



VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD
Autonomous institute affiliated to JNTUH

B.Tech (MECHANICAL ENGINEERING)

Course Outcomes:

Course Outcomes (COs) for R20 Regulations (Batch: 2020-2024)

Course Outcomes for First Year First Semester Course		
Course		
Title with Code	#	Statement
Linear Algebra and Ordinary Differential Equations (A6001)	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 ordinary differential equations first and higher order.
	CO4	Make use of ordinary differential equations to solve engineering problems.
	CO5	Apply Laplace transforms to solve ordinary differential equations.
Engineering Physics (A6004)	CO1	Classify materials based on their crystal structures.
	CO2	Utilize quantum mechanics to interpret the properties of semiconducting materials.
	CO3	Apply wave property of light to study different optical phenomenon.
	CO4	Develop communication systems by means of lasers and optical fibers.
	CO5	Analyze the principles of nanotechnology for electronic applications.
English For Communication (A6009)	CO1	Build competence in grammar and vocabulary.
	CO2	Develop pronunciation as well as listening capabilities.
	CO3	Develop effective academic reading skills.
	CO4	Identify problems in speaking and building their presentation skills.
	CO5	Construct effective academic writing skills.
Problem Solving with Python (A6501)	CO1	Identify the various building blocks to write a Python program.
	CO2	Use control statements for solving a given problem.
	CO3	Implement fundamental data structures for manipulating data.
	CO4	Build user defined functions to improve code reusability.
	CO5	Use File concepts to store and retrieve data from disk.
Engineering Graphics (A6301)	CO1	Construct various types of curves commonly used in engineering practice.
	CO2	Distinguish between first, second, third and fourth angle projections of systems.
	CO3	Estimate lateral surface of the sheet metal requirement for making regular solids.
	CO4	Compare isometric and orthographic views of an object.
	CO5	Select CAD tools for drafting regular solids.

Engineering Workshop(A6302)	CO1	Identify the different materials and tools applied to each trade.
	CO2	Demonstrate each trade by preparing the required model.
	CO3	Analyse the model/component and selection of the trade-based operations.
	CO4	Examines each tool and deduces its working procedure. Examines each tool and deduces its working procedure.
	CO5	Classify different workshop practice methods.
Social Innovation (A6021)	CO1	Develop awareness on social issues faced by local regions.
	CO2	Identify the mind set of human Race and interpret the societal issues as simple, complicated, and complex problems.
	CO3	Identify the need statement along with its main causes and effects.
	CO4	Develop an innovative and sustainable solution for social issues by thinking critically and creatively.
Course Outcomes for First Year Second Semester Course		
Course		
Title with Code	#	Statement
Numerical Methods and Calculus (A6002)	CO1	Apply appropriate Numerical method to find a root of an equation and interpolate to approximate the values of the function at intermediate points.
	CO2	Evaluate definite integrals using appropriate methods.
	CO3	Solve partial differential equations of first order.
	CO4	Examine the extremum of a function of several variables.
	CO5	Make use of vector integral theorems to evaluate area, surface area and volumes.
Engineering Chemistry (A6007)	CO1	Identify differences and similarities of the Batteries.
	CO2	Extrapolate the knowledge of electro chemical series to protect different metals from corrosion.
	CO3	Compare the properties and applications of engineering substances.
	CO4	Analyze the impurities present in the water for industrial and domestic applications.
	CO5	Make use of instrumental techniques and titrations to measure physical and chemical properties.
Business English (A6010)	CO1	Build competence in grammar and vocabulary.
	CO2	Select reading skills in terms of business language.
	CO3	Develop writing skills for business communication.
	CO4	Develop confidence in speaking skills and presentation skills.
	CO5	Make use of listening skills in different business contexts.
Data Structures (A6502)	CO1	Identify the various building blocks to write a C program.
	CO2	Use control statements and functions to solve a given problem.
	CO3	Apply Linear Data Structures concepts for manipulating data.
		Implement operations of non-linear data structures for handling large

	C04	data.
	C05	Select appropriate sorting and searching technique for a given application.
Engineering Mechanics (A6303)	C01	Illustrate the types of forces and moments acting on a rigid body.
	C02	Apply the laws of mechanics to evaluate different types of forces acting on a rigid body.
	C03	Identify the centroid and moment of inertia of composite bodies.
	C04	Apply the basic concepts of kinematics and kinetics to solve numerical problems.
	C05	Measure the forces by using laws of mechanics on different bodies experimentally.
Engineering Exploration (A6022)	C01	Compare and contrast the contributions of different types of engineers in the development of a product, process, or system.
	C02	Apply the common engineering design process to solve complex problems and arrive at viable solution.
	C03	Explore various contemporary software and hardware tools to provide solutions for the problems.
	C04	Apply skills needed for successful teamwork including the basics of project management and written and oral communication.
	C05	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 First Semester Course		
Probability Distributions and statistics (A6012)	C01	Identify an appropriate probability distribution for a given discrete or continuous random variable and use its properties to calculate probabilities.
	C02	Make use of probability distributions to analyse and solve a given problem.
	C03	Interpret correlation coefficient in context and study regression analysis.
	C04	Use knowledge of elementary statistical decision methods such as interval estimation and test of hypothesis.
	C05	Identify the components of a hypothesis test and compute, or approximate, the P- value of a test statistic.
Basic Electrical And Electronics Engineering (A6206)	C01	Understand the basic laws of electrical circuits and Machines.
	C02	Analyze the electrical circuits using Nodal Analysis, Mesh analysis and Network theorems with DC Source.
	C03	Calculate power and Power factor in AC circuits.
	C04	Conduct suitable test to determine the performance of DC and AC Machines.

