COURSE OUTCOMES
B.Tech (Mechanical Engineering)
(3rd Semester to 8th Semester)

B.Tech 3rd Sem		CO	Course Outcomes
Course Name / Course Code	**Course Code (as per NBA-SAR)**		
Probability and Statistics / MA-301	**C201**	C201.1	Recall the counting principle, axiom basic concepts of probability formula on mean, variance, covariance of discrete and continuous random variable concept of sampling distribution and linear regression analysis.
		C201.2	Demonstrate understanding of various probability model and then their properties used for discrete continuous random variable, prediction, confidence interval, various estimators and concept of hypothesis testing.
		C201.3	Solve the probability problems using discrete and continuous random variable, problem related to prediction & confidence interval.
		C201.4	Apply method of estimation, linear correlation & regression analysis, goodness of fit and for independence of attributes.
		C201.5	Test the hypothesis for normal, chi-square, t and F distribution, draw conclusion using prediction & confidence interval and by the process of estimation.
		C201.6	Define strong weak correlation between variable, choose appropriate method for solution of problem and test of hypothesis for distribution under.
Industrial Economics and Management / HS-305	**C202**	C202.1	Rambler the concept of micro economics and Indian economy.
		C202.2	Understand the law of demand, supply, elasticity and elements of cost.
		C202.3	Apply the management function in various decision making.
		C202.4	Calculate future value, present value of money and interest rate.
		C202.5	Estimate the pay-back period, net present value and internal rate of interest.
Strength of Materials-I / ME-301	**C203**	C203.1	Define various concepts, principles and theories related to elastic behaviour of materials.
		C203.2	Differentiate between various mechanical properties, stresses, failure criteria etc.
		C203.3	Apply the theories/principles learned in any given scenario.
		C203.4	Determine the values of stresses, slope, strain energy etc. for real life problems.
		C203.5	Recommend the suitable material/design for a given member based on reasoned argument.
		C203.6	Predict the behaviour of a given member under the proposed loading conditions.
Fluid Mechanics / ME-302	**C204**	C204.1	Apply basic laws and properties associated with the fluid.
		C204.2	Apply the equations of fluid statics to evaluate forces acting on different sections submerged in water.
		C204.3	Interpret the various flow and function types utilised in fluid kinematics.

		C204.4	Illustrate the principles used in fluid dynamics in various situation of fluid flow.
		C204.5	Create the concept of boundary layer and analyse its effect in laminar and turbulent flow.
		C204.6	Evaluate the dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.
Engineering Thermodynamics / ME-303	**C205**	C205.1	Demonstrate understanding of basic concepts of thermodynamics.
		C205.2	Differentiate between quality and quantity of energy, heat and work, enthalpy and entropy etc.
		C205.3	Indicate the importance of phase change diagrams of various pure substances.
		C205.4	Analyze the performance of vapour power cycles and identify methods to improve thermodynamic performance.
		C205.5	Evaluate the performance of gas power cycles.
		C205.6	Apply the laws of thermodynamics to various real life systems.
Machine Drawing / ME-304	**C206**	C206.1	To understand the Indian standard code of practice for engineering drawing and general symbols and abbreviation used on the drawing.
		C206.2	To use the concept of standardization and interchange ability.
		C206.3	To classify relationship between mating parts of an assembly.
		C206.4	To analyze functional behaviour of various mechanical elements.
		C206.5	To read or interpret detail drawing of a given object.
		C206.6	To create/draw details and assembly of mechanical systems.
Strength of Materials Lab / ME-305	**C207**	C207.1	List the various tests used for quantifying the mechanical properties of the materials.
		C207.2	Bring out the contrast between various tests viz. hardness tests, tensile & compression tests, impact tests etc.
		C207.3	Demonstrate the ability to operate the testing machines by perform the tests.
		C207.4	Relate the results obtained to the principles learned.
		C207.5	Summarize the procedure and test results.
		C207.6	Interpret the results obtained.
Fluid Mechanics Lab / ME-306	**C208**	C208.1	Understanding of basic physics of fluids.
		C208.2	Gaining knowledge to calculate and design engineering applications involving fluid.
		C208.3	Analyzing flow systems in terms of mass, momentum and energy balance.
		C208.4	Use of different fluid flow measuring devices.
		C208.5	To practically relate to concepts discussed in the fluid mechanics course.
		C208.6	Prepare professional quality textual and graphical file of laboratory.
Computer Aided Design (CAD) Lab / ME-307	**C209**	C209.1	Demonstrate basic concepts of the AutoCAD software.
		C209.2	Apply basic concepts to develop construction (drawing) techniques.
		C209.3	Manipulate drawings through editing and plotting techniques.
		C209.4	Decide the best geometric construction methods.
		C209.5	Produce template drawings.

