



# Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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## DEPARTMENT OF MECHANICAL ENGINEERING

Program: B.Tech

Academic Year 2019-2020

S No	Course Code	Course Title	CO NO	Description of the Course Outcome
1	19UC1101	BASIC ENGLISH	CO1	Apply the practical knowledge of using action words in sentence construction.
			CO2	Apply and analyze the right kind of pronunciation with regards to speech sounds and able to get different types of pronunciations.
			CO3	Apply the concept of fundamental principle of counting to solve the problems on linear, circular permutations and also for the problems on selections. Apply the concept of probability, while doing the problems on Leap year & Non-Leap year problems, coins, dice, balls and cards.
			CO4	Analyze the given conditions and finding out all the possible arrangements in linear & circular order. Analyze the given numbers or letters to find out the hidden analogy and apply that analogy to find solutions. Finding the odd man out by observing the principle which makes the others similar.
2	19UC1202	ENGLISH PROFICIENCY	CO1	Apply the concepts of accurate English while writing and become equally at ease in using good vocabulary and language skills.
			CO2	Understand the importance of pronunciation and apply the same day to day conversation.
			CO3	Apply the concepts of ratios, percentages, averages and analyze the given information on the basis of comparative analysis of the data in the form of tabulation, bar graphs, pie charts, line graphs.
			CO4	Apply the basic functionality of clocks and calendars to find the solutions for the problems. Analyze the given symbols to understand the hidden meaning of the given expression and find the solutions. Analyze the possible arrangements in linear & circular order.


  
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3	19UC2103	PROFESSIONAL COMMUNICATION SKILLS	CO1	Able to spot the common grammatical errors related to sentence structure, preposition, concord, relative and conditional clauses and parallel structures. The learner should be efficient to construct a context-determined text in addition to learning Technical Writing Skills.
			CO2	Able to read, understand, and interpret a text intrinsically as well as extrinsically. The learner can browse a text quickly to come-up with a gist and personal interpretation. Able to create a healthy work-environment and prove to be an asset or one of the most reliable resources to the organization.
			CO3	Apply the concepts of time and work; men-time-work problems based on wages, pipes and cisterns. Apply the concepts of time and distance and solve the problems related to average speed, relative speed.
			CO4	Apply Venn diagrams to find out appropriate conclusions from the given statements. Apply the logical implications and also the negations of various connectives to find the solutions. Analyze the data and represent in the form of Venn diagrams to find relations between any given set of elements.
4	19UC2204	APTITUDE BUILDER –I	CO1	Apply the concept of Critical Reading and Analytical Reading and comprehend the key ideas and gist of a passage. Understand the importance of the presentation skills, analyze the given topic, apply various strategies and the principles of grammar in written expression.
			CO2	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.
			CO3	Apply the concepts of Numbers to solve the problems related to divisibility rules, problems based on Unit's digit, Remainders, Successive Division, Prime Factorization, LCM & HCF problems. Apply the concepts of Averages & Alligations, students will be able to solve the problems related to Averages as well as problems based on Mixtures.
			CO4	Apply the various concepts of cubes to find out how to cut a cube to get the maximum number of smaller identical pieces, how to minimize the number of cuts required to cut a cube into the given number of smaller identical pieces, how to count the number of smaller cubes which satisfy the given painting scheme. Apply the principles of binary logic to solve problems involving truth-tellers, liars and alternators. Analyze the given data to form an ordered arrangement from an unorganized raw data.



5	19UC3105	APTITUDE BUILDER-II	CO1	Apply the strategies and techniques for conversations in different contexts. Analyze the different parameters and formats of written technical communication and apply in everyday work and life.
			CO2	Analyze the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.
			CO3	Apply the concepts of Ratio & Proportion, Percentages, Profit & Loss, Simple & Compound Interest
			CO4	Analyze the series of numbers or letters to predict the next number in the series or to find the analogy. Analyze the data to find the codes in the process of encoding and decoding. Apply the given set of conditions to select a team from a group of members.
6	19UC3206	CAMPUS TO CORPORATE	CO1	To distinguish product and process and quote them in speaking and writing activities
			CO2	To apply interpersonal skills
			CO3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their problem solving abilities which in turn improve their programming skills.
			CO4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding
7	19UC0007	INDIAN HERITAGE AND CULTURE	CO1	To familiarize with various aspects of the culture and heritage of India through ages.
			CO2	To acquaint with the contributions of Indians in the areas of languages and literature, religion and philosophy
			CO3	To understand the Social structure and the spread of Indian culture abroad
			CO4	To know the development of Science and Technology in India through ages and to appreciate the contributions of some of the great Indian scientists
8	19UC0008	INDIAN CONSTITUTION	CO1	To understand Constitutional development after Independence
			CO2	To learn the fundamental features of the Indian Constitution
			CO3	To get a brief idea of the powers and functions of Union and State Governments