	C05	Analyze the characteristics of DC machines, Transformers, Diodes and rectifiers.
Mechanics Of Solids (A6304)	C01	Understand the concepts of stress and strain in structural members
	C02	Construct Shear force& Bending Moment diagrams for beams
	C03	Solve numerical problems on structural members to find out deformations and deflections.
	C04	Analyze stresses in structural members like bars, beams and cylindrical shells
	C05	Test for mechanical properties of the material
Metallurgy And Material Science (A6305)	C01	Understand the basic principles of materials through crystal structure.
	C02	Identify the phases and interrelationship between structure and properties.
	C03	Construct phase diagram of alloy systems at different temperatures and composition
	C04	Apply basic principles for selection of materials.
	C05	Analyze effect of heat treatment on material properties.
Thermodynamics (A6306)	C01	Understand the basic principles of classical thermodynamics.
	C02	Apply the laws of thermodynamics to solve engineering problems.
	C03	Evaluate change in entropy for ideal and real gases.
	C04	Solve numerical problems using relationships of thermodynamic fluids.
	C05	Analyze the performance of basic thermodynamic cycles.
Universal Human Values2: Understanding Harmony (A6015)	C01	Build the process of self-exploration, right understanding, relationships, natural acceptance and experiential validation.,
	C02	Examine human being as a co-existence of self 'I' and the material 'Body'.
	C03	A6015.3. Understand the universal harmonious order in society-undivided society,
	C04	Interpret the harmony in nature, holistic perception at all levels of existence
	C05	Analyze professional competence for augmenting universal human order, ethical human conduct and natural acceptance of human values.
Engineering Design Thinking (A6023)	C01	Interpret the problem-solving skills and product design skills.
	C02	Apply foundational knowledge of the primary fields of engineering and scientific concepts to find the solution.
	C03	Identify various techniques and applications of the engineering design process.
	C04	Inspect the design and assess a prototype that solves an engineering problem.
	C05	Interpret the solutions and document the findings/reflections.
Quantitative Aptitude (A6013)	C01	Solve problems on Numbers, Averages, Ages.
	C02	Apply the concepts of ratios, proportions and percentages to solve problems such as problems on alligations.
	C03	Solve problems on Geometry, Mensuration and Progressions.

	C04	Solve problems on Time, Speed and Distance, Equations, Profit and Loss, Logarithms and Functions.
Gender Sensitization (A6031)	C01	Interpret gender sensitization and problems of other genders
	C02	Identify the reasons for the female feticide
	C03	Interpret the role of women in domestic, political and economic spheres
	C04	Develop sensitivity towards sexual and domestic violence
	C05	Understand the women's place in Telangana History
Course Outcomes for Second Year Second Semester Course		
Managerial Economics and Financial Analysis (A6016)	C01	Explain the concepts of Managerial Economics and Financial Accounting.
	C02	Analyze interrelationship among various economic variables and its impact.
	C03	Classify the market structure to decide the fixation of suitable price.
	C04	Analyze financial statements to assess financial health of business.
	C05	Apply capital budgeting techniques to select best investment opportunity.
Machine Drawing (A6307)	C01	Understand product symbols, weld symbols, pipe joints
	C02	Illustrate various machine components through drawings as per ISO standards.
	C03	Draw machine components by applying the principles of engineering drawing using CAD software.
	C04	Prepare the part or assembly drawings as per the conventions
	C05	Interpretation of machine drawings that in turn help the students in the preparation of the production drawings
IC Engines And Gas Turbines (A6308)	C01	Compare air standard cycles with actual and fuel air cycles.
	C02	Analyze combustion phenomenon in SI and CI engines
	C03	Explain the performance parameters of internal combustion engines, compressors and gas turbines.
	C04	Solve the problems related to internal combustion engines, compressors and gas turbines.
	C05	Evaluate the performance of internal combustion engines and compressors.
Fluid Mechanics And Hydraulic Machinery (A6309)	C01	Explain the effect of fluid properties on a flow system.
	C02	Identify type of fluid flow patterns and describe continuity equation.
	C03	Solve fluid engineering problems using mass, momentum and energy Conservation principles
	C04	Analyze a variety of practical fluid flows, measuring devices using fluid mechanics
	C05	Estimate performance parameters of a given Centrifugal and reciprocating pump
Manufacturing Processes	C01	Understand various manufacturing operations including their capabilities, limitations and applications.
	C02	Analyze products and be able to improve their manufacturability and to reduce the cost

(A6310)	C03	Analyze the thermal and metallurgical aspects during solidification in casting and welding and their role on quality of cast and weld objects.
	C04	Design the gating and riser system.
	C05	Apply knowledge on selection of suitable manufacturing process for typical component
Kinematics Of Machinery (A6311)	C01	Explain the principles of kinematic pairs, chains and their classification, degrees of freedom, inversions and planar mechanisms.
	C02	Analyze the planar mechanisms for position, velocity and acceleration.
	C03	Select planar four bar and slider crank mechanisms for specified kinematic conditions.
	C04	Evaluate gear tooth geometry and select appropriate gears for the required applications.
	C05	Choose the cams and followers for specified motion profiles.
Product Realization (A6024)	C01	Interpret the specifications of product and solve it for practical realization.
	C02	Analyse the customers mind set and accordingly designing of the product.
	C03	Applying Gantt chart to define timeline for product realization.
	C04	Conceptualize the terms called product, purchase, production and monitoring of products.
	C05	Communicate the process of converting an idea to physical product.
Analytical Reasoning (A6014)	C01	Apply efficient and appropriate methods to solve analytical reasoning problems.
	C02	Choose the techniques to solve puzzles on Blood Relations.
	C03	Apply methods to solve complex puzzles of logical reasoning.
	C04	Apply appropriate techniques to solve Seating Arrangement puzzles.
	C05	Identify and apply appropriate techniques to solve problems on Artificial language.
Environmental Science (A6032)	C01	Outline the important components of environment.
	C02	Identify global environmental problems to come out with best possible solutions.
	C03	Make use of environmental laws for the protection of forest and wildlife.
	C04	Apply environmental ethics to maintain harmonious relation between nature and human being.
	C05	Analyse the major environmental effects of exploiting natural resources.

Course Outcomes (COs) for R19 Regulations (Batch: 20219-2023)

Course Outcomes for First Year First Semester Course		
Course		
Title with Code	#	Statement
Linear Algebra and	CO	Solve system of linear equations using rank of a matrix.