		C209.6	Produce 2D and 3D Drawing Projections.
B.Tech 4th Sem		**CO**	**Course Outcomes**
Course Name / Course Code	**Course Code (as per NBA-SAR)**		
Optimization and Calculus of Variations / MA-401	**C210**	C210.1	Define & classify the optimization problems, functional and extremum.
		C210.2	Demonstrate understanding of using method of the solution to various optimization problems including numerical methods.
		C210.3	Select appropriate method for the solution of LPP, NLPP, extreme value problem using calculus of variation, networking problems including numerical method treatment to NLPP.
		C210.4	Examine the LPP for unique, multiple optimal, infeasible solutions including degeneracy and functional for extremum using Euler's – Lagrange equations.
		C210.5	Appraise the techniques used for solving LPP and networking problems.
		C210.6	Formulate the LPP from real world problems and compile the techniques used for extremum of functional to find Geodesics on surfaces, solving Isoperimetric problems.
Human Values and Professional Ethics / HS-409	**C211**	C211.1	Study the importance of human values and skills for sustained happiness.
		C211.2	Explore a balance between professional and personal happiness / goals.
		C211.3	Realize a significance of trust mutually satisfying human behaviours and enriching interaction with nature.
		C211.4	Develop appropriate technology and management patterns to create harmony in professional and personal life.
		C211.5	Use creative ideas for clarifying about human values in a simple manner.
		C211.6	Evaluate a holistic vision about existence and in the light of understanding they are able to place various educational inputs appropriately.
Manufacturing Technology-I / ME-401	**C212**	C212.1	Demonstrate an understanding of non-chip forming processes such as casting, forging, welding, etc.
		C212.2	Explain the various plastic manufacturing processes.
		C212.3	Understand basics of powder metallurgy.
		C212.4	Select appropriate production processes for a specific application.
		C212.5	Recommend materials in a manufacturing process based on their properties.
		C212.6	Apply appropriate manufacturing techniques for economic production.
Strength of Material-II / ME-402	**C213**	C213.1	Understand the concepts and theories related to pressure vessels, rotating parts (axis-symmetric solids), column & struts, springs, bending of curved bars and un-symmetric bending.
		C213.2	Distinguish between pressure vessels, rotating parts (axis-symmetric solids), column & struts, springs etc. and the related concepts/theories.
		C213.3	Apply concepts of strength of materials to real time Engineering problems.

		C213.4	Analyze the member under consideration using the concepts, principles and theories of strength of materials.
		C213.5	Recommend the dimensions of the mechanical member providing the reasoned argument for the same, under given loading/stress conditions.
		C213.6	Predict the mechanical behaviour of the member under given (or real-life) conditions so as to ensure safety of design.
I.C Engines / ME-403	**C214**	C214.1	Identify the different types of internal combustion engines and their operations.
		C214.2	Understand 2-stroke and 4-stroke engine operations.
		C214.3	Analyze the various air standard cycles such as Otto, diesel, dual combustion etc.
		C214.4	Classify various fuel injections, ignition, cooling, lubrication systems and combustion processes in SI and CI engines.
		C214.5	Explain the effect of design and operating parameters on the performance of SI and CI engines.
		C214.6	Discuss and evaluate the design, testing and performance parameters of IC Engines.
Turbo Machines / ME-404	**C215**	C215.1	Solve analytical problems in fluid machines for incompressible fluid flows.
		C215.2	Demonstrate the knowledge of working, stages, performance characteristics, governing and selection of fluid machinery.
		C215.3	To gain knowledge in performance testing of hydraulic turbines and hydraulic pumps at constant speed and head.
		C215.4	To impart knowledge in measuring pressure, discharge and velocity of fluid flow in machines.
		C215.5	Given the required flow rate and pressure rise, select the proper pump to optimize the pumping efficiency.
		C215.6	Develop a logical approach to solving engineering problems, detect the type of problems that can be solved with simple analytical processes.
Law for Engineers / HS-410	**C216**	C216.1	Classify the laws and bring out the contrast amongst the same.
		C216.2	Demonstrate the interrelationship between the fundamental rights, DPSPs, & centre-state relations.
		C216.3	Explain the essential elements of valid contract.
		C216.4	Compare Law of Torts with Law of Contract, & recommend whether a situation falls in the purview of Law of Torts or Law of Contract providing reasoned argument for the same.
		C216.5	Recommend the Environmental law and human rights in today's world, appraise the existing acts & suggest possible modifications in the existing acts so as to make them more effective.
		C216.6	Propose the course of action to be taken in a given legal context (real life situation) by applying the fundamental knowledge of principles of law.
I.C. Engine Lab / ME-405	**C217**	C217.1	Differentiate two-stroke and four-stroke engines.
		C217.2	Distinguish among the valve timing diagrams of four-stroke petrol and diesel engines.
		C217.3	Demonstrate working of engines components/systems.
		C217.4	Plot and analyze engine performance characteristics.
		C217.5	Prepare heat balance test report.
		C217.6	Perform exhaust gas analysis and comment on adverse implications on environment.
Turbo Machines Lab /	**C218**	C218.1	Using the standard measurement techniques of fluid mechanics and their applications.