			CO4	To understand the basics of working of Indian Judiciary and the Election Commission
9	19UC0009	ECOLOGY AND ENVIRONMENT	CO1	Understand the importance of Environmental education and conservation of natural resources.
			CO2	Understand the importance of ecosystems and biodiversity.
			CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process.
			CO4	Understand the importance of Environmental education and conservation of natural resources.
10	19UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS	CO1	Understand and identify the basic aspiration of human beings
			CO2	Envisage the roadmap to fulfill the basic aspiration of human beings.
			CO3	Analyze the profession and his role in this existence.
11	19UC0011	ENTREPRENEURS HIP	CO1	Analyze the business environment in order to identify business opportunities,
			CO2	Identify the elements of success of entrepreneurial ventures
			CO3	Consider the legal and financial conditions for starting a business venture
			CO4	Evaluate the effectiveness of different entrepreneurial strategies
12	19SC1104	MATHEMATICS FOR COMPUTING	CO1	Explain the basic structures, relations, permutations, combinations, probability.
			CO2	Demonstrate the system of equations and game theory through matrix algebra.
			CO3	Demonstrate the rules of propositional logic to establish validity of argument, induction, recurrence relations and lattices.
			CO4	Interpret the problems associated with graphs, trees, correlation and regression.
			CO5	Demonstrate the Aptitude & Reasoning skills (Tests in skilling hours)
13	19MT2102	MATHEMATICS FOR ENGINEERS	CO1	Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and solve the differential equations.
			CO2	Demonstrate the Fourier series and Laplace transforms.
			CO3	Describe probability, Random Variables
			CO4	Explain complex variables, analytic functions and introduction to stochastic process and Algebraic structures.
14	19PH1010	MECHANICS	CO1	Develop familiarity with the physical concepts and facility with the mathematical methods of classical mechanics
			CO2	Analyze planar and spatial systems and analyze the forces in the members of trusses, frames.


  
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			CO3	Determine first moment and second moment for a given cross sections and problems related to friction
			CO4	Analyze the motion characteristics of a body subjected to a given force system.
15	19PH2007	MATERIALS FOR MECHANICAL ENGINEERING APPLICATIONS	CO1	Understand crystal structures and also to find lattice parameters using different XRD techniques
			CO2	Understand different heat treatment processes and also understand the properties of smart materials
			CO3	Understand different types of semiconducting materials and ceramic materials
			CO4	Understand different types of composite materials and nano materials and its applications
16	19BT1001	BIOLOGY FOR ENGINEERS	CO1	Acquire the Knowledge of basic biology
			CO2	Acquire the Knowledge of Human Biological Systems
			CO3	Acquire Knowledge on Microorganisms and Biosensors
17	19ME1103	DESIGN TOOLS WORKSHOP -I	CO1	Practice design thinking by developing artistic skills
			CO2	Visualize and practice innovative design by final drafting using photogrammetric and model the design using prototyping technique
			CO3	Apply the concept of AI & Data analytics & finalize the requirements to design his idea
			CO4	Draft a report of his project from the initial stage & make a report which include scope, time and cost management of his project
18	19SC1209	DESIGN TOOLS WORKSHOP -II	CO1	Practice the design ideology by artistic skill
			CO2	Visualize the design ideology by using VR technology
			CO3	Visualize the design ideology by incorporating VR technique
			CO4	Visualize and present his design idea by applying AR technique
19	19SC1202	DATA STRUCTURES	CO1	Apply measures of efficiency to algorithms and Compare various linear data structures like Stack ADT, Queue ADT, Linked lists.
			CO2	Analyze and compare linear data structures and analyze different searching and hashing techniques
			CO3	Analyze and compare various non – linear data structures like Trees and Graphs


  
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			CO4	Analyze and compare various sorting algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in a particular context.
			CO5	Execute lab experiments and develop a small project along with his/her team members.
20	19ME1201	MECHANICS OF SOLIDS -I	CO1	Analyze stresses in members with 1D axial loading or torsion
			CO2	Analyze shear force and bending moment diagrams
			CO3	Analyze deflections and stresses in beams
			CO4	Design Columns and pressure vessels
			CO5	Apply the theoretical concepts to conduct various experiments of strength of materials practically and analyze the data
21	19ME1002	ENGINEERING GRAPHICS FOR MECHANICAL ENGINEERS	CO1	Construct and Interpret drawing scale to visualize the geometries of Engineering objects using points, lines both manually and by AutoCAD
			CO2	Draw projection of planes, solids and Generate the sectional views of solids both manually and by AutoCAD
			CO3	Draw Engineering curves and develop the lateral surface of solids both manually and by AutoCAD
			CO4	Build orthographic projections, create isometric sketches and identify standard features both manually and by AutoCAD
22	19ME1003	WORKSHOP PRACTICES FOR MECHANICAL ENGINEERS	CO1	Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications.
			CO2	Fabricate components with their own hands.
			CO3	Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
			CO4	Assemble different components and produce small devices of their interest
23	19SC1101	PROBLEM SOLVING AND COMPUTER PROGRAMMING	CO1	Illustrate how problems are solved using computers and programming
			CO2	Illustrate and use Control Flow Statements in C.
			CO3	Interpret & Illustrate user defined C functions and different operations on list of data.
			CO4	Implement Linear Data Structures and compare them
			CO5	Apply the knowledge obtained by the course to solve real world problems
24	19ME1204	COMPUTATIONAL	CO1	Perform basic computations in Python, including