Ordinary Differential Equations (A5001)	1	
	CO 2	Examine the nature of quadratic form using eigen values and eigen vectors.
	CO 3	Solve ordinary differential equations first and higher order.
	CO 4	Make use of ordinary differential equations to solve engineering problems.
	CO 5	Apply Laplace transforms to solve ordinary differential equations.
Applied Physics (A5003)	CO 1	Classify materials based on their crystal structures.
	CO 2	Utilize quantum mechanics to interpret the properties of semiconducting materials.
	CO 3	Apply wave property of light to study different optical phenomenon.
	CO 4	Develop communication systems by means of lasers and optical fibers.
	CO 5	Analyze the principles of nanotechnology for electronic applications.
English For Communication (A5005)	CO 1	Build competence in grammar and vocabulary.
	CO 2	Develop pronunciation as well as listening capabilities.
	CO 3	Develop effective academic reading skills.
	CO 4	Identify problems in speaking and building their presentation skills.
	CO 5	Construct effective academic writing skills.
Python Programming (A5501)	CO 1	Understand fundamentals of Python language.
	CO 2	Identify and construct common programming idioms: variables, loop, branch, Subroutine and input/output.
	CO 3	Use and manipulate Python lists, tuples, and dictionaries for compound data.
	CO 4	Build functions to increase code reusability.
	CO 5	Read and write data from/to files in Python.
Engineering Graphics And Computer Aided Drafting (A5301)	CO 1	Construct various types of curves commonly used in engineering practice.
	CO 2	Distinguish between first, second, third and fourth angle projections of systems.
	CO 3	Estimate lateral surface of the sheet metal requirement for making regular solids.
	CO 4	Compare isometric and orthographic views of an object.
	CO 5	Select CAD tools for drafting regular solids.

Social Innovation (A5006)	CO 1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.
	CO 2	Apply various titrations for the estimation of strengths of solutions and hardness of water.
	CO 3	Identify different samples from a mixture by using various separation techniques.
	CO 4	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
	CO 5	Evaluate the percentage of yield of chemical substances by organic synthesis.
Course Outcomes for First Year Second Semester Course		
Course		
Title with Code	#	Statement
Advanced Calculus (A5002)	CO1	Examine the extremum of a function of several variables.
	CO2	Evaluate definite and indefinite integrals
	CO3	Determine Divergence and Curl of a vector point function
	CO4	Make use of vector integral theorems to evaluate area, surface area and volumes
	CO5	Build Fourier series and Fourier transforms of a given function
Applied Chemistry (A5004)	CO1	Extend the fundamental concepts of chemistry to describe various chemical Phenomena and application.
	CO2	Compare the properties and applications of engineering substances.
	CO3	Apply various reactions and fundamentals of stereo chemistry to understand organic chemistry.
	CO4	Analyze the impurities present in the water for industrial and domestic applications.
	CO5	Utilize the instrumental techniques and titrations to measure physical and chemical properties.
Data Structures Through C (A5502)	CO1	Understand the fundamentals of C Concepts and its Constructs.
	CO2	Apply the concepts of Arrays, functions, pointers and structures in real world applications.
	CO3	Perform various operations on linear data structures.
	CO4	Implement various Non Linear data structures.
	CO5	Select appropriate searching and sorting techniques for given application.
Engineering Mechanics (A5302)	CO1	Illustrate the types of forces and moments acting on a rigid body.
	CO2	Apply the laws of mechanics to evaluate different types of forces acting on a rigid body.
	CO3	Identify the centroid and moment of inertia of composite bodies.
	CO4	Apply the basic concepts of kinematics and kinetics to solve numerical problems.
	CO5	Measure the forces by using laws of mechanics on different bodies experimentally.

Engineering Exploration (A5007)	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.
Co-Engineering Laboratory (A5008)	CO1	Identify various surveying tools and choose building materials according to field conditions
	CO2	Analyze the basic circuit connections, maintenance and troubleshooting of house hold equipments
	CO3	Make use of various electrical and electronic components to construct simple circuits and measure various physical quantities.
	CO4	Explain basic components used in different trades.
	CO5	Identify the associated tools used in different trades.
Course Outcomes for Second Year First Semester Course		
Managerial Economics And Financial Analysis (A5015)	CO1	Explain the concepts of Managerial Economics and Financial Accounting.
	CO2	Analyze interrelationship among various economic variables and it's impact.
	CO3	Classify the market structure to decide the fixation of suitable price.
	CO4	Analyze financial statements to assess financial health of business.
	CO5	Apply capital budgeting techniques to select best investment opportunity.
Basic Electrical And Electronics Engineering (A5205)	CO1	Understand the basic laws of electrical circuits and Machines.
	CO2	Analyze the electrical circuits using Nodal Analysis, Mesh analysis and Network theorems with DC Source.
	CO3	Calculate power and Power factor in AC circuits.
	CO4	Conduct suitable test to determine the performance of DC and AC Machines.
	CO5	Analyze the characteristics of DC machines, Transformers, Diodes and rectifiers.
Mechanics Of Solids (A5303)	CO1	Understand the concepts of stress and strain in structural members
	CO2	Construct SF & BM diagrams for beams
	CO3	Solve numerical problems on structural members to find deformations and deflections.
	CO4	Analyze stresses in bars, beams and cylindrical shells
	CO5	Test for mechanical properties of the material and its behavioral analysis.
Thermodynamics (A5304)	CO1	Understand the basic principles of classical thermodynamics.
	CO2	Apply the laws of thermodynamics to solve engineering problems.
	CO3	Evaluate change in entropy for ideal and real gases.