ME-406		C218.2	Illustrate the components and working principles of the hydraulic machines- different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
		C218.3	Draw the characteristic curves of hydraulic machines.
		C218.4	Analyze the performance of hydraulic machines.
		C218.5	To practically relate to concepts discussed in the turbo machines course.
		C218.6	Prepare professional quality textual and graphical file of laboratory.
Manufacturing Practice Lab-I / ME-407	**C219**	C219.1	Identify the main techniques for processing of engineering material and distinguish their physical and mechanical properties.
		C219.2	Investigate different casting techniques, identify the defects and suggest the remedial measures.
		C219.3	Investigate different welding, milling and drilling techniques, identify the defects and suggest the remedial measures.
		C219.4	Demonstrate the ability to apply the fundamental principles from prerequisite courses in mechanics, materials and thermo-fluids to analyze manufacturing processes.
		C219.5	Select the most appropriate process for a given product design, application requirements and cost constraint.
		C219.6	Assess and improve the quality, reliability and safety of manufacturing processes and systems.
B.Tech 5th Sem		**CO**	**Course Outcomes**
Course Name / Course Code	**Course Code (as per NBA-SAR)**		
Kinematics of Machines / ME-501	**C301**	C301.1	Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms.
		C301.2	Analyze the planar mechanisms for position, velocity and acceleration.
		C301.3	Drawing displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
		C301.4	Understand the basics of belt, rope and chain drives.
		C301.5	Apply the knowledge of gear and gear trains.
		C301.6	Demonstrate an understanding of kinematic synthesis of mechanisms.
Manufacturing Technology-II / ME-502	**C302**	C302.1	Make a distinction between the machine and machine tool.
		C302.2	Describe various machine and machine tool.
		C302.3	Examine methodically and in detail the mechanics and economics of machine tool, jigs & fixtures etc.
		C302.4	Analyze basic ingredients of machine tool, develop and solve the engineering problems.
		C302.5	Optimize the various manufacturing methods for mechanical components such as gear with safer use.
		C302.6	Compare conventional and unconventional machining processes and their impact on environment.
Heat Transfer / ME-503	**C303**	C303.1	Explain about the real time application of solid medium heat transfer.
		C303.2	Describe the real time application of fluid medium heat

			transfer.
		C303.3	Illustrate real time application of radiation mode of heat transfer.
		C303.4	Develop mathematical model for each mode of heat transfer.
		C303.5	Assess and evaluate various designs for heat transfer and optimize the solution.
		C303.6	Analyse different type of heat exchangers.
Machine Design-I / ME-504	**C304**	C304.1	Select proper material for different machine elements.
		C304.2	Select proper machine component from design data handbooks.
		C304.3	Investigate failure mechanisms for various machine elements and suggest remedies.
		C304.4	Analyse the behaviour of different machine elements in engineering applications.
		C304.5	Design various machine elements for engineering applications.
		C304.6	To identify, define and solve real-life engineering design problems.
Automobile Engineering / ME-505	**C305**	C305.1	Identify the different parts of the automobile.
		C305.2	Understand the constructional, working principle of various types of manual and automotive transmission of an automobile.
		C305.3	Illustrate the constructional, working principle of various sub system of an automobile such as theory of important drive line, structural, its steering, braking and suspension systems of automobiles.
		C305.4	Explain the basics of vehicle electrical and electronics, air-conditioning system and automobile parts.
		C305.5	Design the automotive components like frame, suspension systems, axles, clutch, gear box, drive line components etc.
		C305.6	Develop a strong base for understanding future developments in the automobile industry.
Materials Technology / ME-506	**C306**	C306.1	Define resources and their implications in engineering.
		C306.2	Understand the behaviour of different engineering materials such as properties, defects and failure mechanisms.
		C306.3	Interpret phase diagrams for various important engineering alloys and its significance.
		C306.4	Examine transformation (heat-treatment) processes for specific applications.
		C306.5	Appraise different materials, their processing in suitable applications.
		C306.6	Develop future/smart materials.
Design and Simulation Lab / ME-511	**C307**	C307.1	Define the different modelling terms by analysing the system or the data that is present.
		C307.2	Analyse different mathematical model and their application in simulation.
		C307.3	Adapt the model and from the results check for the correctness of the assumptions.
		C307.4	Understand modelling, design, simulation, planning verification and validation in the areas of simulation.
		C307.5	Analyse the outcomes and make predictions.
		C307.6	Understand the effects of using different tools, workpiece materials in simulation.
Manufacturing Practice Lab-II	**C308**	C308.1	Identify the main techniques for processing of engineering material and distinguish their physical and mechanical