  
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		THINKING AND DATA SCIENCES		working with tabular data.
			CO2	Understand basic probabilistic simulations, statistical thinking and Stochastic Programs.
			CO3	Use good practices in Python programming using Computational Simulations.
			CO4	Implement Computational data modeling and clustering using Python programming.
			CO5	Apply the theoretical concepts to develop Python Programs to solve Optimization Problems and Computational Simulations with the applications of Solid and Fluid Mechanics concepts.
25	19ME2205	NUMERICAL COMPUTATION FOR MECHANICAL ENGINEERS	CO1	Understand elementary programming concepts, and the basics in MATLAB
			CO2	Understand linear algebra, probability and statistics for solving engineering problems
			CO3	Solve a system through linear and nonlinear equations, and ordinary differential equations in Mechanical Engineering
			CO4	Select an appropriate numerical approach for solving engineering problems
			CO5	Ability to select bench marks to confirm the computational approach
26	19EE2105	CIRCUITS AND ELECTRONICS	CO1	Understand the Basic of Electrical network elements
			CO2	Understand the behavior of semiconductor switches and its applications
			CO3	Apply Time & frequency domain analysis of first & second order networks
			CO4	Understand the Applications of Analog & Digital circuits
27	19ME2106	METROLOGY AND MEASUREMENTS	CO1	Understand the basics of standards of measurement, limits, fits & tolerances industrial applications.
			CO2	Identify the uses of gauges and comparators
			CO3	Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices
			CO4	Interpret measurement of field variables like force, torque and pressure
			CO5	Comprehend the fundamentals of thermocouple and strain measurement.
28	19ME2107	THERMAL-FLUIDS ENGINEERING-I	CO1	Understand and apply the fundamental principles and definitions of thermodynamics, fluid mechanics, and heat transfer.
			CO2	Apply the laws of thermodynamics for thermal systems associated with heat transfer and work transfer, entropy generation and its influence on engineering systems.
			CO3	Elucidate the basic properties, principles and applications of fluids, fluid components, fluid statics and different types of fluid flows.


  
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			CO4	Describe fluid boundary layers, turbulence and their implementation in flow of fluid in engineering systems.
			CO5	Apply the theoretical concepts to conduct various experiments of thermodynamics, fluid mechanics practically.
29	19ME2127	ENGINEERING IN THE PHYSICAL WORLD	CO1	Recalling the Laws and fundamentals related to thermal energy and electrical energy
			CO2	Applying the laws in thermal and electrical systems.
			CO3	Analyzing and designing of thermal systems.
			CO4	Analyzing real time energy systems and developing a novel design.
			CO5	Modeling and Numerical analysis of thermal systems
30	19ME2108	MECHANICS OF SOLIDS -II	CO1	Selection of appropriate materials in mechanical design
			CO2	Emphasize the fundamentals of mechanical behavior of materials
			CO3	Design of machine components for static strength
			CO4	Design of machine components for fatigue strength
			CO5	Analyze various machine components using different materials
31	19ME2109	KINEMATICS AND DYNAMICS OF MACHINES	CO1	Identify, select and analyze kinematically suitable mechanisms for required motion of machinery
			CO2	Develop velocity and acceleration diagrams and analyze the data
			CO3	Develop cam profiles and Analyze gears and gear trains kinematically
			CO4	Analyze mechanisms dynamically
			CO5	Apply the theoretical concepts to design mechanisms by using the simulation software and analyzing the data
32	19ME2110	MACHINE DRAWING	CO1	Draft various parts of machine components and their assemblies. Conversion of part drawings to assembly drawing and vice versa in conventional form.
			CO2	Draw different line types and various dimensioning, conventional representation of materials and machine components, sectioning, limits, fits and tolerances.
			CO3	Develop and interpret production drawing for various machine elements
			CO4	Implement Computer Aided Drafting for various machine components using software.
33	19ME2211	MANUFACTURING TECHNIQUES	CO1	Understand and apply the casting processes
			CO2	Apply the welding processes and identify the faults in welding processes


