinguish between various modes of air pollution and their characteristic
	CO2	Examine air pollution sampling and classify its level
	CO3	Evaluate water quality and propose necessary measures
	CO4	List different standards laid by governing authorities
	CO5	Summarize functions carried out by controlling bodies
REMOTE SENSING AND GIS(A3177) (Open Elective)	CO1	Explain basics of Aerial Photography, Remote sensing and GIS
	CO2	Describe the working principle of interpretation of Aerial photographs and satellite
	CO3	Utilize knowledge about the principles and physics of Remote sensing and data acquisition
	CO4	Summarize the data types, data storage and carry out the analysis of spatial and attribute data

	CO5	Apply applications of remote sensing and GIS in various fields
DISASTER MANAGEMENT(A3178) (Open Elective)	CO1	List out different causes of Environmental hazards
	CO2	Classify environmental hazards and disasters, Endogenous hazards, exogenous hazards, infrequent events - Cumulative atmospheric hazards / disasters
	CO3	Explain different characteristics of hazards
	CO4	Develop Emerging approaches in Disaster management
CONSTRUCTING PLANNING AND MANAGEMENT(A3179) (Open Elective)	CO1	Improve business and management skills in positions within the construction industry
	CO2	Adapt technical skills and knowledge in mathematics, science, construction, and technology in support of planning, analysing , and solving construction problems
	CO3	Utilize industry resources including associations and organizations, professional publications, and governmental data to analyze, evaluate, and apply current trends within the industry
	CO4	Make use of decision-making in personal and professional endeavors
	CO5	Design a quality construction project from start to completion while maintaining budget, schedule, and safety requirements
BASIC PROGRAM IN ENTREPRENEURSHIP(A3081) (Open Elective)	CO1	Understand the role, characteristics, qualities, and functions of entrepreneur and use this knowledge to become future entrepreneurs
	CO2	Understand various Institutional support for setting up a business enterprise and apply this knowledge while approaching these institutions for financial support
	CO3	Understand role, importance and functions of women entrepreneur and use this knowledge to become future women entrepreneurs
	CO4	Understand the concept of Project Management and steps in Project development and apply this knowledge while taking future project assignments
	CO5	Understand training programs and different training institutions to impart training and apply this knowledge to train existing and future entrepreneurs
HUMAN RESOURCE MANAGEMENT(A3077) (Open Elective)	CO1	Identify functions of Human Resource Management
	CO2	Illustrate the process of Recruitment and selection
	CO3	Analyze the needs and methods for training
	CO4	Outline the functional relationship with

		performance and compensation
	CO5	Illustrate the importance of Industrial relations through collective bargaining, trade unions and industrial settlement machinery
ORGANIZATION BEHAVIOR(A3078) (Open Elective)	CO1	Understand approaches, opportunities and challenges of OB and use this knowledge to understand behaviour people in organizations
	CO2	Explain the importance of diversity in organizations as well as personality and perception of individual and apply this knowledge for better understanding of human beings in organizations
	CO3	Indicate the group behaviour and leadership styles exhibit by the managers and apply this knowledge to get the things done through subordinates efficiently and effectively
	CO4	Illustrate motivation theories and different Organization structures and apply this knowledge to create suitable organization structure for business as well as to get better work from employees
	CO5	Interpret the role of Conflict management, Stress management, Organization change and Self management and apply this knowledge for solving different problems of organizations
LOGISTICS AND SUPPLY CHAIN MANAGEMENT(A3079) (Open Elective)	CO1	Understand Supply chain management functions, drivers and different types of Logistics and apply the knowledge in business environment
	CO2	Illustrate the importance of Supply chain customer service and bench mark practices and apply them in business environment
	CO3	Explain the role of Sourcing and Distribution in supply chain and apply the knowledge in decision making process of organization
	CO4	Interpret the importance of Co-ordination in supply chain and role of Information Technology in supply chain and use this knowledge to run the organization successfully
	CO5	Classify Global logistics & Global supply chain processes and strategies and use this knowledge to understand Global supply chain and logistics environment
NATIONAL SERVICE SCHEME(A3080) (NSS) (Open Elective)	CO1	Contrast the different types of NSS activities and financial pattern of expenditure in Community service
	CO2	Enhance the concept of youth, as an agent in social change
	CO3	Classify and explain the working of organizational functionaries of NSS
	CO4	Design a system, component or process to meet

		the desired needs applicable to society, with realistic constraints such as economic, safety, manufacturability and sustainability etc
	CO5	Recognize the need for, and an ability to engage in society with lifelong learning capabilities with the concepts of volunteerism and its functions
PYTHON FOR DATA SCIENCE(A3680) (Open Elective)	CO1	Explore Python language fundamentals, including basic syntax, variables, and types
	CO2	Use and manipulate regular lists, functions and packages
	CO3	Build Numpy arrays, and perform interesting calculations
	CO4	Create and customize plots on real data
	CO5	Supercharge your scripts with control flow, and get to know the Pandas Data Frame

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

Autonomous institute affiliated to JNTUH

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Year: 2018-19

Vision, Mission, Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Vision of the Department:

To produce competent engineers with social responsibility who can address the global challenges in the field of Electronics and Communication Engineering.

Mission of the Department:

- By facilitating the students with an environment of academic freedom through student-centric learning approaches (**Student-Centric Learning**).
- By providing self-learning platform for both theoretical and practical foundations enabling life-long learning (**Foundation and Diversified Skills**).
- By imbibing human values and ethics to make them socially responsible professionals (**Social Responsibility**).
- By developing competence through hands-on experience with state-of-the-art hardware and software technologies to meet the requirements of industry (**Competence and Global Challenges**).

Program Educational Objectives (PEOs):

PEO1: Graduates will be able to attain a solid foundation in Electronics and Communication Engineering fundamentals with an attitude to pursue continuing education **(Continuing Education)**.

PEO2: Graduates will be able to function professionally in an increasingly international and rapidly changing world due to the advances in technologies and concepts and contribute to the needs of the society **(Professional Effectiveness and Contribution to Society).**

PEO3: Graduates will be able to acquire and exercise excellent leadership qualities at various levels, appropriate to their experience which addresses issues in a responsive, ethical and innovative manner **(Exercising Leadership).**

PEO4: Graduates will be able to excel in their careers by being a part of success and growth of an organization with which they are associated **(Excellence in Career).**

Program Outcomes (POs)

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

PO2: Problem Analysis: Identity, formulate, 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 specified needs with appropriate consideration for public health and safety, 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 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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

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

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

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary 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 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 lifelong learning in the broadest context of Technological Change.

Program Specific Outcomes (PSOs)

PSO1: Apply the knowledge of domain-specific skill set for the design and analysis of components in VLSI and Embedded systems.

PSO2: Demonstrate the technical competency and use appropriate techniques in the realization of advanced communication systems.

Course Outcomes for First Year First Semester Course		
Course		
Title with Code	**#**	**Statement**
Linear Algebra and Ordinary Differential Equations (A4001)	CO1	Solve system of linear equations using rank of a matrix.
	CO2	Examine the nature of Quadratic form using Eigen values and Eigen vectors.
	CO3	Solve the first and higher order linear ordinary differential equations.
	CO4	Make use of ordinary differential equations to solve, Rate of growth/decay, Newton's law of cooling, Electrical circuits and Simple harmonic motion problems.
	CO5	Apply Laplace transforms to solve ordinary differential equations.
Semiconductor Physics(A4003)	CO1	Analyze crystal structures in terms of lattice parameters and describe structures using X-rays. Identify various planes in crystals.
	CO2	Interpret the principles of quantum mechanics to classify solids. Relate semiconductor solid properties to the underlying physical concepts.
	CO3	Analyze the charge carrier dynamics and transport properties in semiconductors.
	CO4	Apply the concepts of semiconductor physics to analyze the

		various basic electronic devices.
	CO5	Illustrate working of a laser and develop communication systems using optical fibers.
Basic Electrical Engineering (A4201)	CO1	Applythe network reduction techniques and Knowledge of Alternating quantities to calculate Current, Voltage and Power for complex circuits.
	CO2	Analyzethe electrical Circuits using Nodal Analysis, Mesh analysis and Network theorems.
	CO3	Studyand Analyze the different types of DC Machines, Transformers.
	CO4	Test the performance of DC Generator, DC Motor, transformer and Induction Motor.
	CO5	Introduce components of low voltage electrical Installations.
Engineering Graphics and Computer Aided drafting (A4301)	CO1	Construct various types of scales and curves commonly used in engineering practice.
	CO2	Distinguish between first, second, third and fourth angle projections of systems.
	CO3	Estimate sheet metal requirement for making regular solids.
	CO4	Compare isometric and orthographic views of an object.
	CO5	Select CAD tools for modelling regular solids
Semiconductor Physics Laboratory (A4004)	CO1	Determination of Planck's constant and work function of a metal.
	CO2	Evaluation of band gap of a semiconductor and understand the temperature dependence function of resistivity.
	CO3	Analyze the diode characteristics.
	CO4	Analyze the I-V characteristics of solar cell and LED.
	CO5	Apply the principles of laser light and estimate the losses in the propagation of light in optical fibres.
Basic Electrical Engineering Laboratory(A4202)	CO1	Verify Ohms law, Kirchhoff laws and Impedance & Current of Series RL, RC and RLC Circuits.
	CO2	Analyze the transient response of Series RL, RC and RLC series circuits.
	CO3	Calculate the Voltage, Current Real power in a single phase Transformer.
	CO4	Test the performance of DC Motor, 1- phase transformer, Alternator and 3 phase Induction Motor.
Engineering Exploration (A4022)	CO1	Compare and contrast the contributions of different types of engineers in the development of a product, process or system.
	CO2	Apply the common engineering design process to solve complex problems and arrive at viable solution.
	CO3	Explore various contemporary software and hardware tools to provide solutions for the problems.
	CO4	Apply skills needed for successful team work including the basics of project management and written and oral

		communication.
	CO5	Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.
Course Outcomes for First Year Second Semester Course		
Course		
Title with Code	#	Statement
Advanced Calculus (A4002)	CO1	Evaluate improper integrals and examine the extremum of a function of several variables.
	CO2	Make use of multiple integrals to find the area and volume of a solid.
	CO3	Determine scalar potential function for irrotational force fields.
	CO4	Evaluate line, surface and volume integrals using vector integral theorems.
	CO5	Develop Fourier series and Fourier transforms of a function.
Engineering Chemistry (A4007)	CO1	Apply knowledge of three - dimensional arrangements of atoms, molecules and their effects on chemical reactions.
	CO2	Evaluate the behaviour, and interactions between matter and energy at both the atomic and molecular levels.
	CO3	Identify differences and similarities of the Batteries.
	CO4	Apply major chemical reactions in the synthesis of various drugs.
	CO5	Make use of different methods for softening hardness of water.
Programming for Problem Solving (A4501)	CO1	Select right identifiers, data types and operators for effective computation.
	CO2	Write programs using control statements.
	CO3	Write programs demonstrating use of arrays, strings and their applications.
	CO4	Demonstrate the applications of function and recursion.
	CO5	Write programs for simple real life problems using pointers and structures.
Functional English (A4009)	CO1	Demonstrate an understanding of the significance of humanity, love and service to mankind.
	CO2	Utilize appropriate vocabulary in the given contexts.
	CO3	Build competence in grammar.
	CO4	Develop effective academic reading skills.
	CO5	Develop effective academic writing skills.
Engineering Workshop (A4302)	CO1	Demonstrate the applications of manufacturing tools & joining process.
	CO2	Produce basic components using workshop trades.
	CO3	Identify and apply the tools for different trades of engineering workshop practice.

	CO4	Recognize the circuit and its operational features in house wiring.
	CO5	Explain the different materials that are used in workshop trades.
Engineering Chemistry Laboratory (A4008)	CO1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.
	CO2	Apply various titrations for the estimation of strengths of solutions and hardness of water.
	CO3	Identify different samples from a mixture by using various separation techniques.
	CO4	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
	CO5	Evaluate the percentage of yield of chemical substances by organic synthesis.
Programming for Problem Solving Laboratory(A4502)	CO1	Demonstrate use of control statements, arrays and strings.
	CO2	Demonstrate use of functions and recursive functions
	CO3	Design and implement C programs for simple real life problems using pointers and structures.
	CO4	Debug erroneous programs related to the C language.
English Language Communication Skills Laboratory	CO1	Improve his/her pronunciation.
	CO2	Take part in role-plays and perform effectively in real-life situations.
	CO3	Choose appropriate words and phrases to make effective telephonic conversations
	CO4	Minimize stage fear and make effective presentations.
	CO5	Build sustained conversations.
Social Innovation (A4021)	CO1	Develop awareness on social issues faced by local regions.
	CO2	Interpret and classify societal issues as simple, complicated and complex problems.
	CO3	Identify the core problem's cause and effect.
	CO4	Propose an innovative idea to solve the identified problem.

Course Outcomes (COs) for R15 Regulations (Batch: 2015-2019)

Mathematics – III (A3009)	
CO1	Evaluate improper integrals using beta and gamma functions; distinguish the concepts of Bessel and Legendre functions
CO2	Test for analyticity of complex functions using Cauchy-Riemann equations
CO3	Identify real and imaginary parts of elementary functions; apply conformal mapping to transform complex regions into simpler regions
CO4	Develop analytic function in series form using Taylor's series and Laurent's series

CO5	Evaluate integrals along a contour using Cauchy's integral formula and Residue theorem
Environmental Science (A3010)	
CO1	Identify the important components of environment.
CO2	Identify global environmental problems and come out with best possible solutions.
CO3	Apply environmental laws for the protection of forest and wildlife.
CO4	Apply the knowledge of Environmental ethics to maintain harmonious relation between nature and human being.
CO5	Illustrate the major environmental effects of exploiting natural resources.
Digital Logic Design (A3404)	
CO1	Demonstrate the importance of various number systems and to perform different arithmetic operations on them.
CO2	Make use of Boolean algebra postulates-map and tabulation methods to minimize Boolean functions and to implement with logic gates.
CO3	Construct and Analyze various combinational and sequential circuits used in digital systems such as adders, subtractors, code-convertors, decoders, encoders, multiplexers, flip flops, registers and counters.
CO4	Design various PLDs such as ROMs, PALs, PLAs and PROMs
CO5	Minimize the finite state machine and to construct special flow charts called ASM charts to define digital hardware algorithms.
Signals and Systems (A3405)	
CO1	Classify various types of signals and illustrate them with various examples
CO2	Construct the block level representation of system and experiment with the periodic and non-periodic input signals
CO3	Analyze the system in terms of magnitude and phase spectrums with both periodic and non-periodic input signals
CO4	Determine the stability of the continuous and discrete time domain systems with the help of Region of Convergence
CO5	Design the system which is non-aliasing for transmission of the signals
Random Signals And Stochastic Processes (A3406)	
CO1	Recall various probability concepts and apply the knowledge of probability to find cumulative distribution function and Probability density functions of random variables.
CO2	Extend the concept of single random variable to multiple random variables so as to tackle practical statistical communication problems.