	CO4	Solve numerical problems using relationships of thermodynamic fluids.
	CO5	Analyze the performance of basic thermodynamic cycles.
Metallurgy And Material Science (A5305)	CO1	Understand the basic principles of materials through crystal structure.
	CO2	Identify the phases and interrelationship between structure and properties.
	CO3	Construct phase diagram of alloy systems at different temperatures and composition
	CO4	Apply basic principles for selection of materials.
	CO5	Analyze effect of heat treatment on material properties.
Verbal Ability And Logical Reasoning (A5013)	CO1	Identify efficient and appropriate methods to solve logical reasoning problems.
	CO2	Choose the techniques to solve puzzles on analytical reasoning.
	CO3	Apply the grammar rules for effective sentence formation
Gender Sensitization (A5011)	CO1	Interpreting gender sensitization and problems of other genders.
	CO2	Identifying the reasons for the female feticide.
	CO3	Interpreting the role of women in domestic, political and economic spheres.
	CO4	Developing sensitivity towards sexual and domestic violence.
	CO5	Understanding the women's place in Telangana History.
Course Outcomes for Second Year Second Semester Course		
Probability And Statistics (A5010)	CO1	Solve basic concepts of probability and perform probability theoretical distributions
	CO2	Identify the types of random variables and various distributions
	CO3	Make use of probability distributions to analyze and solve a given problem
	CO4	Build practical understanding of various concepts of statistics
	CO5	Inspect scientific hypothesis and theories
IC Engines And Gas Turbines (A5306)	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, compressors and gas turbines.
	CO4	Solve the problems related to internal combustion engines, compressors and gas turbines.
	CO5	Evaluate the performance of internal combustion engines and compressors.
Kinematics Of Machinery (A5307)	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	Select 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	Choose the cams and followers for specified motion profiles.
Fluid Mechanics And Hydraulic Machines (A5308)	CO1	Explain the fundamental aspects of fluid properties, fluid statics, dynamics including the theory of boundary layer and hydraulic turbines & pumps.
	CO2	Establish relationships among fluid flow parameters.
	CO3	Solve fluid engineering problems using mass, momentum, and energy conservation principles.
	CO4	Analyze fluid flow through pipes and its fittings; models and prototypes of fluid systems and performance of hydraulic turbines and pumps.
	CO5	Determine the specifications of pressure and flow measuring devices, piping systems, turbines and pumps
Manufacturing Processes (A5309)	CO1	Understand various manufacturing operations including their capabilities, limitations and applications.
	CO2	Analyze products and be able to improve their manufacturability and to reduce the cost
	CO3	Analyze the thermal and metallurgical aspects during solidification in casting and welding and their role on quality of cast and weld objects.
	CO4	Design the gating and riser system.
	CO5	Apply knowledge on selection of suitable manufacturing process for typical component.
Machine Drawing (A5310)	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 using CAD software.
	CO4	Compare part drawings and assembly drawings.
	CO5	Prepare assembly drawings by applying drawing conventions using CAD Software.
Quantitative Aptitude (A5014)	CO1	Interpret data using graphs and charts.
	CO2	Apply the concepts of ratios, proportions and percentages to solve problems.
	CO3	Solve problems on Logarithms, permutations, combinations, clocks, and calendars.
Environmental Science (A5012)	CO1	Outline the important components of environment.
	CO2	Identify global environmental problems to come out with best possible solutions.
	CO3	Make use of environmental laws for the protection of forest and wildlife.
	CO4	Apply environmental ethics to maintain harmonious relation between nature and human being.
	CO5	Analyze the major environmental effects of exploiting natural resources.
Course Outcomes for third Year First Semester Course		
Design Of Machine	CO1	Understand the concepts of the theories of failure of materials due to

Elements (A5311)		different types of loads.
	CO2	Design different types of mechanical joints such as riveted, welded, and bolted under various loading conditions.
	CO3	Explore the concepts of fastening to connect different types of bars.
	CO4	Develop the knowledge of connection of shaft by couplings mechanism with different operating conditions.
	CO5	Analyze the design of solid and hollow shafts based on strength and rigidity criterions.
Dynamics Of Machinery (A5312)	CO1	Find a solution to minimize vibrations in engines.
	CO2	Apply laws of Mechanics to evaluate forces causing motion.
	CO3	Build turning moment diagrams for two stroke and four stroke engines.
	CO4	Analyze the effect of gyroscopic couple on all rotating bodies.
	CO5	Evaluate the power lost due to friction at different machine elements.
Applied Thermodynamics (A5313)	CO1	Understand the components and processes of Rankine cycle and Vapour compression refrigeration cycle.
	CO2	Solve numerical problems on Rankine cycle, Refrigeration cycle, Steam nozzles, and Turbines.
	CO3	Analyze Steam and Refrigeration cycles and components by applying thermodynamic concepts.
	CO4	Compare and suggest modification in the Rankine cycle and its components to improve performance.
	CO5	Evaluate the specifications of the Rankine cycle, steam nozzles and turbines.
Metrology And Machine Tools (A5314)	CO1	Understand the basic principles of Metal cutting process on different machines.
	CO2	Apply the proper measuring instrument to determine the various elements that are present on the work piece.
	CO3	Evaluate the machining time on machine tools.
	CO4	Solve problems related to machining operations.
	CO5	Analyze the performance of machine tools.
Additive Manufacturing (A5351)	CO1	Define the various process used in Additive Manufacturing
	CO2	Analyse and select suitable process and materials used in Additive Manufacturing.
	CO3	Identify, analyse and solve problems related to Additive Manufacturing.
	CO4	Apply knowledge of additive manufacturing for various real-life applications
	CO5	Apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.
Automobile Engineering (A5352)	CO1	Identify the components of an automobile namely IC engines and Electric vehicles.
	CO2	Classify various sub systems in an automobile.
	CO3	Illustrate the working mechanisms of the different components in an automobile.
	CO4	Analyze various sub systems and their components in an automobile.
	CO5	Assess the performance of an automobile and its sub systems.