  
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			CO3	Apply principles of cold/hot forming processes
			CO4	Apply sheet metal processes and design sheet metal dies.
			CO5	Fabricate the parts using machine tools
34	19ME2212	THERMAL-FLUIDS ENGINEERING-II	CO1	Apply the principles of thermodynamics, heat transfer, and fluid mechanics to the design and analysis of engineering systems.
			CO2	Elucidate the thermodynamics and fluid mechanics steady flow components of thermodynamic plant as well Laminar and turbulent flow of fluids in channels and over surfaces.
			CO3	Identify thermodynamic state of a pure substance and determine the thermodynamic properties and explain the design approach to thermodynamic plants.
			CO4	Analyze Rankine, power cycles and explain refrigeration and air conditioning systems.
			CO5	Apply analytical cognitive skills of the theoretical concepts to conduct various experiments of thermodynamics and fluid mechanics practically.
35	19ME2213	Vibrations and Controls	CO1	Analyze one DOF free and forced undamped vibration systems
			CO2	Analyze and control of one DOF forced damped vibration systems
			CO3	Analyze and control of Two and Multi DOF vibration systems
			CO4	Analyze continuous systems and vibration measurement.
36	19ME3114	MACHINE DESIGN	CO1	Model the machine elements such as bearings, bolts, belts and gears
			CO2	Analyze the machine elements to design a new component
			CO3	Characterize the mechanical system to a real world application
			CO4	Synthesize the modal to design a mechanical system
			CO5	Fabricate the design subject to engineering Constraints
37	19ME3115	DESIGN FOR MANUFACTURING	CO1	Understand and analyze the working of various machining processes.
			CO2	Implement NC and CNC programming for machining simple components
			CO3	Apply the automation of production lines.
			CO4	Design of various manufacturing processes.
			CO5	Implement modern manufacturing techniques
38	19ME3116	ROBOTICS AND	CO1	Implement direct kinematics for robot design

  
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		ARTIFICIAL INTELLIGENCE	CO2	Implement Inverse kinematics and Workspace analysis based robot design
			CO3	Implement Artificial Intelligence in Robotic Applications
			CO4	Implement the task programming for robots
39	19ME3117	PRODUCT DESIGN AND DEVELOPMENT	CO1	Identify and establish product specifications.
			CO2	Selection of concept and Product architecture.
			CO3	Apply Industrial design techniques.
			CO4	Prototype preparation
40	19ME3218	ENGINEERING MANAGEMENT	CO1	Illustrate the primary concepts about management, its principles and functions and the types of business organizations
			CO2	Analyze the concepts of financial management includes present worth and future worth of invested money through cash flow diagram and differed annuities.
			CO3	Acquire knowledge in economic analysis and cost accountancy.
			CO4	Demonstrate the principles of business innovation and entrepreneurship for establishing industrial ventures
41	19ME3219	HEAT TRANSFER	CO1	Apply Fourier law of conduction and combined conduction convection concepts to 1-D heat transfer problems.
			CO2	Analyze heat transfer using extended surfaces , unsteady state heat transfer and 2-D conduction mode of heat transfer
			CO3	Understand convection mode of heat transfer and heat transfer during phase change by applying the empirical correlations to solve convection problems
			CO4	Apply the principles of heat transfer to analyze and design different heat exchangers.
			CO5	Experimental verification of various heat transfer parameters
42	19ME3220	MACHINE LEARNING	CO1	Understand the basic Python Programming and basic computations using Python
			CO2	Understand and apply the basic Machine Learning and Pre-processing techniques in Machine Learning
			CO3	Understand and apply supervised Machine Learning techniques- Regression Techniques
			CO4	Understand and apply supervised Machine Learning techniques – Classification Techniques
			CO5	Apply Machine Learning algorithms to solve real world problems
43	19ME3221	INTERNET OF THINGS	CO1	Understand internet of Things and its hardware and software components
			CO2	Interface I/O devices, sensors & communication modules

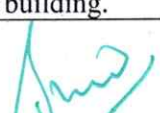
  
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			CO3	Remotely monitor data and control devices
			CO4	Apply Data acquisition and integration
			CO5	Develop real life IoT based projects
44	19ME3222	COMPUTER AIDED DESIGN	CO1	Understand the Fundamentals of CAD and display devices
			CO2	Apply the concept of geometric modelling
			CO3	Able to apply concept of Surface and solid modelling
			CO4	Application of various Geometric transformations
45	19ME3223	GEOMETRIC DIMENSIONING AND TOLERANCING	CO1	Understand the Application of Dimensioning
			CO2	Understand the application of Tolerances.
			CO3	Read and interpret the industrial drawings.
			CO4	Development of a Dimensional Inspection Plan
46	19ME3224	AUTOMOTIVE TRANSMISSION	CO1	Understand the importance of construction and working of a clutch in automobile industry and troubleshooting of clutch
			CO2	Understand the importance of construction and working of gear box and total resistance to motions
			CO3	Understand different mechanisms used while adopting a torque converter and various Automotive Transmission mechanisms
			CO4	Understand working principle of drive line system components
			CO5	Apply contemporary issues and their impact on provided solution in addition to that students will be able to solve open-ended problem related to design the transmission components using CAD
47	19ME3225	AUTOTRONICS	CO1	Understand the automotive electronics for engine management system
			CO2	Analyze required sensors and actuators for an automotive application
			CO3	Apply the suitability of a control system for automotive application
			CO4	Ability to analyze of electronic system for automotive applications
48	19ME3226	AUTOMATION SYSTEM DESIGN	CO1	Understand the design principles of automation and its application in an automated manufacturing system
			CO2	Analyze pneumatic sub-systems of an automated manufacturing system in terms of design, operation and control aspects
			CO3	Analyze hydraulic sub-systems of an automated manufacturing system in terms of design, operation and control aspects