CO3	Classify the different types of random processes to apply to real physical world problems.
CO4	Identify the importance of correlation function and its relation to power spectral density
CO5	Estimate the performance of linear time invariant systems in terms of noise factor, noise band width noise temperature and extend each to cascaded systems.
Electronic Circuit Analysis (A3407)	
CO1	Classify various amplifiers based on the applications and compare its characteristics
CO2	Analyze amplifier circuits using small signal low frequency and high frequency transistor models
CO3	Compare the concepts of positive and negative feedback and analyze its effects on the performance of amplifier circuits
CO4	Identify the need and compare the performance of various power amplifiers and tuned amplifiers
CO5	Design analog circuits such as voltage amplifiers, oscillators, power amplifiers and tuned amplifiers using discrete components
Simulation Lab (A3408)	
CO1	Apply the Basics of MATLAB thereby analyze the generation and transformations of Various Signals and Sequences.
CO2	Determine the Convolution and Correlation between Signals and sequences in real time scenario using MATLAB.
CO3	Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System using MATLAB
CO4	Design various number systems conversions and digital logic design circuits using LabVIEW.
CO5	Analyze the functionality of Combinational circuits and Sequential Circuits using LabVIEW.
Electronic Circuit Analysis Laboratory (A3409)	
CO1	Design small signal amplifiers for given specifications using discrete components and verify using Multisim circuit design software.
CO2	Interpret different types of negative feedback amplifiers using discrete components and compare with Multisim software.
CO3	Make use of Multisim circuit design software and discrete components for the implementation of oscillators like RC, LC for given specifications.
CO4	Compare the conversion efficiency of power amplifiers using discrete components and Multisim circuit design software.
Managerial Economics and Financial Analysis (A3011)	

CO1	Explain and infer the concepts of Managerial Economics and Financial Accounting
CO2	Analyze the demand, production, cost and break even to know interrelationship of among variables and their impact
CO3	Classify the market structure to decide the fixation of suitable price
CO4	Apply capital budgeting techniques to select best investment opportunity
CO5	Prepare financial statements and analyze them to assess financial health of business
Computer Organization and Architecture (A3508)	
CO1	Analyze the computer fundamentals and computer internal organization
CO2	Apply the register transfer operations and instructions in programs
CO3	Analyze the micro program control formats and evaluate the computer arithmetic algorithms
CO4	Analyze the memory access operations and memory architecture
CO5	Apply the multiprocessing in different inter process structures
Principles of Electrical Engineering (A3213)	
CO1	Apply the knowledge of magnetic circuits to different electrical machines.
CO2	Analyze the DC and AC transient behavior of series, parallel circuits.
CO3	Calculate losses and efficiencies of different electrical machines.
CO4	Evaluate the performance of different electrical machines with the help of suitable tests.
Electromagnetic Theory and Transmission lines (A3410)	
CO1	Apply Vector calculus to static electric – Magnetic fields in different engineering situation.
CO2	Apply the concepts of time varying EM fields to obtain Maxwell equations and analyze its application in EM wave propagation
CO3	Examine the phenomena of wave propagation through boundaries of different media.
CO4	Design the stub elements for impedance matching and analyze the characteristics of transmission line using smith chart.
Pulse and Digital Circuits (A3411)	
CO1	Apply the knowledge of Kirchhoff's voltage and Current laws to design various linear and nonlinear circuits
CO2	Analyze Quantitatively and qualitatively the physical behavior of active and passive elements and relate the theory to the evolution of analog and digital circuits.

CO3	Design different multi vibrators, time base generators and sampling gates by making use of semiconductor diodes and transistors.
CO4	Compare and contrast different types of logic families and interpret their use in various applications.
Analog Communications (A3412)	
CO1	Analyze linear and non - linear modulators and demodulators intime as well as frequency domain.
CO2	Design a linear and non-linear modulators and demodulators.
CO3	Determine the fundamental communication system parameters like power and bandwidth etc.
CO4	Evaluate the communication system performance in presence of the noise.
Pulse and Digital Circuits Lab (A3413)	
CO1	Interpret the output response of linear circuits and nonlinear circuits so as to realize the applications like High pass RC circuits, Low pass RC circuit, Clippers, Clampers and etc.
CO2	Conduct experiments to design and demonstrate various multi vibrators and sampling gates using analog components.
CO3	Implement and Examine logic gates and flip flops using discrete components.
CO4	Demonstrate the use of Multisim software and Realize analog and digital circuits using PSPICE tool.
Analog Communication Lab (A3414)	
CO1	Generate time domain waveforms and Evaluate fundamental communication system parameters such as modulation index, bandwidth, and frequency deviation for analog communication system.
CO2	Design pre-emphasis and de-emphasis filters to improve the efficiency of a frequency modulation system.
CO3	Analyze Automatic gain control mechanism and realize squelch action using AGC.
CO4	Implement phase locked loop concept to construct frequency multiplier.
CO5	Implement the fundamental communication system blocks using MATLAB.
Gender Sensitization (A3021)	
CO1	Build the significance of the process of socialization and relationships between men and women on the basis of a just and equal world.
CO2	Examine the decline of female sex ratio and discrimination faced by people with different gender identities.
CO3	Take part in house work, in order to allow for equality and share equal family spaces.

CO4	Estimate women's contribution to the nation's economy.
CO5	Analyze the consequences of sexual violence and importance of consent in friendship and other relationships.
CO6	Perceive the invisibility of women in history and show how locating a women in history makes them visible.
Control Systems (A3212)	
CO1	Develop the fundamentals of various types of control systems and also to determine the transfer function of mechanical and electrical systems.
CO2	Evaluate the transfer function by using block diagram reduction technique and masons gain formula and also to analyze the transfer function of servo motors.
CO3	Analyze the time response of first, second-order systems and concept of stability and also apply the different methods to find the stability of system like R-H criteria and root locus.
CO4	Examine the stability of control system by using different techniques like bode, polar and nyquist plot.
CO5	Design a lag, lead and lead-lag compensators and PID controllers and also to solve state transition matrices, state space models of time invariant systems.
Digital Communications (A3415)	
CO1	Develop the basic concepts of modulation, sampling, need for digital data transmission with an insight into practical applications.
CO2	Compare and contrast ASK, FSK, PSK digital carrier modulation schemes in terms of occupied bandwidth, complexity etc., and extend these into qpsk, mpsk, qam for improved spectral efficiency.
CO3	Apply the basics of information theory to calculate channel capacity and other measures.
CO4	Analyze the differences between the usage of systematic linear block codes and convolutional codes for non-burst and burst channel applications
CO5	Distinguish between source coding and channel coding for optimization of discrete memory less source and for error-free transmission of data over channel.
Digital Design through Verilog HDL (DDTV) (A3416)	
CO1	Apply the knowledge of HDL concepts to FPGA and ASIC design flow.
CO2	Develop all digital electronic circuits using different HDL abstraction level.
CO3	Test for the functionality of combinational and sequential circuits using EDA tools
CO4	Evaluate the performance of digital electronic circuits in view of real time scenario.
Antennas and Wave Propagation (A3417)	

CO1	Analyze various antennas like wire antennas, Aperture, Array and Microstrip.
CO2	Develop the basic skills necessary for designing a wide variety of practical antennas and antennas arrays.
CO3	Test the designed and fabricated antennas for their specifications.
CO4	Evaluate different wave propagation techniques to explain the wireless communication mechanism / modes.
Integrated Circuit Analysis (A3418)	
CO1	Apply the knowledge of Kirchoff's Voltage and Current Law for solving Linear and Non-Linear Applications.
CO2	Design various mathematical operation circuits using IC741 Integrated Circuits.
CO3	Analyze various applications constructed using Integrated Circuits such IC 741 Op-Amp and IC 555 & 565 Timers and also regulator ICs 78XX, 79XX and 723.
CO4	Design various timing applications using IC555 Timer & IC565 Phase Locked Loop Integrated Circuits.
Microprocessors and Microcontrollers (A3419)	
CO1	Apply the fundamentals of microprocessor & controller to investigate existing designs.
CO2	Compare & contrast the processor and controller for the implementation of real time applications.
CO3	Demonstrate assembly language programming proficiency to assemble and run on host machine.
CO4	Identify the required driver circuitry to microprocessor and controller I/O ports to interface external devices.
CO5	Design the required hardware & software modules and integrate to be a functional model.
Integrated Circuit Analysis and HDL Lab (A3421)	
CO1	Interpret the output response of linear Operational Amplifiers so as to realize the applications like Adders, Subtractions, Integrators, filters and etc.
CO2	Design and implement various applications using Analog ICs to demonstrate a given application / problem statement.
CO3	Demonstrate the use of Xilinx software and Realize basic digital Circuits using Verilog HDL.
CO4	Program and synthesize a given application / problem statement using EDA tools.
Microprocessors And Interfacing Lab (A3422)	
CO1	Describe the interaction between CPU, memory and I/O ports in various applications.

CO2	Master the assembly level programming language using 8086 instruction set.
CO3	Analyze how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
CO4	Design a simple microprocessor based system with functional requirements for hardware and software components for few input and output devices.
Professional Ethics and Human Values (PE&HV) (A3012)	
CO1	Adapt engineering ethics to overcome various moral dilemmas after choosing engineering as profession.
CO2	Develop awareness on different human values, such aslove, empathy, honesty, etc. to lead a successful life.
CO3	Know the responsibilities of the engineer towards the society.
CO4	List out and practice the safety procedures to avert the risks at work place.
CO5	Determine various roles of engineer and help them to make the world a better place.
Computer Networks(CN) (A3519)	
CO1	Distinguish the terminology and concepts of OSI reference model and the TCP/IP reference model and functions of each layer.
CO2	Experiment the different types of network topologies, protocols, network devices and their functions within a network.
CO3	Compare the concepts of protocols, network interfaces and design/performance issues in LAN and WAN.
CO4	Understand and building the skills of sub netting and routing mechanisms, familiarity with basic protocols of computer networks and how they can be used to assist in network design and implementation.
CO5	Discriminate deficiencies in existing protocols and then go on to formulate new and better protocols.
Embedded Systems (ES) (A3424)	
CO1	Apply an appropriate software tools to provide an interface between hardware peripherals and systems.
CO2	Interpret the need for RISC type computing system for advanced embedded applications.
CO3	Design the subsystems and integrate for a complete system to perform complex tasks.
CO4	Develop a product with functional requirements using optimal hardware and software components.
CO5	Identify a suitable firmware to meet real time computing constraints of an embedded system.

CMOS VLSI Design (A3425)	
CO1	Understand electrical properties of transistors and make use of fabrication steps to build CMOS circuits.
CO2	Analyze the characteristics of CMOS circuits to examine electrical behavior of digital circuits.
CO3	Experiment with various CMOS logic structures to model any digital circuit.
CO4	Determine the leakage issues in CMOS logic structures to assess the performance of a CMOS circuit.
JAVA PROGRAMMING (A3579)	
CO1	Construct application programs using OOP principles.
CO2	Analyze the various concepts of OOP in problem solving.
CO3	Develop high speed and fault tolerant applications with multi-threading and exception handling.
CO4	Use collections framework API with reduced programming effort.
CO5	Perform file handling with Java IO API.
CO6	Implement rich GUI applications.
Digital System Design (DSD) (A3451)	
CO1	Analyze the timing concepts of combinational and sequential circuits.
CO2	Develop and synthesis the HDL code for combinational and sequential circuits.
CO3	Design the CPLD and FPGA based combinational and sequential circuits.
CO4	Apply various test algorithms for diagnosing faults in combinational and memory.
CO5	Make use of the diverse combinational and sequential logics implementation in real time.
Data Communications (DC) (A3452)	
CO1	Develop basic concepts of data communications and compare digital data transmission techniques in terms of data rate, probability of error.
CO2	Compare diverse modulation techniques to develop a communication system model to increase the spectral efficiency.
CO3	Apply the fundamentals of data link layer for error detection, correction and flow control techniques on a Communication system
CO4	Analyze the application of network topologies for current and future applications to support the Quality of Service requirements
CO5	Design a functional setup of network environment with all the necessary data communication components, procedures and techniques

Low Power VLSI Design (LPVD) (A3454)	
CO1	Recognize the importance of low power circuit design and identify related limits.
CO2	Analyze power dissipation using various approaches in low power circuit design.
CO3	Examine the effect of different modeling techniques on power dissipation of a CMOS circuit.
CO4	Estimate the sources of energy dissipation in CMOS logic circuits and SRAM cells.
CO5	Develop power efficient logic circuits using latest techniques.
Satellite Communications(SC) (A3455)	
CO1	Identify different types of satellites and analyze the orbital mechanics, launching methods.
CO2	Classify different satellite subsystems and evaluate link budget for a satellite
CO3	Compare and contrast the radio propagation channels for Earth station -satellite and various multiple access techniques used for satellite communication applications
CO4	Analyze the principles of low earth orbit and geo stationary satellite systems.
CO5	Interpret the impact of GPS Navigation, NGSO constellation design for tracking and launching
Real Time Operating Systems (RTOS) (A3456)	
CO1	Compare and contrast a Real Time Operating System & other Operating System and also rectify the Real Time Design Issues
CO2	Design the applications to run in parallel either using Process or Threads
CO3	Develop a Practical Real Time System by using optimal core elements
CO4	Identify the Scheduling Schemes for Packet Switching Networks and Protocols for the Broadcast Networks
CO5	Test for the Performance Analysis of different Real Time Systems which are available in market
EMBEDDED SYSTEMS LAB (ES LAB) (A3426)	
CO1	Identify the functionality of development boards to implement embedded applications.
CO2	Compile bug free assembly or C language programs for microcontrollers to a required task.
CO3	Design an electronic circuit for diverse I/O devices used in real time embedded applications.
CO4	Develop a product with all sub systems of functional requirements in optimal hardware and software components.

CMOS VLSI Lab (A3427)	
CO1	Apply the knowledge of advanced concepts of circuit design to optimize digital/analog circuits.
CO2	Analyze the characteristics of CMOS based analog and digital circuits.
CO3	Construct the layouts for complex CMOS logic circuits by following design rules.
CO4	Evaluate the performance of analog/digital circuits in terms of power, speed and area.
Electronic Measurements and Instrumentation (A3428)	
CO1	Apply the acquired knowledge of measuring instruments to design various measuring devices.
CO2	Identify different Oscilloscopes for the measurement of various signals.
CO3	Analyze various bridge circuits for the measurement of physical quantities to minimize errors in measurements.
CO4	Classify different Transducers based on their principles and apply them in Mini Projects.
CO5	Inspect Data Acquisition Systems and to apply for Instrumentation in industrial applications.
Microwave Engineering(MWE) (A3429)	
CO1	Apply the concepts of electromagnetic field theory to analyze different types of microwave transmission lines
CO2	Estimate the S-Matrix of various microwave components from the knowledge of microwave measurement techniques
CO3	Compare the performance characteristics of various microwave tubes and solid state devices
CO4	Design the cavity resonators for a given Q-factor at various microwave frequencies
DIGITAL SIGNAL PROCESSING (DSP) (A3430)	
CO1	Interpret Digital Signal Processing using concepts of Discrete time signals and systems, LSI, stability and causality, discrete time systems described by difference equations
CO2	Interpret Frequency domain representation of discrete time signals and systems using Fourier series and Fourier transforms, Discrete Fourier transforms, Fast Fourier transforms (FFT).
CO3	Interpret applications of Z-Transform: Stability, Realization of Digital Filters: Structures for FIR systems: Direct form structure, Cascade form structures.
CO4	Interpret design of FIR digital filters: Symmetric and anti symmetric FIR filters, Design of linear phase FIR Digital Filters using Windows, Design of linear phase FIR

	Digital Filters
CO5	Interpret design of IIR Digital Filters: IIR filter design by Approximation of Derivatives, IIR filter design by impulse invariance, IIR filter design by bilinear transformation
Fundamentals of Database Management Systems (A3576)	
CO1	Design and implement a database schema for a given problem domain
CO2	Construct Queries in Relational algebra, relational calculus and SQL.
CO3	Apply Normalization techniques to reduce data redundancy in database.
CO4	Analyze various transaction control and recovery methods to keep database consistent.
CO5	construct the file of data records by using appropriate storage and access structure
CPLD and FPGA Architectures and Applications (A3457)	
CO1	Classify various PLDs based on the applications and compare its architectures.
CO2	Identify the technical problem and apply the knowledge to formulate the solutions in various engineering fields related to PLDs.
CO3	Distinguish between the concept of SRAM and Anti-fuse based FPGA architectures.
CO4	Make use of various techniques to implement the digital logic circuits using different FPGA architectures.
CO5	Experiment with the EDA tools to meet the major goals like size, speed and power consumption.
Radar Systems (A3458)	
CO1	Describes about radar fundamentals..
CO2	Classify pulsed and continuous types of radars Doppler Effect and the concepts of continuous wave radars
CO3	Discuss the operation of MTI and pulse Doppler radar. Examine the various tracking mechanisms as applicable to radar systems
CO4	Analyze the detection of radar signals in noise. Demonstrate the noise figure and radar receiver
Cellular and Mobile Communications(CMC) (A3462)	
CO1	Summarize the concepts pertained to cellular and mobile communications.
CO2	Identify different methods for reducing the interference.
CO3	Analyze various mobile radio propagation models and antennas for cell site and mobile.
CO4	Interpret different channel assignment strategies and handoffs.