Composite Materials (A5353)	CO1	Understand the Knowledge of composite materials for component design.
	CO2	Evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
	CO3	apply knowledge of composite mechanical performance and manufacturing methods to a composites design project
	CO4	Identify the most appropriate manufacturing process for fabrication
	CO5	Analyze the elastic properties and simulate the mechanical performance of composite materials and predict the failure behaviour of composites.
Operations Research (A5354)	CO1	Explain the Operations Research features, models, applications and methods such as linear programming, transportation, sequencing, assignment, replacement, games theory.
	CO2	Build mathematical models for finding optimum solutions for various real world problems and case studies.
	CO3	Evaluate various alternatives available to aid in decision making situations.
	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, production, distribution and service systems.
Engineering Design Thinking (A5016)	CO1	Interpret the problem-solving skills and product design skills
	CO2	Apply foundational knowledge of the primary fields of engineering and scientific concepts to find the solution
	CO3	Identify various techniques and applications of the engineering design process
	CO4	Inspect the design and assess a prototype that solves an engineering problem
	CO5	Interpret the solutions and document the findings/reflections
Essence Of Indian Traditional Knowledge (A5018)	CO1	Interpret the nature and characteristics of traditional knowledge.
	CO2	Understand the essence of protecting traditional knowledge through various acts.
	CO3	Utilize the traditional knowledge in the contemporary world.
	CO4	Create an awareness of traditional medicine and health practices.
	CO5	Apply the knowledge of traditional art forms and culture in the present scenario.
Course Outcomes for third Year Second Semester Course		
Machine Design (A5316)	CO1	Understand the mechanism of springs at different loading condition.
	CO2	Apply the mechanism of power screw and condition for self locking.
	CO3	Select the form of bearings for different operating conditions
	CO4	Explore the design of different types gears used in mechanical components.
	CO5	Analyze the design of different types of components used in IC engine part.
Heat Transfer (A5317)	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 the heat transfer at 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.
CAD/CAM (A5318)	CO1	Explain various elements of computers, computer graphics, and product cycle in manufacturing industry, drafting and modelling systems.
	CO2	Model machine components using Computer-Aided Design software.
	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.
Numerical Simulation Laboratory (A5319)	CO1	Understand the simulation techniques for numerical solution
	CO2	Solve linear and non linear ordinary differential equations by using simulation method
	CO3	Solve Fluid flow and heat transfer problems using simulation methods
	CO4	Perform analysis of stress, truss/beam and dynamic analysis of mechanical members.
	CO5	Analyze the temperature distribution in one/two dimensional heat transfer problems
Basic Mechanical Engineering (A5331)	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 design parameters 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.
Design For Manufacturing (Professional Elective - II) (A5355)	CO1	Understand constraints of manufacturing processes that limit design possibilities with respect to cycle time, material handling, and other factory costs.
	CO2	Apply quantitative methods to assess DFA between different designs.
	CO3	Apply principles of DFA to increase manufacturing efficiency in assembly processes.
	CO4	Distinguish poor practices from robust design practices for discussed processes.
	CO5	Prepare project or report to illustrate applied DFM principles per an example from industry.
Tribology (Professional Elective - II)	CO1	Understand the nature of engineering surfaces, concepts of friction, wear and lubrication
	CO2	Explain the different bearing Materials with their properties
	CO3	Apply the basic theories of friction, wear and lubrication to

(A5356)		predictions about the frictional behavior of commonly encountered sliding interfaces.
	CO4	Identify, Analyze and solve the Tribo-logical problems by using laws of friction, wear and lubrication
	CO5	Analyze the behavior of bearing in different lubrication regimes and able to develop mathematical model
Nanotechnology (Professional Elective - II) (A5357)	CO1	Understand the nanotechnology and actual working areas and applications.
	CO2	Distinguish between nanomaterials depending on their technological applications.
	CO3	Determine the characterization techniques for nanomaterials and nano thin films.
	CO4	Discuss the application of nanotechnology in major scientific fields
	CO5	Describe the challenges nanotechnology poses to our environment
Energy Conservation And Renewable Energy Resources (Professional Elective - II) (A5358)	CO1	Understand energy strategy and the importance of energy conservation.
	CO2	Classify renewable and non-renewable sources of energy.
	CO3	Describe the basic operating principle of various renewable energy systems.
	CO4	Develop the basic design for bio gas generation plant.
	CO5	Compare the advantages and limitations of different renewable energy sources.
Product Realization (A5017)	CO1	Interpret the specifications of product and solve it for Practical realization
	CO2	Analyze the Customers mindset and accordingly designing of the product.
	CO3	Applying Gantt Charts to define timeline for Product Realization.
	CO4	Conceptualize the terms called Product, Purchase, Production and Monitoring of products.
	CO5	Communicate the process of converting an idea to physical Product
Indian Constitution (A5019)	CO1	Identify the important components of Indian Constitution.
	CO2	Apply the fundamental rights in right way and become a more responsible citizen.
	CO3	Illustrate the evolution of Indian Constitution.
	CO4	Explain the basic structure of Indian Constitution.
	CO5	Define the basic concepts democracy, liberty, equality, secular and justice.
Course Outcomes for Fourth Year First Semester Course		
Finite Element Methods (A5321)	CO1	Understand the general procedure of finite element method, one dimensional problems and shape functions.
	CO2	Solve structural elements including trusses and beams.
	CO3	Apply finite element method to solve two dimensional and axi-symmetric problems.
	CO4	Analyze heat transfer problems, dynamic analysis on bar and beam

		elements.
	CO5	Simulate the static, dynamic and thermal analysis of the components as per the boundary conditions.
Robotics (A5322)	CO1	Understand the basic concepts and components of a robotic system.
	CO2	Identify the use of actuators and sensors for designing robot mobility system.
	CO3	Solve numerical problems on forward and inverse kinematics of robots for motion analysis.
	CO4	Apply the key concepts of robot dynamics and programming for obstacle avoidance.
	CO5	Select appropriate robots for various applications suitable to modern manufacturing systems.
Gas Dynamics And Propulsion (Professional Elective – III) (A5359)	CO1	Understand the one - dimensional steady compressible fluid flow
	CO2	Calculate the adiabatic and isentropic properties in various regions of flow.
	CO3	Calculate the adiabatic and isentropic properties in various conditions of flows during friction and heat transfer.
	CO4	Analyze the flow properties on shock waves in various flow regions.
	CO5	Apply the gas dynamics principles in the jet and space propulsion.
Automation In Manufacturing (Professional Elective – III) (A5360)	CO1	Illustrate the basic concepts of automation in machine tools.
	CO2	Analyze various automated flow lines, Explain assembly systems and line balancing methods.
	CO3	Describe the importance of automated material handling and storage systems.
	CO4	Interpret the importance of adaptive control systems, automated inspection systems.
	CO5	Apply the concepts of image processing applications of machine vision.
Process Planning And Estimation (A5361)	CO1	Select the process, equipment and tools for various industrial products
	CO2	Prepare process planning activity chart.
	CO3	Explain the concept of cost estimation.
	CO4	Compute the job order cost for different type of shop floor.
	CO5	Calculate the machining time for various machining operations
Power Plant Engineering (A5362)	CO1	Explain the working principle of various power plants.
	CO2	Identify the different components and their importance in the various power plants.
	CO3	Compare merits and demerits of different power plants.
	CO4	Illustrate the pollution from power plant and pollution control methods.
	CO5	Solve problems related to various power plants and plant economics
Course Outcomes for Fourth Year Second Semester Course		
Management Science	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