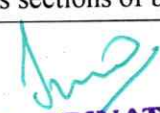
  
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			CO4	Understand programmable automation with regard to the computer integrated manufacturing system
49	19SC1106	TECHNICAL SKILLS – 1 (CODING)	CO1	Apply the concepts of basic programming to solve the basic problems, pattern based problems
			CO2	Build solutions for problems on Numbers and array based problems, functions, recursion
			CO3	Solve problems solutions for character/string based problems and pointers
			CO4	Build solutions to programs on Data structures concepts.
50	19TS701	SKILLING FOR ENGINEERS-1 (MANUFACTURING TECHNOLOGIES)	CO1	Preparation of sand moulds with proper gating and riser system
			CO2	Machining using machine tools and preparation of CNC part program.
			CO3	Preparation of work piece for various welding operations and performing welding using different welding equipment
			CO4	Production of parts using rapid prototyping
			CO5	Hands on experience for performing experiments in Casting, Machining, Welding and Rapid prototyping
51	19TS702	–SKILLING FOR ENGINEERS-2 (CONTROL SYSTEMS FOR MACHINES)	CO1	Understand and apply the control action for first order closed loop systems for various inputs.
			CO2	Understand and apply the control action for second order closed loop systems for various inputs.
			CO3	Apply the concepts of stability and frequency analysis for control action on first and second order systems
			CO4	Apply the concepts of the nature of a system by means of various control actions to stabilize the system.
52	19TS703	SKILLING FOR ENGINEERS-3 (PROBLEM SOLVING TECHNIQUES IN THERMAL ENGINEERING)	CO1	Understand the fundamentals of CFD (Computational Fluid Dynamics) and basic modules in ANSYS FLUENT
			CO2	Analyze the laminar and turbulent flow through pipe
			CO3	Analyze the flow visualization in L-junction and T-joint
			CO4	Analyze the flow through pipes and flow over flat plate and different sections
53	19TS704	SKILLING FOR ENGINEERS-4 (PROBLEM SOLVING TECHNIQUES IN DESIGN)	CO1	To Perform static and dynamic analysis of 1-D structures
			CO2	To Perform static and dynamic analysis of 2-D structures
			CO3	To Perform static and dynamic analysis of 3-D structures
			CO4	Identifying and solving the real complex engineering problems
54	19TS705	TECHNICAL PROFICIENCY &	CO1	Understand the role of power systems and transmission systems in vehicle building.


  
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		TRAINING-1 (AUTOMOBILE DESIGN AND BUILDING)	CO2	Analyze about various control engineering concepts for modern automobiles.
			CO3	Model Automobile components
			CO4	Design of Automobile components
55	19TS706	TECHNICAL PROFICIENCY & TRAINING -2 (ROBOT DESIGN)	CO1	Understand the importance and working of various elements of a Robot and kinematics of serial and parallel robots
			CO2	Analyze the direct and inverse kinematics for Robot design
			CO3	Analyze the motion planning and control of robots
			CO4	Analyze the components of Electrical and Electronic Interface required for Automated Machine Tools
56	19ME4051	DESIGN OF TRANSMISSION ELEMENTS	CO1	Design and selection of various belt and chain drives
			CO2	Design and Selection of the suitable bearing for the given loading condition
			CO3	Analyze kinematic and dynamic aspects in design of brakes, clutches
			CO4	Design and analysis of different types of gear drives
			CO5	Analyze machine elements using analysis software
57	19ME4052	THEORY OF ELASTICITY AND PLASTICITY	CO1	Analyze stresses and strains in planes in elastic or plastic region
			CO2	Solve 2-D problems in rectangular Components
			CO3	Analyze stresses and strains in 3-D problems
			CO4	Analyze Beams and frames in plasticity applications
58	19ME4053	ADVANCED VIBRATIONS AND NOISE CONTROL	CO1	Understand the concepts of acoustics and vibrations
			CO2	Determine the sources of vibrations
			CO3	Measure the level of vibration and control the vibrations
			CO4	Measure and control the noise observed from vehicles.
59	19ME4054	CREEP FATIGUE AND FRACTURE MECHANICS	CO1	Assess the failure of unflawed structural components
			CO2	Assess the fatigue life of structural components under the specified load spectrum
			CO3	Evaluate the fracture toughness and assess the life of flawed structural components
			CO4	Assess the life of structural components under creep
60	19ME4055	ADVANCED STRENGTH OF MATERIALS	CO1	Analyze statically indeterminate beams
			CO2	Analyze stresses in curved beams and Examine the Shear Centre for various cross sections of beams