CO5	Discuss the technical features of emerging cellular communication systems.
Digital Image Processing(DIP) (A3463)	
CO1	Understand image formation model and low level process, mid level process and high level process.
CO2	Apply the concepts of fundamental image enhancement algorithms and restoration techniques to improve the quality of image.
CO3	Analyze the images by applying various transformation techniques.
CO4	Estimate the shape and the pattern of an image using segmentation techniques and color image processing.
CO5	Identify a practical solution to common image processing problems like storage space and channel bandwidth in communication by using compression.
Digital Communications and Microwave Engineering Lab (A3431)	
CO1	Understand the concepts of digital modulation schemes and microwave measurement techniques
CO2	Apply the knowledge of basic mathematical background for communication signal analysis and scattering parameters to understand the operation of various microwave components
CO3	Analyze the signal flow in a digital communication system and wave propagation in the microwave transmission lines
CO4	Design and understand the generation of various digital modulations and microwave Transmission techniques using different sources
CO5	Evaluate the performance of various digital communication systems and characteristics of microwave components and devices.
Digital Signal Processing-Lab (DSP-LAB) (A3432)	
CO1	Identity properties of discrete-time systems such as time-invariance and linearity and compute the linear convolution and correlations of discrete-time sequences.
CO2	Evaluate the discrete Fourier transform (DFT) of a sequence, relate it to the DTFT, and use the DFT to compute the linear convolution of two sequences.
CO3	Develop small projects based on signal processing concepts using MATLAB and CC Studio
CO4	Solve state of the art problems and answer questions using and applying algorithms and programs on a DSP and analyze the changes in the signal after interpolation, decimation and L/M rate conversion
CO5	Examine digital signal processing algorithms like convolution, design of digital filters using CC Studio on DSP processors.
Mini Project (A3433)	
CO1	Apply relevant engineering principles and theories to design, built, operate, simulate

	and analyze the development of an engineering product, system or concept.
CO2	Design and perform investigations/experiments to collect data and analyze result in order to make relevant decision on the performance of an engineering product, system or concept.
CO3	Demonstrate the social, cultural and environmental responsibilities of an engineer.
CO4	Practice ethical and professional norms for the implementation of engineering projects.
CO5	Organize and present technical and scientific findings effectively through written and oral mode with the aid of multimedia tools.
Management Science (A3014)	
CO1	Explain and infer the concepts and aspects of management
CO2	Analyze the different organizational structures, plant layouts, work study tools for enhancement of productivity in an organization.
CO3	Apply the project management techniques to decide the optimum time and cost for completion of a project.
CO4	Apply statistical quality control techniques to know quality of product with in control limits
CO5	Use Human resource management techniques for better people management.
Operating System Fundamentals (A3578)	
CO1	Understand the difference between different types of modern operating systems, virtual machines and their structure of implementation and applications.
CO2	Identify the rationale behind various memory management techniques along with issues and challenges of main memory, virtual memory and file system.
CO3	Understand the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.
CO4	Illustrate different protection and security mechanisms in operating system
Wireless Communications and Networks (A3464)	
CO1	Apply the knowledge of various systems, techniques and technologies for effective wireless communication.
CO2	Analyze the different types of protocols and standards for the enhancement (development) of wireless networking.
CO3	Make use of various design considerations to utilize the spectrum effectively
CO4	Identify the ways for data transfer to achieve higher data rates in wireless networks.
DSP Processors and Architectures (A3466)	
CO1	Develop basic DSP algorithms using DSP processors.
CO2	Analyze the effects of quantization and aliasing in a real-time DSP system.

CO3	Apply interfacing concepts to programmable DSP devices so as to connect the memory and I/O devices.
CO4	Correlate execution control and pipelining as applicable to programmable DSP processors.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD
Autonomous institute affiliated to JNTUH

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Academic Year: 2018-19

Vision of the Department:

Producing professionally competent graduates in the domain of Electrical Engineering to serve the industry/society addressing the challenges.

Mission of the Department:

- Provide professional skills in electrical circuit design and simulation to the students
- Develop industry institute interface for collaborative research, internship and entrepreneurial skills among the stakeholders
- Bringing awareness among the students with emerging technologies to meet the dynamic needs of the society
- Encourage multi-disciplinary activities through research and continuous learning activities.

PEO 1 Graduates will excel to make way to give solutions to real time problems through technical knowledge and operational skills in the field of Electrical Engineering

PEO 2 Graduates will demonstrate their ability to acquaint with the ongoing trends in the field of Electrical Engineering to address the needs of the society.

PEO 3 Graduates will communicate effectively as team players to cope with building a Prospective career.

PEO 4 Graduates of the program will act with Integrity and have inter-personal skills in catering the need based requirements blended with ethics and professionalism.

PROGRAM OUTCOMES (POs):

PO1. 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):

PSO1: Conceptualize complex electrical and electronics systems, employ control strategies for power electronics related applications to prioritize societal requirements.

PSO2: Design, analyze and create energy efficient and eco-friendly power & energy systems.

Course Outcomes for First Year First Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Linear Algebra and Ordinary Differential Equations (A4001)	CO1	Solve system of linear equations using rank of a matrix.
	CO2	Examine the nature of Quadratic form using Eigen values and Eigen vectors.
	CO3	Solve the first and higher order linear ordinary differential equations.
	CO4	Make use of ordinary differential equations to solve, Rate of growth/decay, Newton's law of cooling, Electrical circuits and Simple harmonic motion problems.
	CO5	Apply Laplace transforms to solve ordinary differential equations.
Semiconductor Physics(A4003)	CO1	Analyze crystal structures in terms of lattice parameters and describe structures using X-rays. Identify various planes in crystals.
	CO2	Interpret the principles of quantum mechanics to classify solids. Relate semiconductor solid properties to the underlying physical concepts.
	CO3	Analyze the charge carrier dynamics and transport properties in semiconductors.
	CO4	Apply the concepts of semiconductor physics to analyze the various basic electronic devices.
	CO5	Illustrate working of a laser and develop communication systems using optical fibers.
Basic Electrical Engineering (A4201)	CO1	Apply the network reduction techniques and Knowledge of Alternating quantities to calculate Current, Voltage and Power for complex circuits.
	CO2	Analyze the electrical Circuits using Nodal Analysis, Mesh analysis and Network theorems.
	CO3	Studyand Analyze the different types of DC Machines, Transformers.
	CO4	Test the performance of DC Generator, DC Motor, transformer and Induction Motor.
	CO5	Introduce components of low voltage electrical Installations.
Engineering Graphics and Computer Aided drafting (A4301)	CO1	Construct various types of scales and curves commonly used in engineering practice.
	CO2	Distinguish between first, second, third and fourth angle projections of systems.
	CO3	Estimate sheet metal requirement for making regular solids.
	CO4	Compare isometric and orthographic views of an object.
	CO5	Select CAD tools for modelling regular solids
Semiconductor Physics Laboratory (A4004)	CO1	Determination of Planck's constant and work function of a metal.
	CO2	Evaluation of band gap of a semiconductor and understand the temperature dependence function of resistivity.
	CO3	Analyze the diode characteristics.
	CO4	Analyze the I-V characteristics of solar cell and LED.
	CO5	Apply the principles of laser light and estimate the losses in the propagation of light in optical fibres.
Basic Electrical	CO1	Verify Ohms law, Kirchhoff laws and Impedance & Current of Series RL,

Engineering Laboratory(A4202)		RC and RLC Circuits.
	CO2	Analyze the transient response of Series RL, RC and RLC series circuits.
	CO3	Calculate the Voltage, Current Real power in a single phase Transformer.
	CO4	Test the performance of DC Motor, 1- phase transformer, Alternator and 3 phase Induction Motor.
Engineering Exploration (A4022)	CO1	Compare and contrast the contributions of different types of engineers in the development of a product, process or system.
	CO2	Apply the common engineering design process to solve complex problems and arrive at viable solution.
	CO3	Explore various contemporary software and hardware tools to provide solutions for the problems.
	CO4	Apply skills needed for successful team work including the basics of project management and written and oral communication.
	CO5	Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.
Course Outcomes for First Year Second Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Advanced Calculus (A4002)	CO1	Evaluate improper integrals and examine the extremum of a function of several variables.
	CO2	Make use of multiple integrals to find the area and volume of a solid.
	CO3	Determine scalar potential function for irrotational force fields.
	CO4	Evaluate line, surface and volume integrals using vector integral theorems.
	CO5	Develop Fourier series and Fourier transforms of a function.
Engineering Chemistry (A4007)	CO1	Apply knowledge of three - dimensional arrangements of atoms, molecules and their effects on chemical reactions.
	CO2	Evaluate the behaviour, and interactions between matter and energy at both the atomic and molecular levels.
	CO3	Identify differences and similarities of the Batteries.
	CO4	Apply major chemical reactions in the synthesis of various drugs.
	CO5	Make use of different methods for softening hardness of water.
Programming for Problem Solving (A4501)	CO1	Select right identifiers, data types and operators for effective computation.
	CO2	Write programs using control statements.
	CO3	Write programs demonstrating use of arrays, strings and their applications.
	CO4	Demonstrate the applications of function and recursion.
	CO5	Write programs for simple real life problems using pointers and structures.
Functional English (A4009)	CO1	Demonstrate an understanding of the significance of humanity, love and service to mankind.

	CO2	Utilize appropriate vocabulary in the given contexts.
	CO3	Build competence in grammar.
	CO4	Develop effective academic reading skills.
	CO5	Develop effective academic writing skills.
Engineering Workshop (A4302)	CO1	Demonstrate the applications of manufacturing tools & joining process.
	CO2	Produce basic components using workshop trades.
	CO3	Identify and apply the tools for different trades of engineering workshop practice.
	CO4	Recognize the circuit and its operational features in house wiring.
	CO5	Explain the different materials that are used in workshop trades.
Engineering Chemistry Laboratory (A4008)	CO1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.
	CO2	Apply various titrations for the estimation of strengths of solutions and hardness of water.
	CO3	Identify different samples from a mixture by using various separation techniques.
	CO4	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
	CO5	Evaluate the percentage of yield of chemical substances by organic synthesis.
Programming for Problem Solving Laboratory(A4502)	CO1	Demonstrate use of control statements, arrays and strings.
	CO2	Demonstrate use of functions and recursive functions
	CO3	Design and implement C programs for simple real life problems using pointers and structures.
	CO4	Debug erroneous programs related to the C language.
English Language Communication Skills Laboratory	CO1	Improve his/her pronunciation.
	CO2	Take part in role-plays and perform effectively in real-life situations.
	CO3	Choose appropriate words and phrases to make effective telephonic conversations
	CO4	Minimize stage fear and make effective presentations.
	CO5	Build sustained conversations.
Social Innovation (A4021)	CO1	Develop awareness on social issues faced by local regions.
	CO2	Interpret and classify societal issues as simple, complicated and complex problems.
	CO3	Identify the core problem's cause and effect.
	CO4	Propose an innovative idea to solve the identified problem.
Course Outcomes for II Year I Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Managerial Economics and Financial Analysis (A3011)	CO1	Explain and infer the concepts of Managerial Economics and Financial Accounting.
	CO2	Analyze the demand, production, cost and break even to know interrelationship of among variables and their impact.
	CO3	Classify the market structure to decide the fixation of suitable price.

	CO4	Apply capital budgeting techniques to select best investment opportunity.
	CO5	Prepare financial statements and analyze them to assess financial health of business.
Digital Logic Design (A3404)	CO1	Demonstrate the importance of various number systems and to perform different arithmetic operations on them.
	CO2	Make use of Boolean algebra postulates-map and tabulation method to minimize Boolean functions and to implement with logic gates.
	CO3	Construct and Analyze various combinational and sequential circuits used in digital systems such as adders, sub-tractors, code convertors, decoders, encoders, multiplexer, flip flop, register and counters.
	CO4	Design various combinational PLDs such as ROMs, PALS, PLAS and PROMs.
	CO5	Minimize the finite state machine and to construct special flow charts called ASMs charts to define digital hardware algorithms.
Network Analysis(A3203)	CO1	Apply the knowledge of AC fundamentals to 1-phase coupled circuits, resonant circuits and filter circuits.
	CO2	Identify various 3-phase circuits and connections in the analysis of balanced and unbalanced circuits.
	CO3	Measure active, reactive power and power factor for 3-phase balanced and unbalanced loads.
	CO4	Examine the behaviour of circuit elements by drawing locus diagrams, phasor diagrams and frequency response for series and parallel RLC circuits.
	CO5	Analyze transient and steady state behaviour of RLC circuits for DC and AC excitations using differential equations and Laplace transform technique.
Electro Magnetic Fields(A3204)	CO1	Apply Orthogonal coordinate systems to solve problems related Electric and magnetic Fields from charge distributions.
	CO2	Analyse Electric and Magnetic fields due to charge configurations using Coulombs law, Guass's law, Biot-Savart's Law and Ampere's Law.
	CO3	Evaluate the capacitance, Inductances and Magnetic forces for conductors Electromagnetic fields.
	CO4	Investigate the behaviour of Electric and Magnetic Fields in Static and Time Varying Fields by Maxwell's equations.
Electrical Machines – I (A3205)	CO1	Apply the knowledge of basic principles and construction of DC machines and Transformers for various applications and parallel operation.
	CO2	Analyze the characteristics and performance of DC machines for a suitable application.
	CO3	Apply the knowledge of armature reaction and commutation to suggest suitable method for improving commutation.
	CO4	Analyse speed control techniques and starters of dc motors and suggest

		a suitable method for a given application.
	CO5	Analyze the performance of 1-Ø and 3-Ø transformers for different loading conditions.
Mathematics – III (A3009)	CO1	Evaluate improper integrals using Beta and Gamma functions; distinguish the concepts of Bessel and Legendre functions.
	CO2	Test for analyticity of complex functions using Cauchy-Riemann equations.
	CO3	Identify real and imaginary parts of elementary functions; apply conformal mapping to transform complex regions into simpler regions.
	CO4	Develop analytic function in series form using Taylor's series and Laurent's series.
	CO5	Evaluate integrals along a contour using Cauchy's integral formula and Residue theorem.
Networks lab (A3207)	CO1	Apply knowledge of circuit fundamental to verify network theorems and two port parameters for different circuits using MYDAC and Multisim.
	CO2	Apply ohms law, mesh and nodal analysis for different circuits using MYDAC and Multisim.
	CO3	Analyze transient analysis of RL, RC and RLC circuit using MYDAC and Multisim.
	CO4	Determine self, mutual inductance and coefficient of coupling of magnetic circuits.
	CO5	Analyze filter circuits using MYDAC and Multisim.
	CO6	Analyze diode, opamp and ac circuit using MYDAC and Multisim.
Electrical Machines – I Lab(A3208)	CO1	Apply suitable testing method for a given DC machine or transformer to calculate efficiency.
	CO2	Analyse the excitation methods and characteristics of dc generators by conducting suitable test.
	CO3	Apply the suitable test to calculate the voltage regulation of a transformer.
	CO4	Analyse speed control techniques of dc motors and suggest a suitable method for a given application.
Course Outcomes for II Year II Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Environmental Science(A3010)	CO1	Identify the important components of environment.
	CO2	Identify global environmental problems and come out with best possible solutions.
	CO3	Apply environmental laws for the protection of forest and wildlife.
	CO4	Apply the knowledge of Environmental ethics to maintain harmonious relation between nature and human being.
	CO5	Illustrate the major environmental effects of exploiting natural resources.
Power System Generation(A321	CO1	Apply the knowledge of conversion of energy for different energy sources to generate

0)		electrical power.
	CO2	Analyze the base load and peak load conditions to select suitable generating stations.
	CO3	Develop single line diagram and layout for given substation.
	CO4	Compare different types of tariffs suitable for different loads.
	CO5	Analyze power factor correction techniques and economic aspects to reduce economic losses.
Electrical Machines – II(A3211)	CO1	Apply the basic knowledge of AC machines in selecting appropriate motor for any specified applications.
	CO2	Analyze the characteristics and performance of AC machines.
	CO3	Evaluate the performance of AC machine for different loading conditions.
	CO4	Develop the equivalent circuit and phasor diagrams for AC machine.
Control Systems (A3212)	CO1	Develop transfer functions and state space models of dynamical systems such as electrical, electro-mechanical systems and components of control systems.
	CO2	Analyze feedback characteristics, block diagrams and signal flow graphs, transient and steady state behaviour, controllability and observe ability of time invariant dynamical systems.
	CO3	Apply Routh's and Nyquist stability criterions in the analysis and design of feedback control systems.
	CO4	Examine the performance of feedback control system by using graphical techniques such as root locus, Bode, polar and Nyquist plots.
	CO5	Design compensators and controllers for time invariant systems.
Signals and Systems(A3405)	CO1	Classify various types of signals and illustrate them with various examples.
	CO2	Construct the block level representation of system and experiment with the periodic and non-periodic input signals.
	CO3	Analyze the system in terms of magnitude and phase spectrums with both periodic and non-periodic input signals.
	CO4	Determine the stability of the continuous and discrete time domain systems with the help of Region of Convergence.
	CO5	Design the system which is non-aliasing for transmission of the signals.
Basic Mechanical Engineering(A3313)	CO1	Develop the general energy equations for thermal systems by laws of thermodynamics.
	CO2	Compare types of fluids, fluid flows, pressure and flow measuring devices, losses in pipes, laminar and turbulent boundary layer concepts.
	CO3	Evaluate designparameters of hydraulic turbines at given efficiency and discharge.
	CO4	Analyze an expression for force, workdone and efficiency of vane, turbines and pumps.
	CO5	Apply the principles of conduction, convection and radiation heat transfer to analyze natural phenomena.
Electrical	CO1	Compute the equivalent circuit parameters and performance of