(A5020)	CO3	Apply statistical quality control techniques to know quality of product within control limits.
	CO4	Use Human resource management techniques for better people management.
	CO5	Apply the project management techniques to decide the optimum time and cost for completion of a project.
Refrigeration And Air-Conditioning (Professional Elective – IV) (A5363)	CO1	Understand 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 refrigerants based on environmental considerations.
Total Quality Management (Professional Elective – IV) (A5364)	CO1	Understand the overview of Total Quality Management System.
	CO2	Understand the concepts of customer satisfaction and employee involvement.
	CO3	Apply the appropriate tools and techniques of continuous process improvement for controlling and improving quality.
	CO4	Apply Quality Function Deployment, Six Sigma and Bench Marking tools for improving product or process quality.
	CO5	Implement the concepts of ISO 9000 in quality management.
Micro Electro Mechanical Systems (Professional Elective - IV) (A5365)	CO1	Understand the construction, working and applications of different MEMS structures
	CO2	Identify problems and suggest suitable MEMS material/ Devices/Process to get the Requisite Solution for a given application.
	CO3	Design the micro devices, micro systems using the MEMS fabrication process.
	CO4	Gain a knowledge of basic approaches for various actuator/Sensor design
	CO5	Apply fundamental concepts of MEMS to solve real life engineering problems.
Mechanical Vibrations (Professional Elective - IV) (A5366)	CO1	Formulate mathematical models and develop the equations of motion for vibrating systems by different principles
	CO2	Determine the vibratory responses of SDOF and MDOF system to harmonic, periodic and non-periodic excitation
	CO3	Explain the basic concepts of mechanical vibrations and justify their application in a variety of engineering design contexts
	CO4	Analyze vibrations in structures, machines, vehicles etc.
	CO5	Determine the whirling speed in shafts and the use of vibration instruments.
Numerical Techniques (Open Elective-I) (A5021)	CO1	Apply appropriate Numerical method to find a root of an equation.
	CO2	Make use of interpolation to find approximate values of the function at intermediate points.
	CO3	Evaluate definite integral using appropriate Numerical methods.
	CO4	Construct curve of best fit for the bivariate data using method of least squares.
	CO5	Determine approximate solution of ordinary and partial differential equations.

Mathematical Programming (Open Elective-II) (A5022)	C01	Identify LPP and express in mathematical form to solve by graphical or simplex method.
	C02	Apply artificial variable techniques to obtain the optimal solution of an LPP.
	C03	Interpret various methods under transportation model to get optimal results.
	C04	Solve travelling salesmen problem using Hungarian method.
	C05	Develop various replacement and sequencing models to arrive at an optimal decision.
Special Functions (Open Elective-III) (A5023)	C01	Determine series solutions of ordinary differential equations about ordinary and regular singular points.
	C02	Solve problems in cylindrical and spherical coordinate systems using Bessel functions.
	C03	Relate algebraic polynomials with Legendre and Hermite polynomials.
	C04	Apply Z - Transforms to solve difference equations.
Project Planning And Management (Open Elective-I) (A5131)	C01	Identify project characteristics and various phases of a project.
	C02	Explain project organization, staffing and feasibility of projects.
	C03	Apply the techniques of Project planning, scheduling and Execution Control.
	C04	Analyse the role of stakeholders.
	C05	Evaluate Resources, Budget, Claims and Disputes.
Air Pollution And Control (Open Elective-II) (A5132)	C01	Select sampling technique and appropriate methods to control air pollution.
	C02	Develop a broad overview of the strategies to manage air pollution.
	C03	Examine various particulate and gaseous pollutant removal mechanisms to reduce emissions.
	C04	Explain how atmospheric and chemical composition drives changes in the environment
	C05	Predict the ground level concentration of air pollutants using mathematical formulation.
Disaster Managment (Open Elective-III) (A5133)	C01	Identify concepts, hazards and vulnerabilities of different types of disasters.
	C02	Examine the components of disaster management mechanism.
	C03	Select suitable capacity building frame work for disaster management
	C04	Interpret various disaster coping strategies
	C05	Develop Strategies for disaster management planning
Transducers And Measurements (Open Electives-I) (A5231)	C01	Aware the basic concepts of measurement parameters as well as instrument standards, characteristics and errors.
	C02	Construct and design various measuring devices like voltmeters, Ammeters, Ohmmeters, analog, digital multi-meters and analyze different types of cathode ray oscilloscopes.
	C03	Design different bridge networks and analyze balanced condition for finding out values of resistance, capacitance and inductance.
	C04	Analyze different physical parameters like pressure, force, velocity, acceleration, sound, torque, strain and stress etc. using non-electrical transducers.

	C05	Apply the principles and practice for instrument design and develop for real world problems.
Solar Energy And Applications(Open Electives-II) (A5232)	C01	Compare the present and future available electrical power from solar energy in the world based on the knowledge of global solar horizontal irradiation.
	C02	Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems.
	C03	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.
	C04	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.
	C05	Analyze the techno economics interaction of developments in the solar energy systems
Energy Management And Audit(Open Electives-III) (A5233)	C01	Analyze the influence of energy availability on the development of Industries and various other organizations.
	C02	Discuss the concepts and technologies used for energy conservation.
	C03	Develop methods for evaluating worth of project.
	C04	Investigate the schemes for demand side management.
	C05	Evaluate the VAR requirements for effective voltage control.
Basic Mechanical Engineering (Open Elective-I) (A5331)	C01	Develop the general energy equations for thermal systems by laws of thermodynamics.
	C02	Compare types of fluids, fluid flows, pressure and flow measuring devices, losses in pipes, laminar and turbulent boundary layer concepts.
	C03	Evaluate design parameters of hydraulic turbines at given efficiency and discharge
	C04	Analyze an expression for force, workdone and efficiency of vane, turbines and pumps.
	C05	Apply the principles of conduction, convection and radiation heat transfer to analyze natural phenomena.
Introduction To 3d Printing (Open Elective-II) (A5332)	C01	Understand the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.
	C02	Apply engineering knowledge, techniques, skills and modern tools to analyze problems in 3D PRINTING.
	C03	Appraise additive manufacturing through 3d printing.
	C04	Solve Complex manufacturing problems for significant technological and societal development
	C05	Analyze, design and evaluate engineering products using the knowledge of mathematics, science, engineering and IT tools.
Fundamentals Of Robotics (Open Elective-III)	C01	Understand the basic concepts and components of a robotic system.
	C02	Identify the use of actuators and sensors for designing robot mobility system.
	C03	Solve transformation problems to describe the robot position and orientation of robot.