  
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			CO3	Apply unit load method to find deflections in beams and structures
			CO4	Analyze stresses in rotating members and thick cylinders
			CO5	To simulate the structural members using ANSYS and validate the results with analytical methods
61	19ME4056	MECHANICS OF COMPOSITE MATERIALS	CO1	Know the composite materials and manufacturing methods
			CO2	Understand the behaviour of composite Lamina
			CO3	Know the properties of various types composite materials
			CO4	Apply Failure theories to calculate stresses in composite materials
62	19ME4061	MODERN MANUFACTURING PROCESSES	CO1	To classify and understand the need of Non-Traditional Manufacturing Processes
			CO2	To understand the working principle, mechanism of metal removal and the effect of various process parameters on its performance of various Non-Traditional Machining Processes.
			CO3	To understand the working principle and the effect of various process parameters on its performance of various Non-Traditional Welding Processes.
			CO4	To understand the working principle of various Non-Traditional Forming Processes
63	19ME4062	ADVANCED MATERIALS	CO1	Ability to identify different types of optimization problems
			CO2	Understand basic concepts in solving nonlinear optimization problems
			CO3	Understand optimality conditions for unconstrained and constrained optimization problems and be able to apply them in verifying the optimality of a solution
			CO4	Understand basics of choosing and implementing optimization methods
64	19ME4063	ADDITIVE MANUFACTURING	CO1	To be able to properly distinguish between the hype and realities of additive manufacturing
			CO2	To understand the basic AM processes, and the limitations and advantages of each.
			CO3	To understand the differences between traditional processes and additive manufacturing production, including the differences in design methodology.
			CO4	To use AM terminology properly and understand the role and importance of standards in the additive manufacturing industry.
65	19ME4064	TOOL ENGINEERING AND DESIGN	CO1	Develop the ability to design cutting tools for given single component.
			CO2	Design and development of various die configurations.
			CO3	Design and development of jigs for given component.


  
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			CO4	Design and development of fixtures for given component.
66	19ME4065	FLEXIBLE MANUFACTURING SYSTEMS	CO1	Analyze various production schedules and plant layouts.
			CO2	Apply the concept of group technology to the development of FMS.
			CO3	Identify hardware and software components of FMS.
			CO4	Analyze materials handling and storage system in FMS.
67	19ME4066	REVERSE ENGINEERING AND RAPID PROTOTYPING	CO1	Understand the need of reverse engineering
			CO2	Understand working principles of RP techniques
			CO3	Understand Rapid tooling and RP case studies
			CO4	Understand applications of RP techniques
68	19ME4071	AUTOMOBILE ENGINEERING	CO1	Understand different types of chassis, engine components, fuel systems and its working principles
			CO2	Understand different components of transmission system, cooling and lubrication systems
			CO3	Understand different components of suspension, steering and braking systems
			CO4	Understand different electric and electronic systems used in automobiles and pollution control techniques used in SI and CI engines.
69	19ME4072	AUTOMOBILE ENGINE DESIGN	CO1	Understand the thermodynamics first principles and design major components of an I. C. engine
			CO2	Design cooling, lubrication and engine component systems
			CO3	Simulate and Analyze the designed engine components for stresses
			CO4	Design various automobile engine components experimentally
70	19ME4073	AUTOTRONICS & SAFETY	CO1	Understand various principles, characteristics, testing, maintenance, and servicing of batteries.
			CO2	Understand working of ignition system of an S I engine, its maintenance and service.
			CO3	Understand wiring for Auto electrical systems for I C Engines
			CO4	Understand the concepts of safety for various domains in automobiles.
			CO5	Apply the various concepts of Automobile engineering using electronics through suitable soft wares.
71	19ME4074	ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES	CO1	Acquire comprehensive knowledge on Electric Vehicles and Hybridization of automobiles with applications.
			CO2	Understand the technology of Hydrogen driven vehicles and fuel properties along with application in engine performance.

  
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			CO3	Comprehend about Solar powered automobiles and estimate the performance of engines driven by alternative liquid fuels (Biofuels) and gaseous fuels (Natural Gas and Propane vehicles).
			CO4	Explore and conjecture the emerging technologies and future source of alternative fuels in automobiles.
			CO5	Practically study the various technologies of alternative energy sources applied in the advanced scenario of automobile engineering.
72	19ME4075	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEM	CO1	Understanding battery, Cranking motor construction and testing methods.
			CO2	Understand the principle of alternator and to test the alternator.
			CO3	Understand the Electronic Controls in Gasoline Engine.
			CO4	Understand the basics of Vehicle Motion Control and telematics system
			CO5	Perform OBD II test on vehicle and Program MYRIO hardware using Lab view.
73	19ME4076	AUTOMOBILE ENGINE SYSTEM AND PERFORMANCE	CO1	Apply the knowledge of basic engine technology along with principle. Summaries of Engine Cycles.
			CO2	Apply the concept performance aspect of mixture preparation and ignition system for SI and CI Engines and Combustion in Engines.
			CO3	Pollutant Formation, Emission control methods and Emission norms
			CO4	Engine Testing, Performance analysis and Emerging Engine Technologies
			CO5	Experiments on I C Engines for performance calculation
74	19ME4081	AUTOMOTIVE SENSOR AND APPLICATIONS	CO1	Learn the sensor classification and sensor product selection guide.
			CO2	Analyze the measurement of engine parameter using sensor.
			CO3	Apply required sensors and actuators for automotive applications
			CO4	Analyze the sensors for intelligent transport systems
75	19ME4082	ELECTRONIC ENGINE MANAGEMENT SYSTEM	CO1	Understand the automotive instruments and automotive sensors
			CO2	Learn the measurement of engine parameter by using sensor.
			CO3	Acquire ability to analyze the electronic fuel injection system
			CO4	Apply the principles of digital control techniques and the application of on board diagnosis
			CO5	Experiments on computerized Diesel Engine and Lab view based Engine control unit
76	19ME4083	- INSTRUMENTATION IN	CO1	Understand the knowledge of various Measuring Instruments to design a simple Instrumentation system