Machines – II Lab (A3214)		Induction motor at different loading conditions.
	CO2	Assess the performance of synchronous machines by using various methods.
	CO3	Analyze the synchronization methods of alternators.
	CO4	Distinguish the core losses of a transformer by using Alternator.
Control Systems Lab (A3215)	CO1	Develop transfer functions of dynamical electrical systems such as series RLC second order system, DC motor.
	CO2	A3215.2 Analyze the characteristics of OP-AMP Circuits, magnetic amplifier, AC servo motor and Synchros.
	CO3	Examine the performance of feedback control system by using graphical techniques such as step response, root locus, Bode, polar and Nyquist plots using MATLAB.
	CO4	Analyze the effect of PID controller on second order systems and state space model for classical transfer function using MATLAB.
	CO5	Analyze state space model for classical transfer function using MATLAB.
Gender Sensitization (A3021)	CO1	Understand the significance of process of socialization and relationships between men and women on the basis of a just, equal world.
	CO2	A3021.2 Examine the decline of female sex ratio and discrimination faced by people with different gender identities.
	CO3	To take part in house work in order to allow for more equal, share family spaces.
	CO4	Estimate women's contribution to the nation's economy.
	CO5	Analyze the consequences of sexual violence and importance of consent in friendships and other relationships.
	CO6	Perceive the invisibility of women in history and show how locating a woman in history makes them visible.
Course Outcomes for III Year I Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Electrical Measurements and Instrumentation (A3216)	CO1	Categorize the various electrical instruments for measuring electrical parameters.
	CO2	Determine various unknown electrical parameters by using bridges.
	CO3	Examine the unknown resistance, voltage, current using DC potentiometers.
	CO4	Identify various electrical and non-electrical transducers for suitable Applications.
	CO5	Analyse the Q meter and determine the harmonic distortion using wave analyzers.
Electronic Circuits and Integrated Circuits(A3420)	CO1	Apply the knowledge of Barkhausen criterion to solve the frequency of oscillation for oscillator.
	CO2	Analyze the high pass and low pass RC circuits for sine, step, pulse, exponential and ramp input.
	CO3	Design different types of multivibrators for generating waveforms.

	CO4	Examine linear and nonlinear circuits using 741 IC.
Power System Transmission & Distribution(A3217)	CO1	Apply the knowledge of electromagnetic fields to calculate the transmission line parameters.
	CO2	Analyze the Voltage regulation and efficiency for different Power transmission lines.
	CO3	Analyze power loss due to corona with various factors and physical strength of transmission line by Sag calculations.
	CO4	Identify the importance of various types of insulators and string efficiency in power system transmission.
	CO5	Analyze the voltage drop and power loss calculations for different scheme of connections in AC and DC distribution systems.
Renewable Energy Sources(A3218)	CO1	Apply the principles of Renewable energy sources for the construction of Power generating station.
	CO2	Analyse various harvesting techniques of Renewable energy for different applications.
	CO3	Apply energy storage methods in renewable energy systems.
	CO4	Analyse Renewable energy systems for various environmental conditions.
	CO5	Categorize various energy conversion systems and their limitations.
Advanced Control Systems(A3219)	CO1	Develop the mathematical modelling of linear/non-linear systems in state space.
	CO2	Investigate the controllability/observability of a given system.
	CO3	Analyze stability of linear / Non-linear systems using various methods.
	CO4	Design state feedback controller and optimal controller for a given system.
Computer Organization and Architecture (A3508)	CO1	Analyze the computer fundamentals and computer internal organization.
	CO2	Apply the register transfer operations and instructions in programs.
	CO3	Evaluate the computer arithmetic algorithms.
	CO4	Analyze the memory access operations and memory architecture.
	CO5	Apply the multiprocessing in different inter process structures.
Electrical Measurements and Instrumentation Lab (A3220)	CO1	Measure resistance, inductance and capacitance of all ranges using bridge circuits.
	CO2	Assess percentage error of various measuring instruments, LVDT, resistance strain gauge.
	CO3	Measure 3-Φ active power and reactive power of different loads.
	CO4	Measure Iron loss, transformer turns ratio and test dielectric strength of oil.
Electronic Circuits and	CO1	Determine the frequency response of Voltage series and current shunt feedback amplifiers.

Integrated Circuits Lab (A3423)	CO2	Evaluate the frequency of oscillation for different types of oscillators.
	CO3	Examine the wave shaping circuits and operational Amplifers.
	CO4	Analyse various applications using op-amps and IC 555.
	CO5	Experiment with the different types of Voltage regulator.
Professional Ethics and Human Values(A3012)	CO1	Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
	CO2	Knows the duties and rights towards the society in an engineering profession.
	CO3	Would realize the importance and necessity of intellectual property rights.
	CO4	Take all the necessary precautions while conducting the experiments, which may reduce the risk.
	CO5	Understands the importance of risk evacuation system in reality and takes the utmost.
Course Outcomes for III Year II Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Power System Operation and Control(A3221)	CO1	Apply the basic knowledge for economic operation, load frequency control and reactive power compensation.
	CO2	Analyze the static and dynamic performance of single and multi area Load Frequency Control.
	CO3	Analyze the techniques and devices used for reactive power compensation.
	CO4	Evaluate the load scheduling among various thermal and hydrothermal plants.
	CO5	Model various components of an isolated power system.
Power Electronics(A3222)	CO1	Analyse AC-DC, DC-DC, DC-AC and AC-AC converters and commutation circuits.
	CO2	Apply the knowledge of converters to select suitable converter for a given application.
	CO3	Calculate different parameters of converters for the given requirements to investigate the performance of converters.
	CO4	Apply the knowledge of PWM techniques to improve the performance of DC-DC and DC-AC converters.
	CO5	Analyse AC-DC, DC-DC, DC-AC and AC-AC converters and commutation circuits.
Microprocessors and Microcontrollers (A3419)	CO1	Apply the fundamentals of microprocessor & controller to investigate existing designs.
	CO2	Compare & contrast the processor and controller for the implementation of real time applications.

	CO3	Demonstrate assembly language programming proficiency to assemble and run on host machine.
	CO4	Identify the required driver circuitry to microprocessor and controller I/O ports to interface external devices.
	CO5	Design the required hardware & software modules and integrate to be a functional model.
JAVA programming (A3579) (Open Elective – I)	CO1	Construct application programs using OOP principles.
	CO2	Analyze the various concepts of OOP in problem solving.
	CO3	Develop high speed and fault tolerant applications with multi-threading and exception handling.
	CO4	Use collections framework API with reduced programming effort.
	CO5	Perform file handling with Java IO API.
	CO6	Implement rich GUI applications.
Special Electrical Machines (A3252) Professional Elective - I	CO1	Utilize the series booster, shunt booster, Rosenberg generator and different types of electrical machines for suitable applications.
	CO2	Choose the suitable controller for various types of stepper motor.
	CO3	Categorize the variable reluctance stepper motors by the performance characteristics and Control the position of the motor.
	CO4	Select the suitable stepper motors for different applications.
	CO5	Classify the Switched reluctance motor according to the design parameter and control the motor with logic circuits.
Neural Networks and Fuzzy Logics (A3253) Professional Elective - I	CO1	Build the basic model of artificial neuron and compare the functions of both artificial neuron and biological Neuron.
	CO2	Develop different architectures of Artificial Neural Networks and apply learning laws and the learning rules associated with the neural networks.
	CO3	Analyze the problem of linearly separable using Perceptron model and relate to the concept of Madaline networks.
	CO4	Explore the associative learning of the neural network, the architecture of Hopfield network and the error performance of Hopfield network.
	CO5	Analyze the fuzzy sets and evaluate the fuzzy logic system with fuzzification, rule base and defuzzification methods
Digital Control Systems (A3256) Professional Elective - II	CO1	Apply the Sampling & quantization in A/ D conversion & sampling and hold circuit in reconstruction process D/A Conversion
	CO2	Analysis of the given system in time domain, frequency domain and Z domain.
	CO3	Inspect the Stability, Controllability and Observability of digital systems.
	CO4	Design an appropriate compensator, state feedback controller and observer of digital Systems.
Power System Dynamics and	CO1	Analyze the steady state behavior of synchronous machine using Park's transformation.

Stability (A3258) Professional Elective - II	CO2	Analyze the dynamic behavior of synchronous generator under system conditions leading to instability.
	CO3	Analyze the generator excitation, prime mover controls and recognize their role in power system stability control.
	CO4	Compare different types of power system stabilities and methods to improve overall system stability.
	CO5	Evaluate the power system behavior under small signal, transient and voltage instability conditions using PSCAD simulation.
Power Electronics Lab (A3223)	CO1	Apply the knowledge of Matlab/ Simulink tool to Power electronic converters.
	CO2	Analyze ACR firing and commutation circuits & the characteristics of MOSFET, IGBT, SCR.
	CO3	Analyze dc-dc, dc-ac, ac-ac and ac-dc converters for different loads.
	CO4	Evaluate the performance parameters of power electronic Converters.
Micro Processors and Interfacing Lab (A3422)	CO1	Analyze the data interaction between CPU, external memory and I/O devices in microprocessor based systems.
	CO2	Compile the assembly language programming as error free to general purpose computer systems applications.
	CO3	Apply appropriate techniques to design circuits to interface assorted I/O devices to microprocessor.
	CO4	Design a simple microprocessor based system with functional requirements using optimal hardware and software components.
Intellectual Property Rights (A3013)	CO1	Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
	CO2	Knows the duties and rights towards the society in an engineering profession.
	CO3	Would realize the importance and necessity of intellectual property rights.
	CO4	Take all the necessary precautions while conducting the experiments, which may reduce the risk.
	CO5	Understands the importance of risk evacuation system in reality and takes the utmost. Responsibility while handling the risky situations.
Course Outcomes for IV Year I Semester Course		
Course		
Title with Code	**#**	**Course Outcomes**
Power Semi Conductor Drives (A3224)	CO1	Analyze1phase and 3phase controlled converters for speed control operation of DC Drives.
	CO2	Apply the knowledge of DC-Dc Converter and dual converter for speed and torque control of DC Drives.
	CO3	Analyze variable frequency control of Induction motor on stator side using different converters.

	CO4	Test the performance of Induction Motor by conducting different speed control methods.
	CO5	Assess different power electronic converter to control speed of synchronous motor drives.
Computer Methods in Power Systems (A3225)	CO1	Develop per-unit reactance diagrams, bus incidence, Ybus and Zbus matrices for modelling the actual power system.
	CO2	Determine steady state power flow analysis of power system using Gauss-Seidel, Newton-Raphson and fast decoupled iterative methods.
	CO3	Analyze symmetrical and unsymmetrical power system faults.
	CO4	Examine steady state and transient stability of power system.
	CO5	Apply the methods to improve steady state and transient stability of power system.
Power System Switchgear and Protection (A3226)	CO1	Analyze the operational aspects of different types of circuit breakers.
	CO2	Distinguish various types of relaying schemes such as differential, distance, over current / under voltage, Instantaneous, DMT and IDMT relays.
	CO3	Develop protection schemes for generators, bus-bars, feeders & transformers.
	CO4	Analyze power system transients for termination of lines with different types of conditions.
Environmental Pollution and Management (A3176) Open Elective - II	CO1	Distinguish between various modes of air pollution and their characteristic.
	CO2	Examine air pollution sampling and classify its level.
	CO3	Evaluate water quality and propose necessary measures.
	CO4	List different standards laid by governing authorities.
	CO5	Summarize functions carried out by controlling bodies.
Fundamentals of Database Management Systems (A3576) Open Elective - II	CO1	Design and implement a database schema for a given problem domain.
	CO2	Construct Queries in Relational algebra, relational calculus and SQL.
	CO3	Apply Normalization techniques to reduce data redundancy in data base.
	CO4	Analyze various transaction control and recovery methods to keep data base consistent.
	CO5	Construct the file of data records by using appropriate storage and access structure.
High Voltage Engineering (A3259) Professional Elective - III	CO1	Analyze the techniques used for high voltage generation and their measurements.
	CO2	Apply various methods to find field factor for uniform and non-uniform fields.
	CO3	Discriminate the dielectric strengths usedfor all electrical apparatus and their breakdown mechanism.
	CO4	Categories the methods used for testing electrical apparatus and its insulation coordination.

	CO5	Analyze the protective devices for over voltages, surge voltages and their control.
Utilization of Electrical Engineering (A3263) Professional Elective - IV	CO1	Analyze various types Electric drives and their applications.
	CO2	Identify the various modern methods of speed control & braking techniques.
	CO3	Analyze the modern circuits for generation of high frequency power for induction & electric heating.
	CO4	Explain the various welding processes used in industry.
	CO5	Model the different illumination schemes for different applications.
Power System Lab (A3227)	CO1	Analyze the characteristics of circuit breaker, LG, LL, LLG, LLL, LLLG faults and Ferranti effects on long transmission using PSCAD.
	CO2	Evaluate the compensation required at mid-point, end-point, line and load ends for a transmission line using PSCAD.
	CO3	Apply Gauss-Seidal method on power flow study to get optimal values using MATLAB.
	CO4	Analyze the load behaviour of short and medium transmission lines using MATLAB.
	CO5	Analyze y-bus matrix and single area load frequency of power system using MATLAB.
Power Semi Conductor Drives Lab (A3228)	CO1	Apply various configurations of 1phase & 3phase AC-DC Converters and DC-DC converters to control the speed of DC Motor.
	CO2	Apply various AC-AC Convertors to control the speed of Induction Motor.
	CO3	Apply various control techniques for speed control of Induction Motor drive.
	CO4	Apply closed loop technique to control the speed of PMDC Motor.
Course Outcomes for IV Year II Semester Course		
Course		
Title with Code	**#**	**Course Outomes**
Management Science (A3014)	CO1	Explain and infer the concepts and aspects of management and Industrial Psychology.
	CO2	Analyze the different organization structures, plant layouts, work study tools for enhancement of productivity in an organization.
	CO3	Apply the project management techniques to decide the optimum time and cost for completion of a project.
	CO4	Apply statistical quality control techniques to know quality of product with in control limits.
	CO5	Use human resources management and marketing techniques for better people management.
Entrepreneurship (A3076)	CO1	Understand the role, characteristics, qualities and functions of entrepreneur and use this knowledge to become future entrepreneurs.

Open Elective - III	CO2	Various Institutional supports for setting up a business enterprise.
	CO3	Role, importance and functions of women entrepreneur and women entrepreneur development.
	CO4	Concept of Project Management and steps in Project development.
	CO5	Training programs to inculcate entrepreneurial spirit and different training institutions to impart training to entrepreneurs.
National Service Scheme (NSS) (A3080) Open Elective - III	CO1	Contrast the different types of NSS activities and financial pattern of expenditure in Community service.
	CO2	Enhance the concept of youth, as an agent in social change.
	CO3	Classify and explain the working of organizational functionaries of NSS.
	CO4	Design a system, component or process to meet the desired needs applicable to society, with realistic constraints such as economic, safety, manufacturability and sustainability etc., by youth –adult partnership.
	CO5	Recognize the need for, and an ability to engage in society with lifelong learning capabilities with the concepts of volunteerism and its functions.
Power System Transients (A3270) Professional Elective - V	CO1	Apply the basic knowledge to identify the sources of transients and its effects on power system.
	CO2	Analyze the RL and RLC transient circuits in various cases like current suppression, chopping, capacitive switching and restriking transients of power system.
	CO3	Analyze the nature of voltage transients on closing and reclosing lines.
	CO4	Analyze the behavior of travelling waves on transmission lines and compute transients.
	CO5	Distinguish between voltage transients on closing and reclosing lines and examine the switching surges on integrated system.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

Autonomous institute affiliated to JNTUH

DEPARTMENT OF INFORMATION TECHNOLOGY

Academic Year: 2018-19

Vision:

To evolve as a center of academic excellence with ethical values in the field of Information Technology to meet global needs.