(A5333)	CO4	Apply the concepts of robot work cell design and control.
	CO5	Select appropriate robots for various applications suitable to modern manufacturing systems.
Fundamentals Of Iot(Open Elective – I) (A5431)	CO1	Identify the basic building blocks of IoT and its characteristics
	CO2	Choose the application-layer protocols and web services architectures for a seamless integration of various components within an IoT ecosystem
	CO3	Utilize Python standard libraries for implementing various IoT Applications
	CO4	Examine the communication between a machine or a device with a remote system
	CO5	Analyze cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms
Principles Of Analog And Digital Communications (Open Elective – II) (A5432)	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 a 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.
Introduction To Signal Processing (Open Elective – III) (A5433)	CO1	Understand mathematical description of signals and representation of systems
	CO2	Identify the spectrum of continuous-time periodic and non-periodic signals
	CO3	Apply various transforms to analyze continuous and discrete-time systems
	CO4	Analyze digital systems using various transform techniques
	CO5	Design and implement FIR and IIR filters for given specifications
Fundamentals Of Java (Open Elective – I) (A5531)	CO1	Understand the principles of Object Oriented Programming to model real world problem.
	CO2	Use various constructs / concepts to write programs in OOP paradigm.
	CO3	Analyze the applications for Handling Exceptions and Multithreading in Java runtime environment.
	CO4	Implement Collection Frameworks to retrieve and process data efficiently.
	CO5	Build GUI applications using AWT for Interactive applications.
Fundamentals Of Dbms (Open Elective – II) (A5532)	CO1	Understand design and implementation of a database 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

Fundamentals Of Operating Systems (Open Elective – III) (A5533)	CO1	Understand the various services provided by the operating system.
	CO2	Analyze the concepts of Process management and Synchronization in a multi processing system.
	CO3	Apply the Memory management techniques for efficient usage.
	CO4	Use File and Disk management schemes for effective storage management.
	CO5	Demonstrate Deadlock Handling Methods to allocate resources among processes.
Principles Of Software Engineering (Open Elective- I) (A5631)	CO1	Understand metrics in the process and project domains.
	CO2	Identify the right process model to develop the right software system.
	CO3	Gather requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements documents.
	CO4	Apply testing strategies for application being developed.
	CO5	Propose design as per functional and non-functional requirements using design principles.
E-Commerce Trends (Open Elective-II) (A5632)	CO1	Illustrate the components and roles of the E-Commerce environment.
	CO2	Understand legal and ethical issues related to E-Commerce and web marketing approaches.
	CO3	Identify how to sell products and services on the web as well as to meet the needs of web site Visitors.
	CO4	Analyze e-commerce payment systems.
	CO5	Illustrate the components and roles of the E-Commerce environment.
Fundamental Of Cyber Security (Open Elective-III) (A5633)	CO1	Understand how to protect them self and ultimately society from cyber-attacks by studying various case studies.
	CO2	Summarize different government cyber laws and cyber-forensics techniques.
	CO3	Apply different techniques to classify different types of cybercrimes
	CO4	Analyze cyber-attacks on different online web applications
	CO5	Apply various investigating methods on the new cases using previous case studies
Entrepreneurship Development (Open Elective-I) (A5034)	CO1	Understand the role, characteristics, qualities and functions of entrepreneur and use this knowledge to become future entrepreneurs.
	CO2	Interpret various Institutional supports 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 analyze 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.
Human Resource Management	CO1	Identify functions of Human Resource Management
	CO2	Illustrate the process of Recruitment and selection

(Open Elective-II) (A5035)	CO3	Analysis the needs and methods for training
	CO4	Outline the functional relationship of performance and compensation
	CO5	Illustrates the importance of Industrial relations through collective bargaining, trade unions and industrial settlement machinery.
Logistics And Supply Chain Management (Open Elective-III) (A5036)	CO1	Explain the concepts of Logistics & Supply chain management.
	CO2	Analyze the role of Supply chain drivers & Customer services of supply chain.
	CO3	Examine the Benchmarking process and role of Sourcing in supply chain.
	CO4	Analyze Network design in supply chain along with Coordination in supply chain.
	CO5	Examine the role of IT in supply chain as well as Global logistics & Global supply chain.

Course Outcomes (COs) for R18 Regulations (Batch: 2018-2022)

Course Outcomes for Fourth Year First Semester Course		
Finite Element Methods (A4322)	CO 1	Understand the general procedure of finite element method, one dimensional problems and shape functions.
	CO 2	Solve structural elements including trusses and beams.
	CO 3	Apply finite element method to solve two dimensional and axis-symmetric problems.
	CO 4	Analyze heat transfer problems, dynamic analysis on bar and beam elements.
	CO 5	Simulate the static, dynamic and thermal analysis of the components as per the boundary conditions.
Robotics (A4323)	CO 1	Understand the basic concepts and components of a robotic system.
	CO 2	Identify the use of actuators and sensors for designing robot mobility system.
	CO 3	Solve numerical problems on forward and inverse kinematics of robots for motion analysis.
	CO 4	Apply the key concepts of robot dynamics and programming for obstacle avoidance.
	CO 5	Apply the concepts of work cell design and control.
Introduction To	CO	Understand the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.

3d Printing (A4332)	1	
	CO 2	Apply engineering knowledge, techniques, skills and modern tools to analyze problems in 3D PRINTING .
	CO 3	Appraise additive manufacturing through 3d printing.
	CO 4	Solve Complex manufacturing problems for significant technological and societal development
	CO 5	Analyze, design and evaluate engineering products using the knowledge of mathematics, science, engineering and IT tools.
Operations Research (A4532)	CO 1	Explain the Operations Research features, models, applications and methods such as linear programming, transportation, sequencing, assignment, replacement, games theory.
	CO 2	Build mathematical models for finding optimum solutions for various real world problems and case studies.
	CO 3	Evaluate various alternatives available to aid in decision making situations.
	CO 4	Choose the best strategies to maximize the profit in the presence of a competitor
	CO 5	Devise operating policies for the efficient and effective management of men, materials and machines, production, distribution and service systems.
Solar Energy And Applications (A4232)	CO 1	Compare the present and future available electrical power from solar energy in the world based on the knowledge of global solar horizontal irradiation.
	CO 2	Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems.
	CO 3	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.
	CO 4	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.
	CO 5	Analyze the techno economics interaction of developments in the solar energy systems
Environmental Pollution And Management	CO 1	Identify water pollution sources, types and treatment methods.
	CO	Apply knowledge on Prevention and control of air pollution.