  
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		AUTOMOTIVE INDUSTRIES	CO2	Analyze the various instruments and use them in various fields
			CO3	Learn and apply the measuring instruments in various industries application
			CO4	Analyze suitable instrument for a given application
77	19ME4084	AUTOTRONICS AND VEHICLE INTELLIGENCE	CO1	Analyze various electronics systems like sensors
			CO2	Understand Fuel injection and Ignition system
			CO3	Understand Electric vehicles and hybrid vehicles
			CO4	Design of intelligence vehicle systems
78	19ME4085	AUTOMOTIVE SYSTEMS	CO1	Understand the importance of automotive systems
			CO2	Understand the Two-wheel drive, four-wheel drive vehicles
			CO3	Analyze the transmission system
			CO4	Analyze control system for Automotive systems
79	19ME4086	PROGRAMMABLE LOGIC CONTROLLERS	CO1	Understand the importance of Factory Automation
			CO2	Understand the functions and operations of PLC
			CO3	Understand the Installation and maintenance procedures for PLC
			CO4	Analyze PLC for the control of industrial processes
80	19ME4091	ARTIFICIAL INTELLIGENCE FOR ROBOTICS	CO1	Understand the concepts of AI
			CO2	Apply basic principles of AI in solutions that require problem solving and planning.
			CO3	Apply basic principles of AI in solutions that require problem solving, planning, reasoning and learning
			CO4	Analyze AI in Robotics
81	19ME4092	INDUSTRIAL AUTOMATION AND CONTROL	CO1	Understand the concepts industrial automation and measurement systems
			CO2	Apply the controllers in automation
			CO3	Analyze and select a suitable PLC system for the given application
			CO4	Apply the concepts of control systems for industrial automation
82	19ME4093	INDUSTRIAL HYDRAULIC AND PNEUMATIC SYSTEMS	CO1	Learn the concepts hydraulic or pneumatic actuation system
			CO2	Analyze diagnose maintenance problems of hydraulic and pneumatic system
			CO3	Analyze required components to develop an automation system using pneumatics and hydraulic system
			CO4	Develop circuits for controlling hydraulic and

				pneumatic using PLC
83	19ME4094	INDUSTRIAL ROBOTICS AND MATERIAL HANDLING SYSTEMS	CO1	Understand the concepts of robot, sensors and their applications in robots
			CO2	Learn material handling equipment used both in automated and non-automated systems
			CO3	Analyze and select a suitable material handling system for the given application
			CO4	Apply the various applications of robots in material handling
84	19ME4095	MICROCONTROLLER AND PLC	CO1	Understand the concept of 8051 microcontroller
			CO2	Design the 8051 microcontroller
			CO3	Understand the concept of PLC
			CO4	Write ladder logic in Programmable logic controllers.
85	19ME4096	MECHATRONICS SYSTEM DESIGN	CO1	Understand the approach used for mechatronic system design and relevant considerations
			CO2	Apply suitable sensors and actuators used in a Mechatronic system
			CO3	Analyze signal conditioning interface in a Mechatronic system and implementation of control systems
			CO4	Modeling and Simulation for the Mechatronic System design perspective
86	19ME4101	PROGRAMMING SKILLS	CO1	Able to know the Basics of Computation, Algorithms, and Functional Programming.
			CO2	Able understand the Iterative style, recursive style, and efficiency issues in programming.
			CO3	Able to understand the Basics of imperative style programming, Assertions, and Loop invariants.
			CO4	Able to understand Top down design, Step-wise refinement, structures, encapsulation, and object-oriented programming.
			CO5	Able to Apply the theoretical concepts of programming to develop and execute the programs.
87	19ME4102	DATA ANALYTICS	CO1	Able to know the Basics of Descriptive Statistics.
			CO2	Able understand the Inferential Statistics.
			CO3	Able to understand the Basics of Regression & ANOVA.
			CO4	Able to understand Prescriptive analytics.
			CO5	Able to Apply the theoretical concepts of data analytics to solve problems.
88	19ME4103	PYTHON	CO1	Able to know the Basics of Programming, and Python.
			CO2	Able understand Lists, Function definition, Sorting, Passing functions.