Mission:

- To mould young graduates to unleash their abilities for innovation and demands of the industry.
- To train students to take up diverse career paths.
- To develop interpersonal skills through participation in the process of technology transfer.
- To inculcate innovative thinking through collaborative research.

Program Educational Objectives (PEOs):

PEO1: Graduates will be able to excel as IT Professional with Proficiency in understanding, applying, analyzing and designing solutions to Information Technology relevant problems.

PEO2: Graduates will be able to pursue higher studies with good knowledge in core areas of Information Technology and promote collaborative research.

PEO3: Graduates will be able to exhibit professionalism, teamwork, leadership skills and exposure to current needs.

PEO4: Graduates will be able to excel as an entrepreneur with the potential knowledge to design software-based solutions for societal needs.

Program Outcomes (POs):

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

PO2: Problem Analysis: Identity, 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 specified needs with appropriate consideration for public health and safety, 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 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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

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

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

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary 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 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 lifelong learning in the broadest context of Technological Change.

Program Specific Outcomes (PSOs):

PSO1: Competent in Emerging Trends: Apply software design and development practices to develop software applications in emerging areas such as Cloud and High-performance computing, Data analytics and Cyber security.

PSO2: Successful Career and Entrepreneurship: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur and a zest for higher studies.

Course Outcomes for First Year First Semester Course		
Course		
Title with Code	**#**	**Statement**
Linear Algebra and Ordinary Differential Equations (A4001)	CO1	Solve system of linear equations using rank of a matrix.
	CO2	Examine the nature of Quadratic form using Eigen values and Eigen vectors.
	CO3	Solve the first and higher order linear ordinary differential equations.
	CO4	Make use of ordinary differential equations to solve, Rate of growth/decay, Newton's law of cooling, Electrical circuits and Simple harmonic motion problems.
	CO5	Apply Laplace transforms to solve ordinary differential equations.
Engineering Chemistry (A4007)	CO1	Apply knowledge of three - dimensional arrangements of atoms, molecules and their effects on chemical reactions.
	CO2	Evaluate the behaviour, and interactions between matter and energy at both the atomic and molecular levels.
	CO3	Identify differences and similarities of the Batteries.
	CO4	Apply major chemical reactions in the synthesis of various drugs.
	CO5	Make use of different methods for softening hardness of water.
Programming for Problem Solving (A4501)	CO1	Select right identifiers, data types and operators for effective computation.
	CO2	Write programs using control statements.
	CO3	Write programs demonstrating use of arrays, strings and their applications.
	CO4	Demonstrate the applications of function and recursion.
	CO5	Write programs for simple real life problems using pointers and structures.
Engineering Workshop (A4302)	CO1	Demonstrate the applications of manufacturing tools & joining process.
	CO2	Produce basic components using workshop trades.
	CO3	Identify and apply the tools for different trades of engineering workshop practice.
	CO4	Recognize the circuit and its operational features in house wiring.
	CO5	Explain the different materials that are used in workshop trades.
Engineering Chemistry Laboratory	CO1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.
	CO2	Apply various titrations for the estimation of strengths of solutions and hardness of water.

(A4008)	CO3	Identify different samples from a mixture by using various separation techniques.
	CO4	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
	CO5	Evaluate the percentage of yield of chemical substances by organic synthesis.
Programming for Problem Solving Laboratory(A4502)	CO1	Demonstrate use of control statements, arrays and strings.
	CO2	Demonstrate use of functions and recursive functions
	CO3	Design and implement C programs for simple real life problems using pointers and structures.
	CO4	Debug erroneous programs related to the C language.
Social Innovation (A4021)	CO1	Develop awareness on social issues faced by local regions.
	CO2	Interpret and classify societal issues as simple, complicated and complex problems.
	CO3	Identify the core problem's cause and effect.
	CO4	Propose an innovative idea to solve the identified problem.

Course Outcomes for First Year Second Semester Course		
Course		
Title with Code	**#**	**Statement**
Advanced Calculus (A4002)	CO1	Evaluate improper integrals and examine the extremum of a function of several variables.
	CO2	Make use of multiple integrals to find the area and volume of a solid.
	CO3	Determine scalar potential function for irrotational force fields.
	CO4	Evaluate line, surface and volume integrals using vector integral theorems.
	CO5	Develop Fourier series and Fourier transforms of a function.
Semiconductor Physics(A4003)	CO1	Analyze crystal structures in terms of lattice parameters and describe structures using X-rays. Identify various planes in crystals.
	CO2	Interpret the principles of quantum mechanics to classify solids. Relate semiconductor solid properties to the underlying physical concepts.
	CO3	Analyze the charge carrier dynamics and transport properties in semiconductors.
	CO4	Apply the concepts of semiconductor physics to analyze the various

		basic electronic devices.
	CO5	Illustrate working of a laser and develop communication systems using optical fibers.
Basic Electrical Engineering (A4201)	CO1	Apply the network reduction techniques and Knowledge of Alternating quantities to calculate Current, Voltage and Power for complex circuits.
	CO2	Analyze the electrical Circuits using Nodal Analysis, Mesh analysis and Network theorems.
	CO3	Study and Analyze the different types of DC Machines, Transformers.
	CO4	Test the performance of DC Generator, DC Motor, transformer and Induction Motor.
	CO5	Introduce components of low voltage electrical Installations.
Functional English (A4009)	CO1	Demonstrate an understanding of the significance of humanity, love and service to mankind.
	CO2	Utilize appropriate vocabulary in the given contexts.
	CO3	Build competence in grammar.
	CO4	Develop effective academic reading skills.
	CO5	Develop effective academic writing skills.
Engineering Graphics and Computer Aided drafting (A4301)	CO1	Construct various types of scales and curves commonly used in engineering practice.
	CO2	Distinguish between first, second, third and fourth angle projections of systems.
	CO3	Estimate sheet metal requirement for making regular solids.
	CO4	Compare isometric and orthographic views of an object.
	CO5	Select CAD tools for modelling regular solids
Semiconductor Physics Laboratory (A4004)	CO1	Determination of Planck's constant and work function of a metal.
	CO2	Evaluation of band gap of a semiconductor and understand the temperature dependence function of resistivity.
	CO3	Analyze the diode characteristics.
	CO4	Analyze the I-V characteristics of solar cell and LED.
	CO5	Apply the principles of laser light and estimate the losses in the

		propagation of light in optical fibres.
Basic Electrical Engineering Laboratory (A4202)	CO1	Verify Ohms law, Kirchhoff laws and Impedance & Current of Series RL, RC and RLC Circuits.
	CO2	Analyze the transient response of Series RL, RC and RLC series circuits.
	CO3	Calculate the Voltage, Current Real power in a single phase Transformer.
	CO4	Test the performance of DC Motor, 1- phase transformer, Alternator and 3 phase Induction Motor.
English Language Communication Skills Laboratory	CO1	Improve his/her pronunciation.
	CO2	Take part in role-plays and perform effectively in real-life situations.
	CO3	Choose appropriate words and phrases to make effective telephonic conversations
	CO4	Minimize stage fear and make effective presentations.
	CO5	Build sustained conversations.
Engineering Exploration (A4022)	CO1	Compare and contrast the contributions of different types of engineers in the development of a product, process or system.
	CO2	Apply the common engineering design process to solve complex problems and arrive at viable solution.
	CO3	Explore various contemporary software and hardware tools to provide solutions for the problems.
	CO4	Apply skills needed for successful team work including the basics of project management and written and oral communication.
	CO5	Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

Course Outcomes for Second Year Courses		
Course		
Title with code	**#**	**Statement**
Discrete Mathematical Structures (A3505)	CO1	Simplify logic statements including implications using truth tables and express logic statements in terms of predicates, quantifiers, and logical connectives.
	CO2	Understand relations, functions and determine their properties.

	CO3	Apply elementary counting techniques such as permutations, combinations and binomial expansion to solve counting problems.
	CO4	Solve recurrence relations to analyze problems such as finding Fibonacci numbers, merge sort and Towers of Hanoi.
	CO5	Distinguish, identify and prove the properties of groups and subgroups.
	CO6	Demonstrate graph theory concept such as Euler path, Hamiltonian Cycle, Chromatic number etc.
Managerial Economics and Financial Analysis (A3011)	CO1	Capable of analyzing fundamentals of economics such as demand, production, price, supply concepts etc., which helps in effective business administration.
	CO2	Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity.
	CO3	Prepare and analyze accounting statements like income & expenditure statement, balance sheet apart from the fundamental knowledge, to understand financial performance of the business and to initiate the appropriate decisions to run the business profitably.
Design and Analysis of Algorithms (A3506)	CO1	Demonstrate the importance of various algorithmic notations and their usage to give asymptotic upper, lower bounds on time and space complexity of algorithms.
	CO2	Apply divide and conquer strategy to solve various computing problems.
	CO3	Estimate all feasible solutions using greedy strategy and recite an algorithm that employs this strategy.
	CO4	Construct algorithms for solving real world problems using dynamic programming.
	CO5	Apply fundamental graph traversal techniques to solve various applications using backtracking.
	CO6	Analyze Branch and Bound techniques and explain the significance of NP Completeness.
Object Oriented Programming (A3509)	CO1	Use various constructs of Object Oriented Programming language
	CO2	Apply principles of Object Oriented Programming to model/design real world problems
	CO3	Use Exception Handling Mechanism to develop fault tolerant applications
	CO4	Apply the concepts of Multithreaded Programming and Synchronization
	CO5	Use GUI controls and Event handling mechanism to develop interactive Window/Desktop applications
	CO6	Analyze need of Applets, Swings to develop simple web application

Digital Logic Design (A3404)	CO1	Perform arithmetic operations on different number systems and to apply the principles of Boolean algebra to minimize logic expressions.
	CO2	Use K-map and Tabulation method to minimize and optimize two-level logic functions up to five variables.
	CO3	Analyze some basic components used in digital systems such as adder and subtractor, decoder, encoder, multiplexer, flip-flops, registers and counters.
	CO4	Design various combinational PLDs such as ROMs, PALs, PALs and PROMs.
	CO5	Minimize the finite state machines and to construct special flow charts called ASM charts to define digital hardware algorithms
DataBase Management Systems (A3516)	CO1	Apply the concepts to the real world applications to design and development of database application systems.
	CO2	Analyze the relational database theory, and be able to write relational algebra expressions for queries.
	CO3	Generate a set of relational schemas that allows us to store information without redundancy.
	CO4	Apply structure query language to construct queries
	CO5	Manage the concurrent execution of transaction by using query evaluation techniques.
	CO6	Organize the file of data records using indexes
Object Oriented Programming through JAVA Lab (A3511)	CO1	Identify classes, objects, members of a class and the relationships among them needed for solving a specific problem.
	CO2	Illustrate how to achieve reusability using inheritance, interfaces and packages.
	CO3	Implement concurrent applications using multithreading.
	CO4	Apply exception handling mechanism to overcome run time errors.
	CO5	Design interactive GUI applications using AWT classes.
	CO6	Design web applications using applets.
Data Base Management Systems Lab (A3518)	CO1	Understand, appreciate and effectively explain the underlying concepts of database technology.
	CO2	Design and Implement a database scheme for a given problem domain
	CO3	Apply Normalization to reduce redundancies.
	CO4	Populate and query a database using SQL DML/DDL commands.

	CO5	Declare and enforce integrity constraints on a database using a state of art of RDBMS
Environmental Science (A3010)	CO1	Apply knowledge regarding environment, natural resources and its components.
	CO2	Analyze various ecosystems, their biodiversity and scientific methods to protect them.
	CO3	Compare different types of pollutions and their control measures.
	CO4	Maximize awareness about environmental laws and environmental impact assessment.
Web Technologies (A3601)	CO1	Apply various HTML tags used to design static web pages.
	CO2	Apply CSS and JavaScript Constructs to perform Client side validation and designing of dynamic web pages.
	CO3	Apply various PHP constructs to develop server side applications and also familiar of transporting data among applications using XML.
	CO4	Understand how to configure Web servers and deployment of applications
	CO5	Design MVC based applications using Servlet, JSP and JDBC.
	CO6	Implement more interactive web applications using AJAX programming by handling asynchronous requests.
Formal Languages and Automata Theory (A3513)	CO1	Interpret the core concepts in automata theory and formal languages.
	CO2	Prepare regular expressions for different formal languages
	CO3	Apply context-free grammar for various programming constructs.
	CO4	Identify membership properties for different formal languages.
	CO5	Construct computational models including decidability and intractability
Computer Organization and Architecture (A3508)	CO1	Illustrates the basic organization of modern computer systems.
	CO2	Exhibit knowledge about how the computer programs are organized, stored, and executed at the machine level
	CO3	Analyze instruction-set architecture and propose a suitable data path and control unit implementation.
	CO4	Develop the format of operation of fixed- and floating-point arithmetic units.
	CO5	Show how instruction pipelining enhances processor performance.
	CO6	Understand the basic organization of the memory hierarchy and I/O mechanism
Computer Graphics (A3602)	CO1	Identify computer graphics applications, computer graphics Hardware and software.
	CO2	Extend basic geometric primitives algorithms for producing custom

		shapes and Compute 2D or 3D transformations for doing manipulations on objects
	CO3	Combine basic transformations to produce composite transformations and compare the 2D, 3D viewing process and can select the appropriate clipping techniques for producing view of objects
	CO4	Analyze the curve generation techniques and Illustrate 3D rendering process, various types of projection methods available.
	CO5	Utilize the efficient visible surface detection algorithms, projection concepts in rendering a view of scene of objects
	CO6	Interpret and Create the animation sequences of motion by using animation techniques like key frame animations, Interpolation techniques etc.
Operating Systems (A3515)	CO1	Understand the concepts of basic operating system, Process Management
	CO2	Apply Synchronization and Concurrency Control in inter process communication
	CO3	Use Deadlock handling methods and concepts of Memory Management techniques
	CO4	Apply the File and Disk Management Schemes for effective Storage
	CO5	Examine different Protection and Security principles associated with Operating Systems and fundamental commands in UNIX
Web Technologies Lab (A3603)	CO1	Analyze and create web pages using languages like HTML, DHTML, CSS, PHP and JavaScript.
	CO2	Design a valid XML document by following the constructs of Schema and DTD.
	CO3	Apply server side components like Servlets to build dynamic web applications.
	CO4	Create web applications using server-side scripting languages like JSP.
	CO5	Construct database and perform various operations on database using JDBC.
Operating Systems Lab (A3517)	CO1	Use file handling utilities / commands of UNIX operating system
	CO2	Apply inter process communication mechanisms of UNIX
	CO3	Compare various CPU scheduling algorithms performance
	CO4	Analyze whether a system is in safe state or not using deadlock avoidance algorithm
	CO5	Apply memory management strategies
	CO6	Use file management system calls to simulate UNIX commands

Course Outcomes for Third Year Courses		
Course		
Title with code	**#**	**Course Outcomes**

Microprocessors and Micro Controllers (A3419)	CO1	Understand the importance of statements and predicate calculus in deriving valid inferences. Understand the fundamentals of 8086 microprocessor & 8051 microcontroller internal architecture, pin description, memory organization and instruction set.
	CO2	Exhibit the knowledge of various addressing modes, data transfer instructions, stack, program counter, registers and their operations to enable writing assembly language programs.
	CO3	Demonstrate assembly language programming proficiency, assemble into machine cross assembler utility and download and run their program on the training boards.
	CO4	Design microprocessor based systems using chips like 8259, 8257 and 8254.
	CO5	Acquire knowledge on both hardware and software aspects of a microprocessor/microcontroller -based system by implementing real time projects.
Compiler Design (A3520)	CO1	Design and implement lexical analyzer for a simple programming language.
	CO2	Design and implement syntax analyzer using top down or bottom up techniques.
	CO3	Analyze semantic analyzer for a simple programming language.
	CO4	Compare different intermediate code generation forms.
	CO5	Analyze machine dependent and independent code optimizer techniques
Computer Networks(A3519)	CO1	Distinguish the terminology and concepts of OSI reference model and the TCP/IP reference model and functions of each layer.
	CO2	Experiment the different types of network topologies, protocols, network devices and their functions within a network.
	CO3	Compare the concepts of protocols, network interfaces and design/performance issues in LAN and WAN.
	CO4	Understand and building the skills of sub netting and routing mechanisms, familiarity with basic protocols of computer networks and how they can be used to assist in network design and implementation.
	CO5	Discriminate deficiencies in existing protocols and then go on to formulate new and better protocols.
Open Source Technologies (A3604)	CO1	Solve computer software problems by using PHP and MySQL
	CO2	Familiarize and define the programming syntax and constructs of different open source programming languages
	CO3	Analyze and implement Scripting applications using Python.
	CO4	Demonstrate ability to exhibit knowledge of developing applications

		using Python
	CO5	Develop scripts using AngularJS and Jquery.
E-Commerce (A3605)	CO1	Understand the components and roles of the e-commerce environment and basic electronic commerce functions.
	CO2	Analyze E-Commerce payment systems, EFT and EDI.
	CO3	Explain how business sell products and services on the web.
	CO4	Explain how to meet the needs of web site visitors
	CO5	Identify and reach customers on the web.
	CO6	Evaluate web marketing approaches and elements of branding and legal and ethical issues related to E-commerce
Software Engineering (A3514)	CO1	Illustrate the right process model to develop the right software system.
	CO2	Choose requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements document.
	CO3	Design as per functional and non-functional requirements using design principles.
	CO4	Evaluate testing strategies for application being developed.
	CO5	Classify right set of umbrella activities for quality management and assurance.
Micro Processors and Interfacing Lab (A3422)	CO1	Describe the interaction between CPU, memory and I/O ports in various applications.
	CO2	Master the assembly level programming language using 8086 instruction set.
	CO3	Analyze how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
	CO4	Design a simple microprocessor based system with functional requirements for hardware and software components for few input and output devices.
	CO5	Completed a subsystem and integrate this with a complete system to perform a complex task involving networked, mobile, embedded systems.
Open Source Technologies Labb(A3606)	CO1	Demonstrate an ability to design and develop Web based programs, analyze, and interpret object oriented data and report results.
	CO2	Develop confidence for self-education and ability for life-long learning needed for other open source languages and can participate and succeed in competitive examinations like Engineering services, exit interviews etc.

