



DEPARTMENT MECHANICAL ENGINEERING
2015 SCHEME CO's

Course Code	Course Name	CO Code	CO
15MAT31	Engineering Mathematics – III	CO1	Know the use of periodic signals and Fourier series to analyze circuits and system communication.
		CO2	Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier transforms and Z-transform
		CO3	Employ appropriate Numerical methods to solve algebraic and transcendental equations
		CO4	Apply Greens theorem, Divergence theorem and Stokes theorem in various applications in the field of elector-magnetic and gravitational fields and fluid flow problems.
		CO5	Determine the extremals of functionals and solve the simple problems of the calculus of variations
15ME32	Materials Science	CO1	Understanding the structure and various modes of failure in materials
		CO2	Describe the mechanical properties of Engineering Materials
		CO3	Learn the means of modifying properties, as well as the processing and failure of materials
		CO4	Understand the use of materials for various applications oh metals and non-metals
		CO5	Explore the mechanical property of Composite materials
15ME33	Basic Thermodynamics	CO1	Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions
		CO2	Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics.
		CO3	Interpret behavior of pure substances and its applications to practical problems.
		CO4	Determine enthalpy and change in entropy using TD relations for ideal gases



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		CO5	Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie
15ME34	Mechanics of Materials	CO1	<ul style="list-style-type: none"> Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations
		CO2	Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads And Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle
		CO3	Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders
		CO4	Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples And Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL
		CO5	Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory
15ME35B	Machine Tools and Operations	CO1	Explain the construction & specification of various machine tools
		CO2	Describe various machining processes pertaining to relative motions between tool & work piece
		CO3	Discuss different cutting tool materials, tool nomenclature & surface finish
		CO4	Apply mechanics of machining process to evaluate machining time

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		CO5	Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost
15ME36B	Mechanical Measurements and Metrology	CO1	Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars. Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator
		CO2	Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design. Understand and explain the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter
		CO3	Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope. Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile Understand laser interferometers and Coordinate measuring machines.
		CO4	Explain measurement systems, transducers, intermediate modifying devices and terminating devices
		CO5	Describe functioning of force, torque, pressure, strain and temperature measuring devices.
15MEL37B	Mechanical Measurements and Metrology Lab	CO1	To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer
		CO2	To measure angle using Sine Centre/ Sine Bar/ Bevel Protractor, alignment using

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			Autocollimator
		CO3	To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats. And force measurement by drill tool dynamometer/Lathe tool dynamomete
		CO4	To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometer
		CO5	To measure surface roughness using Tally Surf/ Mechanical Comparator
15MEL38B	Machine Shop	CO1	Perform turning , facing , knurling , thread cutting, tapering , eccentric, turning and allied operations
		CO2	Perform keyways / slots , grooves etc using shaper
		CO3	Perform gear tooth cutting using milling machine
		CO4	Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder
		CO5	Understand Surface Milling/Slot Milling, Exhibit interpersonal skills towards working in a team
15MAT41	17MAT41-Engineering Mathematics-IV	CO1	Solve first order ordinary differential equation arising in flow problems using single step and multi-step numerical methods.
		CO2	Solve second order ordinary differential equation arising in flow problems using single step numerical methods and Illustrate problems of potential theory, quantum mechanics and heat conduction by employing notions and properties of Bessel's functions and Legendre's polynomials
		CO3	Explain the concepts of analytic functions, residues, poles of complex potentials and describe conformal and Bilinear transformation arising in field theory and signal processing.
		CO4	Develop probability distribution of discrete, continuous random variables and joint



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			probability distribution occurring in digital signal processing, information theory and design engineering
		CO5	Demonstrate testing of hypothesis of sampling distributions and illustrate examples of Markov chains related to discrete parameter stochastic process
15ME42	KINEMATICS OF MACHINERY	CO1	To Identify mechanisms with basic understanding of motions.
		CO2	To comprehend velocity and acceleration analysis by graphical method, Instantaneous center method and kleins construction.
		CO3	To comprehend velocity and acceleration analysis by analytical method and Freudensteins equation.
		CO4	To comprehend and carry out motion analysis of gears and gear trains.
		CO5	To comprehend and carry out motion analysis of CAMS.
15ME43	APPLIED THERMODYNAMICS	CO1	Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems
		CO2	Evaluate the performance of steam turbine components.
		CO3	Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment
		CO4	Determine performance parameters of refrigeration and air-conditioning systems. Understand the principles and applications of refrigeration systems. Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an air-conditioning system
		CO5	Understand the working, applications, relevance of air and identify methods for performance improvement. Apply thermodynamic concepts to analyze turbo machines