  
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			CO3	Able to understand Exception handling, Input / output, File handling, String processing, Backtracking, Scope, Data structures.
			CO4	Able to understand Classes, Objects and user defines data types.
			CO5	Able to Apply the theoretical concepts of python to develop and execute the programs.
89	19ME4104	MACHINE LEARNING	CO1	Understand the basics of Machine Learning.
			CO2	Understand Model Validation Approaches, Discriminant Analysis.
			CO3	Understand Random Forest, Neural Networks Deep learning.
			CO4	Understand Clustering, Associative Rule Mining, and Challenges for big data analytics.
			CO5	Apply the theoretical concepts of Machine Learning to solve problems.
90	19ME4105	ARTIFICIAL INTELLIGENCE	CO1	Introduction to AI, Understand about intelligence, knowledge and Artificial Intelligence, techniques of AI as a State space search, Production Systems.
			CO2	Problem solving by Search, Heuristic Search, Randomized search techniques and Finding Optimal paths
			CO3	Analyze the appropriate methodologies for problem decompositions, planning and constraint data constraint satisfactions.
			CO4	Understand Knowledge Representation using Predicate Logic, Representing Knowledge using Rules, Semantics Nets, Frames and Conceptual dependencies.
91	19ME4106	FUZZY LOGIC AND NEURAL NETWORKS	CO1	Understanding the Concepts of Fuzzy sets, Fuzzy Logic, importance of membership functions, Fuzzy Rule, and operations on fuzzy sets, Principles of Fuzzy Logic System in solving the complex engineering problems
			CO2	Applications of Fuzzy sets for real time problems of various domains using Fuzzy Logic control system
			CO3	Understand Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Back propagation, Associative Learning,
			CO4	Understanding Neuro Fuzzy Approaches, Computing with Neural Nets and Applications of Neural Network in various Domains
92	19ME4201	DESIGN FOR QUALITY AND RELIABILITY	CO1	Model repairable and non-repairable systems and calculate failure rate, repair rate, reliability and availability
			CO2	Use various probability density distributions significant to reliability calculations
			CO3	Fit a given failure data set of a product into a Weibull distribution and estimate the reliability parameters.

  
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			CO4	Preventive maintenance failure modes and effects
93	19ME4202	DESIGNING INTELLIGENCE SYSTEMS	CO1	Principles of complex and living systems
			CO2	Concepts such as Information intensity & Knowledge
			CO3	Introduction to emerging digital technologies
			CO4	Apply these ideas in design
94	19ME4203	SUSTAINABLE DESIGN	CO1	To equip the design student with specific environmentally-responsive tools, principles
			CO2	To understand the methodologies in preparation for professional application. Management
			CO3	To use a variety of techniques to communicate effectively
			CO4	To understand the life-cycle assessment methods
95	19ME4204	SYSTEMS THINKING FOR DESIGN	CO1	The importance of modeling systems to realize effective designs
			CO2	Abstraction of key elements from problem situations
			CO3	Use of specific techniques to model problems in a holistic manner
			CO4	Use of specific techniques for self-regulating systems
96	19ME4205	DESIGN WITH ADVANCED ENGINEERING MATERIALS	CO1	Understanding selection of materials for various engineering application
			CO2	Understanding the need of high temperature materials (super-alloys)
			CO3	Understanding the need of engineering plastics, elastomers
			CO4	Understanding the need of ceramics, and coatings
97	19ME4206	DESIGN FOR MANUFACTURE AND ASSEMBLY	CO1	Understand the importance of DFMA and various manufacturing processes
			CO2	Understand the various machining processes and the respective design rules
			CO3	Understand the procedure and advantages of Assembling
			CO4	Understand the principles in Design of Manual Assembly
98	19ME40B4	ROBOTICS	CO1	Analyze the anatomy of existing robotic systems and their performance specifications, end effectors etc
			CO2	Analyze a robotic system with respect to the suitable sensors, actuators for its performance.
			CO3	Understand manipulator kinematic analysis and joint trajectory plan for a given end effector.
			CO4	Classification of Robot Languages, Comprehensive identification of suitable Robotic system for various applications.

  
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99	19ME40B5	MECHATRONICS	CO1	Identify appropriate sensor, Identify appropriate actuation system for a given application.
			CO2	Identify appropriate microcontroller for a given application and to build a mathematical Model of system for evaluating open loop system performance and behaviour.
			CO3	Identify an appropriate closed loop control strategy to attain the desired system behaviour.
			CO4	Suggest a Mechatronic product design for a given application and evaluate its performance.
100	19ME40B6	OPERATIONS RESEARCH	CO1	Model and Solve for the optimum solutions using LPP
			CO2	Model and Find the Optimized solutions for the problems in the field of Transportation and Management / Assignments.
			CO3	Model and Optimize Game theory, Dynamic Part Programming, Queuing Theory , Inventory Control & Simulation Problems
			CO4	Understand and solve the Concepts related to PERT/CPM



**Academic Professor In charge**



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