	CO3	Solve computer software problems by writing customized programs in an efficient way using python Language
	CO4	Demonstrate an ability to design and develop PHP based novel products
	CO5	Exhibit profound knowledge to create, debug, and execute scripting programs using JQuery, AngularJS.
Professional Ethics and Human Values (A3012)	CO1	Develop awareness on ethics and human values.
	CO2	Become morally and socially responsible
	CO3	Find engineering solutions from the ethical platform.
	CO4	Motivate others on moral values.
Object Oriented Analysis and Design (A3607)	CO1	Choose appropriate modeling concepts principles which can helps users to understand the software system.
	CO2	Demonstrate understanding of ideas to design and develop software systems based on object-oriented thinking.
	CO3	Apply knowledge of object-oriented analysis and design methods with a clear emphasis on UML to model software systems**.**
	CO4	Analyze and explore the conceptual model into various scenarios and applications.
	CO5	Design software systems to meet desired needs of user.
Data Warehousing and Data Mining (A3522)	CO1	Apply preprocessing techniques on various data sets.
	CO2	Develop data warehouse using various schemas for enterprise applications.
	CO3	Apply supervised learning techniques on various data sets.
	CO4	Apply unsupervised techniques on various data type.
	CO5	Analyze various web mining techniques.
Information Security (A3608)	CO1	Analyze the different Security Attacks, Services, and Mechanisms work security models.
	CO2	Apply classical encryption algorithms (Substitution and Transposition ciphers) and DES algorithms to encrypt plaintext.
	CO3	Distinguish the modern Cryptography algorithm such as DES, AES, double DES, Triple DES, RC4 algorithm and analyze modern cryptanalysis techniques.
	CO4	Solve the problem on Number theory, public key cryptography techniques (RSA) and key management algorithms (Diffie-Hellman).
	CO5	Compare and contrast message authentication algorithms (SHA-512,

		MAC, HMAC), symmetric and asymmetric encryption and authentication standards and protocols.
	CO6	Examine the different network security protocols (IPSec, TLS/SSL, SET, S/MIME, PGP) and Firewall types and principles.
Image Processing (A3554)	CO1	Know and understand the basics and fundamentals of digital signal and image processing, such as digitization, sampling, quantization, and2D-transforms.
	CO2	Operate on images using the processing techniques of smoothing, sharpening, enhancing, reconstructing geometrical alterations, filtering, restoration, segmentation, features extraction, compression, encoding and color/multichannel.
	CO3	Manipulate images using the computer: reading, writing, printing, and operating on them.
	CO4	Apply and relate the basic imaging techniques to practical cases, such as, multimedia, videoconferencing, pattern and object recognition.
	CO5	Aware of the ethical and legal issues related to image processing, such as, copyright, security, privacy, pornography, electronic distribution etc.
Python for Machine Learning (A3681)	CO1	Explore Machine learning and Python language fundamentals
	CO2	Usage of lists, functions and packages
	CO3	Apply data analysis over various data sets.
	CO4	Develop Basic mathematics, C programming Fundamentals classification and prediction models addressable by python language.
	CO5	Analyze various clustering, text mining techniques
Data Warehousing and Data Mining Lab (A3524)	CO1	Develop skills required to work with WEKA and KETTLE Pentaho tools
	CO2	Develop various data transformations and flow controls using Kettle Pentaho tool.
	CO3	Build data Cubes and perform OLAP Operations using Kettle Pentaho tool.
	CO4	Apply various association rule mining and classification Techniques on given datasets and analyze their results.
	CO5	Compare the clustering Techniques on given datasets and analyze

		their results.
Case Tools Lab (A3609)	CO1	Understand the overall concepts of software system by using UML modeling.
	CO2	To Model real time software applications.
	CO3	To develop object-based models in real world projects.
	CO4	Analyze the basic design principles in solving real life problem
	CO5	To construct real world system using UML diagrams
Intellectual Property Rights (A3013)	CO1	Understand different types of Intellectual Property
	CO2	List the International organizations and its functions to protect Intellectual Property
	CO3	Explain in detail about agencies and treaties related to Intellectual Property Rights and importance of Intellectual Property Rights
	CO4	Explain the Trademark Evaluation, Registration Processes and describe the fundamentals of Copyright Law & patent law
	CO5	Explain the New International Developments in Trademarks Law and Copyright Law and Patent Law
Entrepreneurship Development (A3076)	CO1	Understand the role, characteristics, qualities and functions of entrepreneur and use this knowledge to become future entrepreneurs.
	CO2	Interpret various Institutional support for setting up a business enterprise and apply this knowledge while approaching these institutions for financial support.
	CO3	Illustrate role, importance and functions of women entrepreneur and use this knowledge to become future women entrepreneurs.
	CO4	Infer the concept of Project Management and steps in Project development and analyse while taking future project assignments.
	CO5	Indicate training programs and different training institutions to impart training and apply this knowledge to train existing and future entrepreneurs.
Course Outcomes for Fourth Year Courses		
Course		
Title with code	**#**	**Course Outcomes**

Cloud Computing &Big Data (A3610)	CO1	Describe the architecture, service, deployment models, and pros and cons of cloud computing, vendors offering cloud services.
	CO2	Comprehend the technical capabilities and business benefits by accessing cloud and virtualization.
	CO3	Develop application on cloud platform such as Google, Azure, AWS and so on.
	CO4	Evaluate open source cloud computing software, and free/commercial cloud services
	CO5	Understand the basic computing environment of Big Data, Hadoop distributed file structure and Map Reduce and Develop a Map Reduce application and run it on locally and clusters
Mobile Application Development (A3611)	CO1	Develop mobile applications using android development application tools
	CO2	Design, customize and enhance mobile applications
	CO3	Modify existing mobile apps for better performance
	CO4	Design various mobile applications for real time problems
	CO5	Create effective user interfaces that leverage evolving mobile device capabilities
	CO6	Identify and apply discipline-specific practices that contribute to the local and global community through social responsibility, economic commitment and environmental stewardship
Software Testing Methodologies (A3612)	CO1	Understand various basic concepts, test processes, continuous quality improvement, types of errors and fault models.
	CO2	Review various test techniques proposed
	CO3	Analyze different kinds of testing techniques like path testing, transaction flow testing, data flow testing, domain testing, etc their application in different scenarios and their limitations.
	CO4	Assessing the complexity of the testing by using various techniques like regular expression, kv maps, graphs and matrices
	CO5	Demonstrate the usage of testing tools for different types of testing
Design Patterns (A3655)	CO1	Identify the appropriate design patterns to solve object oriented design problems.
	CO2	Develop design solutions using creational patterns.
	CO3	Apply structural patterns to solve design problems.
	CO4	Construct design solutions by using behavioral patterns.
Information Retrieval Systems (A3559)	CO1	Understand the functional processes and effectiveness of information storage and retrieval systems.
	CO2	Implement different data structures and indexing techniques for information retrieval systems.
	CO3	Analyze different clustering and visualization techniques to generate classification among the web pages.
	CO4	Apply appropriate user search techniques and text search algorithms for different database systems.
	CO5	Analyze new models based on existing challenges over multimedia

		web search and modern digital libraries.
Cloud Computing & Big Data Lab (A3613)	CO1	Implement a data center with two hosts using Virtual box and Map Reduce applications
	CO2	Implement cloud Services using Windows Azure, GCP, AWS etc.
	CO3	Write case studies on real time implementation of AmazonEC2, AmazonS3 and windows Azure etc.
	CO4	Evaluate various vendor offerings in the cloud.
Mobile Application Development Lab (A3614)	CO1	Install and configure Android application development tools, Apply Java programming concepts to Android applicationdevelopment
	CO2	Design and develop user Interfaces for the Androidplatform
	CO3	Understand the technical challenges posed by current mobile devices and wireless communications; be able to evaluate and select appropriatesolutions
	CO4	Select and evaluate suitable software tools and APIs for the development of a particular mobile application and understand their strengths, scope andlimitations
	CO5	The students will be able to develop mobile applications with underlying databasesupports
	CO6	Develop and apply current standard-compliant scripting/programming techniques for the successful deployment of mobile applications targeting a variety of android supporteddevices
Human Resource Management (A3077)	CO1	Understand HR functions effectively and apply this knowledge to manage the employees in the organizations.
	CO2	Explain Job Analysis, Recruitment and Employee Retention practices and strategies and apply this knowledge to hire and retain the right people for the right jobs inorganizations.
	CO3	Indicate different training methods and performance appraisal systems and apply this knowledge to impart appropriate training method as well as appraise the performance of the employees by using different appraisalmethods.
	CO4	Analyze decisions relating to compensation and factors influencing the employeecompensation
	CO5	Apply knowledge on different techniques to resolve industrial disputes in theorganization
Management Science (A3014)	CO1	Explain and infer the concepts and aspects of management
	CO2	Analyze the different organizational structures, plant layouts, work study tools for enhancement of productivity in an organization
	CO3	Apply the project management techniques to decide the optimum time and cost for completion of a project.
	CO4	Apply statistical quality control techniques to know quality of product with in control limits

	CO5	Use Human resource management techniques for better people management.
Software Project Management (A3661)	CO1	Understand different models for development of the software.
	CO2	Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
	CO3	Analyze organizational structure and project structure.
	CO4	Implement a project to manage project schedule, expenses and resources with the application of suitable application management tools.
Disaster Management (A3178)	CO1	List out different causes of Environmentalhazards.
	CO2	Classify environmental hazards and disasters, Endogenous hazards, exogenous hazards, infrequent events - Cumulative atmospheric hazards /disasters
	CO3	Explain different characteristics ofhazards.
	CO4	Develop Emerging approaches in Disastermanagement

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

Autonomous institute affiliated to JNTUH

DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department:

To be a premier center for producing competent mechanical engineers to cater the ever changing industrial demands and societal needs.

Mission of the Department:

- To impart knowledge and skills in basic and applied areas of Mechanical Engineering through innovative learner-centric approach.
- To associate with industries and research organizations for gaining real time practical knowledge.
- To facilitate continuous learning based on dynamic needs of the society.

Program Educational Objectives (PEOs):

PEO 1: Graduates make their way to the society with proper scientific and technical knowledge to identify, formulate and solve Mechanical Engineering problems.

PEO 2: Graduates adapt to rapidly changing environment in the areas of Mechanical Engineering and explore possible profession in industry, academic, research and self-employment opportunities.

PEO 3: Graduates excel in career by their team-working abilityand communicate effectively to complete task with minimal resources.

PEO 4: Graduates commit toprofessional and ethical practicesencouragingdiversity, continuous improvementandlifelong learning.

(A) PROGRAM OUTCOMES

Engineering Graduates will be able to:

PO1. 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.

(B)PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Demonstrate knowledge in the area of design, analysis and fabrication of mechanical systems.

PSO2: Apply learned concepts and management skills to associate professionally in industry or as an entrepreneur.

Course Outcomes for First Year First Semester Course		
Course		
Title with Code	**#**	**Statement**
Linear Algebra and Ordinary Differential Equations (A4001)	CO1	Solve system of linear equations using rank of a matrix.
	CO2	Examine the nature of Quadratic form using Eigen values and Eigen vectors.
	CO3	Solve the first and higher order linear ordinary differential equations.
	CO4	Make use of ordinary differential equations to solve, Rate of growth/decay, Newton's law of cooling, Electrical circuits and Simple harmonic motion problems.
	CO5	Apply Laplace transforms to solve ordinary differential equations.
Programming for Problem Solving (A4501)	CO1	Select right identifiers, data types and operators for effective computation.
	CO2	Write programs using control statements.
	CO3	Write programs demonstrating use of arrays, strings and their applications.
	CO4	Demonstrate the applications of function and recursion.
	CO5	Write programs for simple real life problems using pointers and structures.
Engineering Graphics and Computer Aided drafting (A4301)	CO1	Construct various types of scales and curves commonly used in engineering practice.
	CO2	Distinguish between first, second, third and fourth angle projections of systems.
	CO3	Estimate sheet metal requirement for making regular solids.
	CO4	Compare isometric and orthographic views of an object.
	CO5	Select CAD tools for modelling regular solids
Programming for Problem Solving Laboratory(A4502)	CO1	Demonstrate use of control statements, arrays and strings.
	CO2	Demonstrate use of functions and recursive functions
	CO3	Design and implement C programs for simple real life problems using pointers and structures.
	CO4	Debug erroneous programs related to the C language.
OSCILLATIONS, WAVES AND OPTICS	CO1	Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator.
	CO2	Construct travelling and standing solutions to the wave equation.
	CO3	Use the geometrical approximation, including Fermat's principle, the ray equation and paraxial matrix formalism for refractive and reflective surfaces.
	CO4	Apply wave optics and diffraction theory to a range of problems.
	CO5	Estimate the properties of various lasers and the propagation of laser beams.
OSCILLATIONS, WAVES AND OPTICS LABORATORY	CO1	Evaluate the rigidity modulus and spring constant of the given materials to interpret the material properties.
	CO2	Estimate the acceleration due to gravity (g) and frequency of AC power supply.
	CO3	Determine the wavelength of a given light source and thickness of a wire by using interference mechanism.

	CO4	Estimate the dispersive power and refractive index of various light sources.
	CO5	Apply the principles of optics to evaluate the characteristics of lasers and optical fibres.
Social Innovation (A4021)	CO1	Develop awareness on social issues faced by local regions.
	CO2	Interpret and classify societal issues as simple, complicated and complex problems.
	CO3	Identify the core problem's cause and effect.
	CO4	Propose an innovative idea to solve the identified problem.

Course Outcomes for First Year Second Semester Course		
Course		
Title with Code	**#**	**Statement**
Advanced Calculus (A4002)	CO1	Evaluate improper integrals and examine the extremum of a function of several variables.
	CO2	Make use of multiple integrals to find the area and volume of a solid.
	CO3	Determine scalar potential function for irrotational force fields.
	CO4	Evaluate line, surface and volume integrals using vector integral theorems.
	CO5	Develop Fourier series and Fourier transforms of a function.
Engineering Chemistry (A4007)	CO1	Apply knowledge of three - dimensional arrangements of atoms, molecules and their effects on chemical reactions.
	CO2	Evaluate the behaviour, and interactions between matter and energy at both the atomic and molecular levels.
	CO3	Identify differences and similarities of the Batteries.
	CO4	Apply major chemical reactions in the synthesis of various drugs.
	CO5	Make use of different methods for softening hardness of water.
ENGINEERING MECHANICS (A4303)	CO1	Apply the laws of mechanics to evaluate resultant force.
	CO2	Solve the problems using equations of equilibrium through free body diagram.
	CO3	Analyze the frictional forces to maintain the equilibrium.
	CO4	Identify the centroid and centre of gravity of a body by using principle of moments and calculate the area moment of inertia and mass moment of inertial of a body
	CO5	Utilize the basic concepts of kinematics and kinetics to solve the problem.
Functional English (A4009)	CO1	Demonstrate an understanding of the significance of humanity, love and service to mankind.
	CO2	Utilize appropriate vocabulary in the given contexts.
	CO3	Build competence in grammar.
	CO4	Develop effective academic reading skills.
	CO5	Develop effective academic writing skills.
Engineering	CO1	Demonstrate the applications of manufacturing tools & joining process.