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15ME44	FLUID MECHANICS	CO1	Identify and calculate the key fluid properties used in the analysis of fluid behavior. Understand and apply the principles of pressure, buoyancy and floatation
		CO2	To understand the flow characteristic and dynamics of flow field for various Engineering applications • To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important.
		CO3	To discuss the main properties of laminar and turbulent pipe flow and appreciate their differences and the concept of boundary layer theory
		CO4	Understand the concept of dynamic similarity and how to apply it to experimental modeling
		CO5	To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows
15ME45A	Metal Casting and Welding	CO1	Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds. Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines
		CO2	Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.
		CO3	Explain the Solidification process and Casting of Non-Ferrous Metals.
		CO4	Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing. Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing
		CO5	Describe the Metallurgical aspects in Welding



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			and inspection methods for the quality assurance of components made of casting and joining process.
15ME46A	Computer Aided Machine Drawing	CO1	Identify the national and international standards pertaining to machine drawing.
		CO2	Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings
		CO3	Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.
		CO4	Interpret the Machining and surface finish symbols on the component drawings
		CO5	Preparation of the part or assembly drawings as per the conventions
15MEL47A	Materials Testing Lab	CO1	To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
		CO2	To understand mechanical behavior of various engineering materials by conducting standard tests
		CO3	To learn material failure modes.
		CO4	To UNDERSTAND different loads causing failure.
		CO5	To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.
15MEL48A	Foundry and Forging Lab	CO1	DEMONSTRATE COMPRESSION, SHEAR, USTM, PERMEABILITY SAND TESTS
		CO2	DEMONSTRATE SIEVE ANALYSIS AND CLAY CONTENT TEST
		CO3	DEMONSTRATE FOUNDRY TOOLS AND SAND PREPARATION WITH PATTERN AND WITHOUT PATTERN
		CO4	DEMONSTRATE FOUNDRY TOOLS AND SAND PREPARATION WITH CORE AND ALUMINIUM CASTING
		CO5	DEMONSTRATE VARIOUS SKILLS OF



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			FORGING OPERATIONS.
15ME51	Management and Engineering Economics	CO1	Understand needs, functions, roles, scope and evolution of Management, importance, purpose of Planning and hierarchy of planning and also analyze its types
		CO2	Discuss Decision making, Organizing, Staffing, Directing and Controlling
		CO3	Select the best economic model from various available alternatives & Prepare the project reports effectively
		CO4	Understand various interest rate methods and implement the suitable one
		CO5	Estimate various depreciation values of commodities
15ME52	Dynamics of Machinery	CO1	Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
		CO2	Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes & Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
		CO3	Determine sensitiveness, isochronism, effort and power of porter and hartnell governors & Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
		CO4	Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
		CO5	Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems, Determine the natural frequency, force and motion transmissibility of single degree freedom systems & Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of



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			forced vibration (SDOF) systems.
15ME53	Turbo Machines	CO1	Able to give precise definition of turbo machinery
		CO2	Identify various types of turbo machinery
		CO3	Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines
		CO4	Understand the principle of operation of pumps, fans, compressors and turbines.
		CO5	Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines) & Analyze the performance of turbo machinery.
15ME54	Design of Machine Elements - I	CO1	Understand the design process, choose materials and Apply the codes and
		CO2	Analyze the behavior of machine components under static, impact, fatigue
		CO3	Design shafts, joints, couplings.
		CO4	Design of riveted and welded joints.
		CO5	Design of threaded fasteners and power screws
15ME554	Non Traditional Machining	CO1	Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process
		CO2	Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
		CO3	Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
		CO4	Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
		CO5	Understand the LBM equipment, LBM parameters, and characteristics. EBM