(A4132)	2	
	CO 3	Inspect sources, effects and mitigation methods of noise pollution.
	CO 4	Examine soil pollution sources, effects and control measures.
	CO 5	Formulate Environmental management plan to minimize environmental pollution.
E-Commerce Trends (A4632)	CO 1	Illustrate the components and roles of the E-Commerce environment.
	CO 2	Understand legal and ethical issues related to E-Commerce and web marketing approaches.
	CO 3	Identify how to sell products and services on the web as well as to meet the needs of web site Visitors.
	CO 4	Analyze e-commerce payment systems.
Principles Of Analog And Digital Communications (A4432)	CO 1	Analyze linear and non - linear modulators and demodulators in time as well as frequency domain.
	CO 2	Design a linear and non linear modulators and demodulators for the analog signals
	CO 3	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
	CO 4	Estimate a overall digital communication system for the improvement of the system performance.
	CO 5	Analyze the performance of a digital communication system by introducing various spread spectrum modulation techniques.
Automation In Manufacturing (A4357)	CO 1	Illustrate the basic concepts of automation in machine tools.
	CO 2	Analyze various automated flow lines, Explain assembly systems and line balancing methods.
	CO 3	Describe the importance of automated material handling and storage systems.
	CO	Interpret the importance of adaptive control systems, automated inspection systems.

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	CO 5	Apply the concepts of image processing applications of machine vision.
Power Plant Engineering (A4358)	CO 1	Explain the working principle of various power plants.
	CO 2	Identify the different components and their importance in the various power plants.
	CO 3	Compare merits and demerits of different power plants.
	CO 4	Illustrate the pollution from power plant and pollution control methods.
	CO 5	Solve problems related to various power plants and plant economics.
Process Planning And Estimation (A4359)	CO 1	Select the process, equipment and tools for various industrial products.
	CO 2	Prepare process planning activity chart.
	CO 3	Explain the concept of cost estimation.
	CO 4	Compute the job order cost for different type of shop floor.
	CO 5	Calculate the machining time for various machining operations
Course Outcomes for Fourth Year Second Semester Course		
Management Science (A4026)	CO 1	Explain and infer the concepts and aspects of management
	CO 2	Analyze the different organizational structures, plant layouts, work study tools for enhancement of productivity in an organization
	CO 3	Apply statistical quality control techniques to know quality of product with in control limits.
	CO 4	Use Human resource management techniques for better people management.
	CO	Apply the project management techniques to decide the optimum time and cost for completion of a project

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Fundamentals Of Robotics (A4333)	CO 1	Understand the basic concepts and components of a robotic system.
	CO 2	Identify the use of actuators and sensors for designing robot mobility system.
	CO 3	Solve transformation problems to describe the robot position and orientation of robot.
	CO 4	Apply the concepts of robot work cell design and control.
	CO 5	Select appropriate robots for various applications suitable to modern manufacturing systems.
Energy Management And Audit (A4233)	CO 1	Analyze the influence of energy availability on the development of Industries and various other organizations.
	CO 2	Discuss the concepts and technologies used for energy conservation.
	CO 3	Develop methods for evaluating worth of project.
	CO 4	Investigate the schemes for demand side management.
	CO 5	Evaluate the VAR requirements for effective voltage control.
Fundamentals Of Dbms (A4533)	CO 1	Understand design and implementation of a database for a given problem domain.
	CO 2	Construct Queries in Relational algebra, relational calculus and SQL.
	CO 3	Apply Normalization techniques to reduce data redundancy in data base.
	CO 4	Analyze various transaction control and recovery methods to keep data base consistent
Disaster Managment (A4133)	CO 1	Identify concepts, hazards and vulnerabilities of different types of disasters.
	CO 2	Examine the components of disaster management mechanism.

	CO 3	Select suitable capacity building frame work for disaster management
	CO 4	Interpret various disaster coping strategies
	CO 5	Develop Strategies for disaster management planning
A4633- Fundamental Of Cyber Security	CO 1	Understand how to protect them self and ultimately society from cyber-attacks by studying various case studies.
	CO 2	Summarize different government cyber laws and cyber-forensics techniques.
	CO 3	Apply different techniques to classify different types of cybercrimes
	CO 4	Analyze cyber-attacks on different online web applications
	CO 5	Apply various investigating methods on the new cases using previous case studies
A4433 - Introduction To Signal Processing	CO 1	Understand mathematical description of signals and representation of systems
	CO 2	Identify the spectrum of continuous-time periodic and non-periodic signals
	CO 3	Apply various transforms to analyze continuous and discrete-time systems
	CO 4	Analyze digital systems using various transform techniques
	CO 5	Design and implement FIR and IIR filters for given specifications
A4360- Total Quality Management	CO 1	Understand the overview of Total Quality Management System.
	CO 2	Understand the concepts of customer satisfaction and employee involvement.
	CO 3	Apply the appropriate tools and techniques of continuous process improvement for controlling and improving quality.
	CO	Apply Quality Function Deployment, Six Sigma and Bench Marking

	4	tools for improving product or process quality.
	CO 5	Implement the concepts of ISO 9000 in quality management.
Refrigeration And Air-Conditioning (A4361)	CO 1	Understand the basic concepts and working of various refrigeration and air-conditioning systems.
	CO 2	Compare the performance of different refrigeration and air conditioning systems.
	CO 3	Solve problems of different refrigeration and air conditioning systems.
	CO 4	Assess merits and demerits of different refrigeration and air conditioning systems.
	CO 5	Classify refrigerants based on environmental considerations.
Micro Electro Mechanical Systems (A4362)	CO 1	Understand the construction, working and applications of different MEMS structures
	CO 2	Identify problems and suggest suitable MEMS material/ Devices/Process to get the Requisite Solution for a given application.
	CO 3	Design the micro devices, micro systems using the MEMS fabrication process.
	CO 4	Gain a knowledge of basic approaches for various actuator/Sensor design
	CO 5	Apply fundamental concepts of MEMS to solve real life engineering problems.