Workshop (A4302)	CO2	Produce basic components using workshop trades.
	CO3	Identify and apply the tools for different trades of engineering workshop practice.
	CO4	Recognize the circuit and its operational features in house wiring.
	CO5	Explain the different materials that are used in workshop trades.
Engineering Chemistry Laboratory (A4008)	CO1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.
	CO2	Apply various titrations for the estimation of strengths of solutions and hardness of water.
	CO3	Identify different samples from a mixture by using various separation techniques.
	CO4	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
	CO5	Evaluate the percentage of yield of chemical substances by organic synthesis.
ENGINEERING MECHANICS LABORATORY (A4304)	CO1	Examine basic laws of Mechanics by using experiment setup.
	CO2	Determine the co-efficient of friction between wood and various surfaces.
	CO3	Apply the basic concepts of mechanics to find the Mechanical Advantage, velocity ratio and mechanical efficiency.
	CO4	Calculate moment of Inertia of an irregular body using Computation method
	CO5	Analyze the different force systems by using graphical method.
English Language Communication Skills Laboratory	CO1	Improve his/her pronunciation.
	CO2	Take part in role-plays and perform effectively in real-life situations.
	CO3	Choose appropriate words and phrases to make effective telephonic conversations
	CO4	Minimize stage fear and make effective presentations.
	CO5	Build sustained conversations.
Engineering Exploration (A4022)	CO1	Compare and contrast the contributions of different types of engineers in the development of a product, process or system.
	CO2	Apply the common engineering design process to solve complex problems and arrive at viable solution.
	CO3	Explore various contemporary software and hardware tools to provide solutions for the problems.
	CO4	Apply skills needed for successful team work including the basics of project management and written and oral communication.
	CO5	Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

Course Outcomes for First Year First Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Engineering Mechanics-I (A 3301)	CO1	**Apply** the laws of mechanics and evaluate the resultant force.
	CO2	**Construct** free body diagrams and solve the problems using equations of equilibrium.
	CO3	**Analyze** the frictional forces to maintain the equilibrium of system.
	CO4	**Identify** the centroid and centre of gravity of a body by using principle of moments.
	CO5	**Determine** the area moment of inertia and mass moment of inertia of a body.
Engineering Drawing-I (A 3302)	CO1	**Construct** various types of scales for the design of maps and models.
	CO2	**Represent** the objects using various types of lines and dimensioning rules.
	CO3	**Make use of** the knowledge of geometry and engineering curves for constructions.
	CO4	**Analyze** the objects such as points, lines and regular planes held in different orientations using conventional drawing and CAD tools.
	CO5	**Visualize** the solids held in different orientations using conventional drawings and CAD tools.

Course Outcomes for First Year Second Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Engineering Mechanics-II (A3303)	CO1	Explain the principles of kinematic pairs, chains and their classification, degrees of freedom, inversions and planar mechanisms.
	CO2	Analyze the planar mechanisms for position, velocity and acceleration.
	CO3	Synthesize planar four bar and slider crank mechanisms for specified kinematic conditions.
	CO4	Evaluate gear tooth geometry and select appropriate gears for the required applications.
	CO5	Design cams and followers for specified motion profiles.
Engineering Drawing-II (A 3304)	CO1	**Develop** the lateral surface of regular solids.
	CO2	**Imagine** the sectional views and curves of intersections of regular solids.
	CO3	**Analyze** isometric projections of objects such as regular planes and solids using conventional drawing and CAD tools.
	CO4	**Convert** isometric views to orthographic views & vice versa.
	CO5	**Visualize** the perspective projections of regular planes and solids using conventional drawing and CAD tools.

Engineering Workshop (A3305)	CO1	**Identify** the tools and equipment utilized in workshop.
	CO2	**Choose** the required trade for the suitable operations.
	CO3	**Make** the Wooden joints, MS fittings, house wiring, sheet metal components and simple forgings.
	CO4	**Explain** the working of Arc Welding and Plumbing operations, uses of power tools and installation of Software in the computer systems.
	CO5	**Prepare** the documents, data sheets and power point slides by using the Microsoft office tools.

Course Outcomes for Second Year First Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Mechanics of Solids (A3307)	CO1	**Explain** the basics of material properties, concepts of stress-strain relationships for homogenous, isotropic materials.
	CO2	**Design** and analyze structural members and machine parts under axial load, shear load, bending moment and torsional moment.
	CO3	**Determine** the deflections and deformations of loaded flexural members.
	CO4	**Calculate** stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.
	CO5	**Build** the necessary theoretical background for further structural analysis and design courses.
Mechanics of Fluids (A3308)	CO1	**Explain** the fundamental aspects of fluid statics, kinematics and dynamics.
	CO2	**Compare** types of fluids, fluid flows, pressure and flow measuring devices, losses in pipes, laminar and turbulent boundary layer concepts.
	CO3	**Solve** problems by applying the principles of mass, momentum and energy conservation.
	CO4	**Analyze** flow through pipes and pipe fittings, nozzles, drag and lift on submerged bodies, propagation of pressure waves.
	CO5	**Determine** the specifications of pressure and flow measuring devices, piping, nozzles and submerged bodies.
Thermodynamics (A 3309)	CO1	**Explain** the properties and basic concepts of thermodynamics.
	CO2	**Develop** the general energy equations for thermal systems by laws of thermodynamics.
	CO3	**Solve** heat and work transfer for different thermodynamic processes.
	CO4	**Evaluate** the performance of power cycles and refrigeration cycles**.**
	CO5	**Determine** the properties of pure substance in various regions using

		steam tables.
Metallurgy & Material Science (A 3310)	CO1	**Explain** the basic principles of materials.
	CO2	**Identify** the phases and interrelationship between structure and properties.
	CO3	**Construct** phase diagram of alloy systems.
	CO4	**Apply** basic principles for selection of materials.
	CO5	**Characterize** materials based on structure.
ELECTRICAL TECHNOLOGY (A3206)	CO1	Understand the basic principles of electrical circuit analysis.
	CO2	Apply the basic knowledge of electrical circuit analysis to find the response in any branch of network using network theorems.
	CO3	Apply the basic knowledge of DC Machines in finding their performance.
	CO4	Apply the basic knowledge of AC Machines in finding their performance.
	CO5	Develop the equivalent circuit and draw the phasor diagrams of AC machines for different types of loads.
Machine Drawing (A 3311)	CO1	**Identify** the national and international standards pertaining to machine drawing.
	CO2	**Illustrate** various machine components through drawings as per ISO standards.
	CO3	**Draw** machine components by applying the principles of engineering drawing.
	CO4	**Compare** part drawings and assembly drawings.
	CO5	**Prepare** assembly drawings by applying drawing conventions.
Mechanics of Solids & Metallurgy Lab (A 3312)	CO1	**Apply** methods to determine mechanical properties and elastic constants.
	CO2	**Estimate** compressive strength of wood/concrete/brick materials.
	CO3	**Determine** slope and deflection of beams.
	CO4	**Characterize** the microstructures of different ferrous and non-ferrous metals.
	CO5	**Identify** the effect of heat treatment and cooling rates on the properties of steels.
Electrical And Electronics Engineering Lab (A3209)	CO1	Analyze basic electrical Circuits in calculation of electrical parameters.
	CO2	Analyze different circuits in application of mesh and Nodal analysis.
	CO3	Able to conduct experiments on D.C. Generators and Dc Motors and plot the characteristics.
	CO4	Differentiate various speed control techniques that are used for dc shunt motors.
	CO5	Analyze the tests of a single phase transformer and discuss about the

		operating conditions of a transformer.
GENDER SENSITIZATION (A3021)	CO1	Build the significance of the process of socialization and relationships between men and women on the basis of a just and equal world.
	CO2	Examine the decline of female sex ratio and discrimination faced by people with different gender identities.
	CO3	Take part in house work, in order to allow for equality and share equal family spaces.
	CO4	Estimate women's contribution to the nation's economy.
	CO5	Analyze the consequences of sexual violence and importance of consent in friendship and other relationships.

Course Outcomes for Second Year Second Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Environmental Science (A3010)	CO1	**Identify** the important components of environment
	CO2	**Identify** global environmental problems and come out with best possible solutions.
	CO3	**Apply** environmental laws for the protection of forest and wildlife.
	CO4	**Apply** the knowledge of Environmental ethics to maintain harmonious relation between nature and human being.
	CO5	**Illustrate** the major environmental effects of exploiting natural resources.
Managerial Economics and Financial Analysis (A3011)	CO1	Explain and infer the concepts of Managerial Economics and Financial Accounting
	CO2	Analyze the demand, production, cost and break even to know interrelationship of among variables and their impact
	CO3	Classify the market structure to decide the fixation of suitable price.
	CO4	Apply capital budgeting techniques to select best investment opportunity.
	CO5	Prepare financial statements and analyze them to assess financial health of business
Thermal Engineering –I (A 3314)	CO1	**Compare** air standard cycles with actual and fuel air cycles.
	CO2	**Analyze** combustion phenomenon in SI and CI engines.
	CO3	**Explain** the performance parameters of internal combustion engines and compressors.
	CO4	**Solve** the problems related to IC engines and compressors.
	CO5	**Evaluate** the performance parameters of internal combustion engines and compressors.

Production Technology-I (A 3315)	CO1	**Understand** various manufacturing operations, including their capabilities, limitations, and applications.
	CO2	**Analyze** products and be able to improve their manufacturability and to reduce their costs.
	CO3	**Analyze** the thermal, metallurgical aspects during solidification in casting and welding and their role on quality of cast or weld objects.
	CO4	**Design** the gating and riser system needed for defect free casting.
	CO5	**Apply** knowledge on selection of suitable manufacturing process for the typical component.
Hydraulic Machines (A 3316)	CO1	**Explain** the basic concepts and working of hydraulic turbines, pumps and systems.
	CO2	**Classify** the hydraulic turbines and pumps.
	CO3	**Solve** problems of impact of jet on vanes using impulse momentum equation.
	CO4	**Analyze** the performance of vanes, turbines and pumps.
	CO5	**Evaluate** the design parameters of hydraulic turbines and pumps.
Kinematics of Machinery (A 3317)	CO1	**Explain** the principles of kinematic pairs, chains and their classification, degrees of freedom, inversions and planar mechanisms.
	CO2	**Analyze** the planar mechanisms for position, velocity and acceleration.
	CO3	**Synthesize** planar four bar and slider crank mechanisms for specified kinematic conditions.
	CO4	**Evaluate** gear tooth geometry and select appropriate gears for the required applications.
	CO5	**Design** cams and followers for specified motion profiles.
Fluid Mechanics and Hydraulic Machinery Lab (A 3318)	CO1	**Demonstrate** the working of flow meters and hydraulic machines.
	CO2	**Evaluate** the discharge and co-efficient of discharge of flow meters.
	CO3	**Identify** the type of flow through a pipe.
	CO4	**Estimate** the major and minor loss of flow through pipes.
	CO5	**Determine** the performance parameters of vanes, hydraulic turbines and pumps.
Production Technology Lab (A3326)	CO1	**Determine** mould sand properties.
	CO2	**Prepare** pattern for casting processes.
	CO3	**Apply** various casting and welding techniques.
	CO4	**Perform** different sheet metal operations.
	CO5	**Prepare** plastic moulding technique.

Course Outcomes for Third Year First Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Dynamics of Machinery (A3319)	CO1	**Determine** the value of gyroscopic couple and explain the effect of gyroscopic couple on all rotating bodies.
	CO2	**Apply** the laws of friction and laws of motion to determine the power lost in brakes, clutches, pivots and calculate the forces developed in governors and torque developed in machine bodies.
	CO3	**Minimize** the vibrations developed in engines due to unbalanced masses by balancing the rotating and reciprocating masses.
	CO4	**Determine** the frequency of vibrations in different types of beams by using the concept of Simple harmonic Motion.
	CO5	**Discuss** effectively on dynamics of machinery and work as a team for solving problems on reducing the effect of unwanted effect of forces developed in engines.
Production Technology-II (A3320)	CO1	**Apply** the knowledge of cutting tool geometry, mechanism of chip formation and mechanics of orthogonal cutting.
	CO2	**Evaluate** the tool life and cutting forces by using Taylor's tool life equation and Merchant circle diagram.
	CO3	**Explain** the features, working principles and applications of lathe, shaper, planer, slotter, milling, drilling, grinding and broaching machines.
	CO4	**Analyze** the various surface finishing operations like lapping honing and grinding.
	CO5	**Classify** the various jigs, fixtures and clamping devices used in machining.
Thermal Engineering –II (A3321)	CO1	**Explain** the working principles of components of steam, gas turbine power plants and different jet propulsion systems.
	CO2	**Sketch** various property diagrams and plot the cycle diagrams for steam, gas turbines and jet propulsion systems.
	CO3	**Derive** the efficiency, property relations for Steam, Gas turbines and jet propulsion systems.
	CO4	**Solve** problems of steam, gas turbines and jet propulsion systems.
	CO5	**Analyze** the thermodynamic aspects of steam, gas turbines and jet propulsion systems.
Design of Machine Members –I	CO1	**Explain** the fundamental concepts of design for various design elements such as shafts, couplings, rivets, welded and bolted joints.
	CO2	**Apply** theories of failure and fatigue failure criteria for the design of

(A3322)		mechanical components.
	CO3	**Design** of riveted, welded and bolted joints for various loading conditions.
	CO4	**Determine** the dimensions of shaft with different geometrical features under various loading conditions.
	CO5	**Design** shaft couplings for various operating conditions.
Operations Research (A3333)	CO1	**Explain** the Operations Research features, models, applications and methods such as linear programming, transportation, sequencing, assignment, replacement, games theory and dynamic programming.
	CO2	**Build** mathematical models for finding optimum solutions for various real world problems and case studies.
	CO3	**Evaluate** various alternatives available to aid in effective decision making.
	CO4	**Choose** the best strategies to maximize the profit in the presence of a competitor.
	CO5	**Devise** operating policies for the efficient and effective management of men, materials and machines in inventory, production, distribution and service systems.
Instrumentation and control Systems (A3323)	CO1	**Identify** the basic functional elements of a generalized measuring system, errors occurring in instrumentation and its remedial measures.
	CO2	**Categorize** the mechanical, electrical and optical measuring instruments.
	CO3	**Apply** skills in instrumentation, measurement and signal processing through vibration testing for several physical and mechanical systems.
	CO4	**Measure** displacement, pressure, temperature, speed, flow, liquid level, stress, strain, humidity etc.
	CO5	**Make use of** control systems for various applications.
Thermal Engineering & Fuels Lab (A3324)	CO1	**Compare** the performance of SI and CI engines.
	CO2	**Determine** the performance parameters of internal combustion engines and compressor.
	CO3	**Analyze** an engine under different loading conditions to calculate brake power, indicated power, friction power and efficiencies.
	CO4	**Find** the properties of different fuels and lubricants.
	CO5	**Draw** the valve and port timing diagrams of two stroke and four stroke engines
Theory of Machines Lab (A3325)	CO1	**Examine** the active and reactive couple based on the principle of angular momentum using gyroscope.
	CO2	**Apply** the force couple polygon method for balancing the reciprocating and rotating mass systems.