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			equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM
15ME562	ENERGY AND ENVIRONMENT	CO1	Summarize the basic concepts of energy, its distribution and general Scenario.
		CO2	Explain different energy storage systems, energy management, audit and economic analysis.
		CO3	Summarize the environment eco system and its need for awareness
		CO4	Identify the various types of environment pollution and their effects.
		CO5	Discuss the social issues of the environment with associated acts.
15MEL57	Fluid Mechanics & Machinery Lab	CO1	Perform experiments to determine the coefficient of discharge of flow measuring devices.
		CO2	Describe the minor & friction losses, impact of jet on vanes
		CO3	Evaluate the performance of compressor & blower
		CO4	Evaluate the performance of pumps
		CO5	Conduct experiments on hydraulic turbines to draw characteristics
15MEL58	Energy Lab	CO1	Perform experiments to determine the properties of fuels and oils.
		CO2	Conduct experiments on engines and draw characteristics.
		CO3	Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
		CO4	Identify exhaust emission, factors affecting them and report the remedies.
		CO5	Determine the energy flow pattern through the IC Engine
15ME61	Finite Element Analysis	CO1	Understand the basic principles of finite element analysis procedure, Interpolation models and concepts behind formulation methods in FEM like Potential energy method, Rayleigh Ritz method, Galerkin's method,



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			Displacement method of finite element formulation.
		CO2	Identify the application and characteristics of FEA elements such as bars, trusses, and iso-parametric elements. Also able to apply suitable boundary conditions to a global equation for bars, trusses, and solve them displacements, stress and strains induced.
		CO3	Identify the application and characteristics of FEA elements such as Beams, Shafts and Torsion of Shaft elements. Also able to apply suitable boundary conditions to a global equation for Beams, Shafts, and solve them displacements, stress and strains induced.
		CO4	Identify the application and characteristics of FEA elements such as 1D bar elements for Heat Transfer, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins. Also able to apply suitable boundary conditions to a global equation for heat transfer, fluid flow, and solve them displacements, stress and strains induced.
		CO5	Develop element characteristic equation and generation of global equation for Axi-symmetric Solid Elements and Dynamic Considerations. Also able to apply suitable boundary conditions to a global equation for axi symmetric and dynamic problems and solve them displacements, stress and strains induced.
15ME62	Computer integrated Manufacturing	CO1	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen.
		CO2	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
		CO3	Analyze the automated flow lines to reduce



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			down time and enhance productivity.
		CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
		CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.
15ME63	Heat Transfer	CO1	Understand the basic modes of heat transfer
		CO2	Understand and interpret heat transfer through extended surfaces and Compute temperature distribution in steady-state and unsteady-state heat conduction
		CO3	Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems
		CO4	Interpret and compute forced and free convective heat transfer
		CO5	Design heat exchangers using LMTD and NTU methods
15ME64	Design of Machine Elements -II	CO1	Determine Stresses in curved beams , cylinders and cylinder heads
		CO2	Design mechanical systems involving springs, belts and pulleys
		CO3	Design different types of gears (Spur, Helical and Bevel) and simple gear boxes for different applications.
		CO4	Design Worm gear, brakes and clutches.
		CO5	Design hydrodynamic bearings for different applications& selection of Anti friction bearings for different applications using the manufacturers, catalogue.
15ME655	Automobile Engineering	CO1	To identify the different parts of an automobile and it's working
		CO2	To understand the working of transmission and braking systems
		CO3	To comprehend the working of steering and suspension systems
		CO4	To learn various types of fuels and injection



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			systems
		CO5	To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions.
15ME664	Total Quality Management	CO1	Understand various approaches to TQM
		CO2	Understand the characteristics of quality leader and his role
		CO3	Develop CUSTOMER feedback and suggestion systems for quality management
		CO4	UNDERSTAND statistical tools for continuous improvement of systems
		CO5	Enhance the knowledge in Tools and Techniques of quality management
15MEL67	Heat Transfer Lab	CO1	Perform experiments to determine the thermal conductivity of a metal rod
		CO2	Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
		CO3	Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
		CO4	Determine surface emissivity of a test plate
		CO5	Estimate performance of a refrigerator and effectiveness of fin • Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.
15MEL68	Modeling and Analysis Lab(FEA)	CO1	Use the modern tools to formulate the problem, and able to create geometry, descritize, apply boundary condition to solve problems of bars, truss, beams with different loading conditions.
		CO2	Use the modern tools to formulate the problem, and able to create geometry, descritize, apply boundary condition to solve problems of plate to find stress with differentloading conditions
		CO3	Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available