	CO3	**Calculate** the moment of inertia of various suspension and rotor systems.
	CO4	**Analyze** the centrifugal forces in governors.
	CO5	**Determine** the critical speed of shafts
Professional Ethics and Human Values (A3012)	CO1	Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
	CO2	Knows the duties and rights towards the society in an engineering profession.
	CO3	Would realize the importance and necessity of intellectual property rights.
	CO4	Take all the necessary precautions while conducting the experiments, which may reduce therisk.
	CO5	Understands the importance of risk evacuation system in reality and takes the utmost

Course Outcomes for Third Year Second Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Design of Machine Members –II (A3327)	CO1	**Illustrate** different types of bearings, IC engine parts and power transmission elements related terminology.
	CO2	**Select** the bearings for different operating conditions.
	CO3	**Design** basic IC engine parts used in power transmission.
	CO4	**Determine** the design parameters of gears and power screws.
	CO5	**Analyze** helical compression and helical torsion springs with respect to loading
Heat Transfer (A3328)	CO1	**Apply** the principles of conduction, convection and radiation heat transfer to analyze natural phenomena.
	CO2	**Determine** thermal resistance for conduction, convection and radiation heat transfer using fundamental relationships and correlations.
	CO3	**Analyze** and apply empirical correlations in connection with convection, boiling and condensation.
	CO4	**Design** and analyze the performance of heat exchangers and evaporators.
	CO5	**Examine** blackbody and gray surface radiation, and evaluate radiation exchange between surfaces.
Metrology and Surface Engineering (A3330)	CO1	**Apply** the knowledge of limits, fits and tolerance for interchangeability and selective assembly.
	CO2	**Measure** the length, angles and other physical geometrical characteristics using various instruments, tools and techniques.

	CO3	**Use** various measuring instruments such as Talysurf, comparators, toolmakers microscope, profile thread gauges, slip gauges, sine bars etc.
	CO4	**Determine** the flatness and roughness of surface using various methods and tools.
	CO5	**Conduct** alignment tests on machine tools such as lathe, milling and drilling machine
Heat Transfer Lab (A3331)	CO1	**Determine** the thermal conductivity of a given material.
	CO2	**Estimate** the performance of heat exchangers and fins.
	CO3	**Determine** the heat transfer coefficient in convection process.
	CO4	**Compare** heat pipe performance with other pipes.
	CO5	**Determine** the emissivity of a given material
Metrology and & Machine Tools Lab (A3332)	CO1	**Demonstrate** the working principle and parts of different machine tools used in machine shop.
	CO2	**Apply** the procedures to measure length, width, depth, bore diameters, internal and external tapers, tool angles, and surface roughness by using different instruments.
	CO3	**Inspect** machine tools whether properly aligned or not.
	CO4	**Measure** effective diameter of thread profile using different methods.
	CO5	**Create** stepped surface using shaper and keyways using milling machine, perform different turning operations.
Intellectual Property Rights (A3013)	CO1	Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
	CO2	Knows the duties and rights towards the society in an engineering profession.
	CO3	Would realize the importance and necessity of intellectual property rights.
	CO4	Take all the necessary precautions while conducting the experiments, which may reduce the risk.
	CO5	Understands the importance of risk evacuation system in reality and takes the utmost. Responsibility while handling the risky situations.

Course Outcomes for Fourth Year First Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Finite Element Methods (A3329)	CO1	**Choose** the type of analysis to solve the given problem.
	CO2	**Develop** shape functions for 1D, 2D and 3D elements.
	CO3	**Model** the given physical problem to mathematical form.
	CO4	**Analyze** deformation of elements as per boundary and loading

		conditions.
	CO5	**Determine** the stresses, strains and reaction forces in the element applying finite element methods
Computer Aided Design and Computer Aided Manufacturing (A3334)	CO1	**Explain** various elements of computers, computer graphics, product cycle in manufacturing industry, drafting and modeling systems.
	CO2	**Model** various synthetic curves and surfaces.
	CO3	**Develop** NC part programming, group technology and computer aided process planning.
	CO4	**Perceive** quality using computer aided quality control techniques.
	CO5	**Make use of** computer integrated manufacturing systems in industries.
Management Science (A3014)	CO1	Apply the concepts & principles of management in industry.
	CO2	Design & develop organization structure for an enterprise.
	CO3	Apply Quality Control techniques and Work-study principles in industry.
	CO4	Handle purchase process and can determine Economic Order Quantity.
	CO5	Apply the concepts of HRM in Recruitment, Selection and Training & Development.
	CO6	Develop PERT/CPM Charts for projects of an enterprise and estimate time & cost of project.
CAD & M LAB (A3335)	CO1	**Model** machine components using Computer Aided Design software.
	CO2	**Identify** parametric modeling techniques to reflect engineering requirements.
	CO3	**Simulate** the static, dynamic and thermal analysis of the components as per the boundary conditions.
	CO4	**Operate** CNC machine to produce machine components.
	CO5	**Build** the NC part program as per the geometry of component
Production Drawing Practice and Instrumentation Lab (A3336)	CO1	**Choose** suitable fits and associated tolerance for machine elements.
	CO2	**Develop** detailed part drawings from assembly drawings of machine components.
	CO3	**Calibrate** pressure, temperature, strain, speed, and angle by measuring instruments.
	CO4	**Justify** the appropriate device for the measurement of parameters like temperature, pressure, speed, strain etc.
	CO5	**Represent** materials, screw joints, welded joints, and gears conventionally
Mini Project (A3338) - XXXXXXXXXXXX	CO1	Demonstrate presentation and communication skills.
	CO2	Compare the theoretical approach with the practical approach in the industry.

X	CO3	Identify the gaps, issues and directions for future applications.
	CO4	Develop problem solving skills and industrial expertise in specific domain .
	CO5	Conclude the idea of expertise in the industry in the form of presentation and documentation

Course Outcomes for Fourth Year Second Semester Course		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Refrigeration and Air Conditioning (A3337)	CO1	**Explain** the basic concepts and working of various refrigeration and air-conditioning systems.
	CO2	**Compare** the performance of different refrigeration and air conditioning systems.
	CO3	**Solve** problems of different refrigeration and air conditioning systems.
	CO4	**Assess** merits and demerits of different refrigeration and air conditioning systems.
	CO5	**Classify** the refrigerants based on environmental considerations
Technical Seminar (A3339) - XXXXXXXXXXXX	CO1	**Demonstrate** presentation and communication skills.
	CO2	**Compare** old technology with emerging technology.
	CO3	**Identify** the gaps, issues and directions for future research.
	CO4	**Develop** problem solving skills.
	CO5	**Conclude** the presentation of ideas/ procedures for validity
Project Work (A3340) XXXXXXXXXX	CO1	Demonstrate presentation and communication skills.
	CO2	Compare the theoretical approach with the practical approach in the industry.
	CO3	Identify the gaps, issues and directions for future applications.
	CO4	Develop problem solving skills and expertise in specific domain further.
	CO5	Conclude the idea of expertise in the industry in the form of model, presentation and sequential procedures in documentation for validation.

Course Outcomes for PROFESSIONAL ELECTIVE-I		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Automobile Engineering (A3351)	CO1	**Explain** the working components of four wheeler automobile.
	CO2	**Classify** the different ignition systems used in automobiles.
	CO3	**Differentiate** various types of automobile Transmission.
	CO4	**Elaborate** the requirements of fuel injection systems used in

		automobiles.
	CO5	**Discuss** the steering control mechanism used in automobiles
Advanced Strength of Materials (A3352)	CO1	**Remember** the concepts of mechanics of solids and analyze the responses of structures (shear centre, curved beam, unsymmetrical bending) at different loading conditions.
	CO2	**Analyze** the theory of elasticity and its application to plane stress and strain problems.
	CO3	**Examine** the torsion problems with linear elastic solution of non-circular cross section with different analogies.
	CO4	**Explain** the responses of structures on elastic foundation at various end conditions with different loading scenarios.
	CO5	**Analyze** the influences of contact stress induced in structures
Welding Technology (A3353)	CO1	**Explain** different types of welding processes and the principles guiding the operations.
	CO2	**Analyze** the causes of welding defects and their prevention.
	CO3	**Select** welding parameters to obtain desired mechanical properties of welded joints.
	CO4	**Describe** arc welding and resistance welding processes.
	CO5	**Identify** the welding equipment needed for different applications
Manufacturing of Composite Materials (A3354)	CO1	**Explain** various types of composite materials.
	CO2	**Compare** the characteristics of composite materials.
	CO3	**Select** the production processes for various composite materials.
	CO4	**Evaluate** the strength of composite materials.
	CO5	**Recommend** materials for advanced applications

Course Outcomes for PROFESSIONAL ELECTIVE-II		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Power plant Engineering (A3355)	CO1	**Classify** conventional and non-conventional power plants.
	CO2	**Explain** the classification, working principle, components and auxiliaries, merits and limitations of various power plants.
	CO3	**Illustrate** the layouts of conventional power plants with schematics.
	CO4	**Solve** problems by considering economic and environmental aspects.
	CO5	**Analyze** the performance of Diesel and Gas turbine power plants
Unconventional Manufacturing Processes	CO1	**Significance** of the modern machining processes
	CO2	**Understand** the latest machining technologies.
	CO3	**Knowledge** of metal removal mechanism for various machining

(A3356)		techniques.
	CO4	**Selection** of machining process for various work materials
	CO5	**Apply** suitable machining process for the typical component
Nanotechnology (A3357)	CO1	**Explain** the features of nanomaterials and nanotechnology.
	CO2	**Identify** the techniques for nanoparticle fabrication.
	CO3	**Categorize** the operations for making the nanocomponents.
	CO4	**Evaluate** the parameters applicable to complex problems in manufacturing process.
	CO5	**Compare** the various tools and techniques to optimize the systems.
Production Planning and Control (A3358)	CO1	**Explain** various elements of production, planning and control (PPC) and the role of computers in PPC.
	CO2	**Estimate** the demand for products using forecasting techniques.
	CO3	**Determine** operating policies for inventory control systems to manage inventories efficiently and effectively using the techniques such as ABC analysis, VED analysis, MRP, ERP, JIT etc.
	CO4	**Devise** procedures and strategies for various functions of PPC such as aggregate planning, routing, scheduling, dispatching, and follow-up.
	CO5	**Apply** line balancing techniques for the efficient management of assembly lines

Course Outcomes for PROFESSIONAL ELECTIVE-III		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Renewable Energy Systems (A3359)	CO1	**Illustrate** various renewable energy technologies and systems.
	CO2	**Identify** various forms of renewable energy sources by imparting the knowledge of storage technologies.
	CO3	**Apply** the knowledge and understanding of various possible mechanisms to develop renewable energy projects.
	CO4	**Explain** the performance characteristics of renewable energy sources and policies associated with energy sources.
	CO5	**Evaluate** the techno economic analysis of renewable energy systems and conduct life cycle analysis of renewable sources
Design of Production Tooling (A3360)	CO1	**Interpret** the geometrical and dimensional details of a production drawing.
	CO2	**Classify** the various jigs, fixtures and clamping devices used during machining.
	CO3	**Identify** various tools for the different machining processes
	CO4	**Design** single point and multipoint cutting tools

	CO5	**Understand** theory of deformation, stages of cutting operation
NDT Techniques (A3361)	CO1	**Explain** the operation of various NDT equipment used for inspection of metals and non metals.
	CO2	**Apply** scientific and technical knowledge to the field of non destructive testing.
	CO3	**Adapt** the relevant non destructive testing method for various engineering practice.
	CO4	**Conduct** the experiments and validate the report.
	CO5	**Test** the product quality and manufacturing defects using emerging technologies.
Materials for high temperature applications (A3362)	CO1	**Explain** the property requirements of high temperature materials.
	CO2	**Interpret** the condition of use in order to select the correct material for specific application.
	CO3	**Choose** the appropriate manufacturing process of high temperature materials.
	CO4	**Correlate** high temperature material properties with application.
	CO5	**Evaluate** and recommend material for advanced applications.

Course Outcomes for PROFESSIONAL ELECTIVE-IV		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Gas Dynamics and Jet propulsion (A3363)	CO1	**Explain** the basic concepts and property variations of a flow through ducts.
	CO2	**Determine** the performance of different jet propulsion systems.
	CO3	**Develop** governing equations of normal and oblique shocks that encounter in jet propulsion systems.
	CO4	**Solve** problems of different jet propulsion systems.
	CO5	**Assess** functioning, merits and demerits of different jet propulsion systems
Fatigue and Fracture Mechanics (A3364)	CO1	**Understand** the concepts of fatigue and fracture mechanics of structure and emphasize the significance of material properties on the behavior of structures.
	CO2	**Illustrate** the critical issues related to the design of machine component.
	CO3	**Analyze** aspects of fatigue behavior based on loading conditions.
	CO4	**Design** of mechanical components against failure.
	CO5	**Apply** the concepts of fracture mechanics to the behavior of cracks in the structures

Robotics (A3365)	CO1	**Define** the basic concepts and components of a robotic system.
	CO2	**Utilize** the key concepts of programming and program the robot path with obstacle avoidance.
	CO3	**Identify** the use of actuators and sensors for mobility system.
	CO4	**Classify** the industrial robot program as per functions based application.
	CO5	**Interpret** the various applications of robots in Modern Manufacturing Systems
Rapid Prototyping (A3366)	CO1	**Explain** product development, conceptual design and classify rapid prototyping systems; stereo lithography process and applications.
	CO2	**Make use of** techniques for processing of CAD models for rapid prototyping.
	CO3	**Compare** the practical issues that are important for the effective use of technologies.
	CO4	**Apply** the concepts of Rapid Prototyping through software.
	CO5	**Estimate** the industrial standards.

Course Outcomes for PROFESSIONAL ELECTIVE-V		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Computational Fluid Dynamics (A3367)	CO1	**Identify** the governing differential equations and apply the boundary conditions for fluid dynamics problems.
	CO2	**Explain** discretization techniques and error analysis for stability.
	CO3	**Apply** general transformation equations for grid generations.
	CO4	**Develop** algorithms for flow field analysis.
	CO5	**Analyze** turbulence models for different Reynolds numbers
Vibrations and Structural Dynamics (A3368)	CO1	**Formulate** the mathematical models and develop the equation of motion of vibrating systems by different principles.
	CO2	**Advance** the essential information, skills and competencies to evaluate and resolve vibration problems across a wide range of applications.
	CO3	**Articulate** the basic concepts of mechanical vibrations and justify their application in a variety of engineering design contexts.
	CO4	**Discuss** the influences of factors on the dynamic behavior of structures.
	CO5	**Analyze** the structures and machines by considering the economic, industry, human and environment
Micro Electro Mechanical Systems	CO1	**Discuss** the development of MEMS by using different principles and methods.
	CO2	**Analyze** the different sensors and actuators for particular application.

(A3369)	CO3	**Apply** the MEMS for different applications.
	CO4	**Discover** the micro-opto-mechanical systems and micro fluidic systems.
	CO5	**Understand** the RFMEMS using RF based communication systems in electronic devices
Mechatronics (A3370)	CO1	**Describe** the precision actuation systems, signal conditioning, electro mechanical drives and electronic interface systems.
	CO2	**Analyze** the precision actuation systems, signal conditioning, electro mechanical drives and electronic interface systems.
	CO3	**Analyze** the performance of devices using microcontrollers.
	CO4	**Develop** the mechanical systems using the micro controllers and programmable logic controllers
	CO5	**Design** a system, component, or process to meet desired needs within realistic constraints

Course Outcomes for OPEN ELECTIVES		
Course		**VCE MECH - R15**
Title with Code	**#**	**Statement**
Solar Energy and Applications (A3278)	CO1	Compare the present and future available electrical power from solar energy in the world based on the knowledge of global solar horizontal irradiation.
	CO2	Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems
	CO3	Identify simple to complex problems involved in solar thermal energy conversion technique used in the liquid based solar heating and cooling systems for buildings/societal needs.
	CO4	Examine a solar PV(Photo Voltaic) system components and their function by utilizing the previous literature knowledge on different Photovoltaic solar cells like crystalline, Multi-Crystalline, Amorphous and thin film
	CO5	Analyze the techno economics interaction of developments in the solar energy systems
Disaster Management (A3178)	CO1	List out different causes of Environmental hazards.
	CO2	Classify environmental hazards and disasters, Endogenous hazards, exogenous hazards, infrequent events - Cumulative atmospheric hazards / disasters.
	CO3	Explain different characteristics of hazards.
	CO4	Develop Emerging approaches in Disaster management
	CO5	
Constructing Planning and	CO1	Improve business and management skills in positions within the construction industry.

Management (A3179)	CO2	Adapt technical skills and knowledge in mathematics, science, construction, and technology in support of planning, analyzing, and solving construction problems.
	CO3	Utilize industry resources including associations and organizations, professional publications, and governmental data to analyze, evaluate, and apply current trends within the industry.
	CO4	Make use of decision-making in personal and professional endeavors.
	CO5	Design a quality construction project from start to completion while maintaining budget, schedule, and safety requirements