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			results to draw shear force and bending moment diagrams
		CO4	Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
		CO5	Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.
15ME71	Energy Engineering	CO1	Summarize the basic concepts of thermal energy systems
		CO2	Identify renewable energy sources and their utilization
		CO3	Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
		CO4	Understand principles of energy conversion from alternate sources including wind and geothermal.
		CO5	Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator as well as principles of energy conversion from biomass, biogas
15ME72	Fluid Power Systems	CO1	List various hydraulic components and explain the need of them in automation systems.
		CO2	Explain the need for Positive displacement pumps in hydraulic systems with construction and working of different types
		CO3	Discuss different control components used in Hydraulic and Pneumatic systems and summarize working principle and ISO representations
		CO4	Design hydraulic circuits with various hydraulic components for mechanical applications.
		CO5	Design pneumatic circuits with various pneumatic components for pneumatic and electro-pneumatic applications & various trouble shooting methods



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15ME73	Control Engineering	C01	Recognize control system and its types , control actions
		C02	Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical) and Calculate the gain of the system using block diagram and signal flow graph
		C03	Illustrate the response of 1st and 2nd order systems
		C04	Determine the stability of transfer functions in complex domain and frequency domain
		C05	Employ state equations to study the controllability and observability
15ME745	Smart Materials & MEMS	C01	Describe the methods of controlling vibration using smart systems and fabrication methods of MEMS
		C02	Explain the principle concepts of Smart materials, structures, Fibre optics, ER & MR Fluids, Biomimetics and MEMS with principles of working.
		C03	Analyze the properties of smart structures,
		C04	Summarize the methods and uses of Fibre optics, piezoelectric sensing, actuation and MEMS, with the applications and select suitable procedure for fabrication
		C05	Summarize the methods and uses of Micro fabrications, Biomimetics, types of polymers used in MEMS
15ME753	MECHATRONICS	C01	Illustrate various components of Mechatronics systems.
		C02	Assess various control systems used in automation
		C03	Develop PLC system
		C04	Develop mechanical electrical control systems
		C05	Develop a hydraulic and Pneumatic system
15MEL76	DESIGN LAB	C01	To understand and determine the natural frequency, logarithmic decrement, damping ratio and damping. And also to identify vibrations in machine elements and design appropriate damping methods and to



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			determine the critical speed of a rotating shaft.
		CO2	To identify forces and couples in rotating mechanical system components
		CO3	To measure strain in various machine elements using strain gauges.
		CO4	To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
		CO5	To determine strain induced in a structural member using the principle of photo-elasticity.
15MEL77	CIM LAB	CO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
		CO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling-circular, rectangular, Mirror commands etc.
		CO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
		CO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine
		CO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time. Understand & write programs for Robotcontrol; understand the operating principles of hydraulics, pneumatics and electropneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.
15ME81	OPERATION RESEARCH	CO1	Understand the meaning, definitions, scope, need, phases and techniques of operations research. Formulate as L.P.P.
		CO2	Derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual



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			Simplex method.
		CO3	Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
		CO4	Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks. Solve waiting line problems for M/M/1 and M/M/K queuing models.
		CO5	Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm. Solve problems on game theory for pure and mixed strategy under competitive environment.
15ME82	ADDITIVE MANUFACTURING	CO1	Understand the different process of Additive Manufacturing and its Application.
		CO2	Understand the different System Drives, Devices and Actuators.
		CO3	Understand the different process of Additive Manufacturing. using Polymer, Powder Technology
		CO4	Understand the different process of Nano materials manufacturing and Analyse the different characterization techniques.
		CO5	Describe the various NC, CNC machine programing and Automation techniques.
15ME835	PRODUCT LIFE CYCLE MANAGEMENT	CO1	Explain about PLM, the various strategies of PLM and Product Data Management
		CO2	Describe decomposition of product design, Product design process and model simulation
		CO3	Apply the concept of New Product Development and its structuring, redesign of product
		CO4	Analyze the technological forecasting and the tools in the innovation
		CO5	Apply the virtual product development and model analysis