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/ ME-512			properties.
		C308.2	Investigate different casting techniques, identify the defects and suggest the remedial measures.
		C308.3	Investigate different welding, milling and drilling techniques, identify the defects and suggest the remedial measures.
		C308.4	Demonstrate the ability to apply the fundamental principles from prerequisite courses in mechanics, materials and thermo-fluids to analyze manufacturing processes.
		C308.5	Select the most appropriate process for a given product design, application requirements and cost constraint.
		C308.6	Assess and improve the quality, reliability and safety of manufacturing processes and systems.
Heat Transfer Lab / ME-513	C309	C309.1	Illustrate the basic modes of heat transfer.
		C309.2	Apply principles of heat transfer to predict heat transfer coefficients.
		C309.3	Analyze working of various heat transfer equipments.
		C309.4	Compare the performance characteristics for provided shapes/geometries/arrangements in the equipment under different boundary conditions.
		C309.5	To practically relate to concepts with the theoretical.
		C309.6	Prepare professional quality textual and graphical file of laboratory.
B.Tech 6th Sem		**CO**	**Course Outcomes**
Course Name / Course Code	**Course Code (as per NBA-SAR)**		
Computer Aided Design and Manufacturing (CAD/CAM / ME-601	C310	C310.1	Understand the importance of CAD/CAM principles in the product development.
		C310.2	Identify proper computer graphics techniques for geometric modelling.
		C310.3	Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix.
		C310.4	Develop/analyze programs related to manufacturing using codes.
		C310.5	Prepare and test part programming applicable to CNC machines.
		C310.6	Evaluate design and optimize it using CAD, CAE software and validate and rate the design with the standard.
Measurement and Control / ME-602	C311	C311.1	Explain working principle of various measuring instruments.
		C311.2	Understand the output from different systems.
		C311.3	Identify and select proper measuring instruments for specific application.
		C311.4	Understand calibration methodology and error analysis related to measuring instruments.
		C311.5	Develop various methods to minimize errors based on characteristics.
		C311.6	Formulate mathematical model and analyze system/process for standard input responses.
Machine Design-II	C312	C312.1	Select proper material for different machine elements.

/ **ME-603**		C312.2	Select bearings for a given application from the manufacturer's catalogue.
		C312.3	Investigate failure mechanisms for various machine elements and suggest remedies.
		C312.4	Analyse the behaviour of different machine elements in engineering applications.
		C312.5	Design various machine elements for engineering applications.
		C312.6	To identify, define and solve real-life engineering design problems.
Operation Research / **ME-604**	**C313**	C313.1	Define the fundamental terminologies related to operations research.
		C313.2	Differentiate amongst various models and methods used in operations research.
		C313.3	Apply the concepts of various models in real life situations (related problems).
		C313.4	Analyze the given scenario using the methods learned in the course.
		C313.5	Recommend the choice that should be made by the organization based on reasoned argument.
		C313.6	Formulate the model and plan the course of action to be taken by the management in the given/real-life situation to maximize the objective function.
Thermal Engineering / **ME-605**	**C314**	C314.1	Understand the concept of steam formation with the use of boilers.
		C314.2	Classify various boilers and estimate the performance parameters related to boiling systems.
		C314.3	Analyze the performance of vapour power cycles and identify methods to improve thermodynamic performance.
		C314.4	Explain the constructional features and working principles of various steam turbines and steam condensers.
		C314.5	Design and optimize various thermal engineering systems.
		C314.6	Develop an understanding of steam power as a whole.
Dynamics of Machinery / **ME-606**	**C315**	C315.1	Define the basic terminologies and principle which governs the dynamics.
		C315.2	Relate the motion with force causing it in a given system.
		C315.3	Apply the suitable methods to find static and dynamic forces in the links and mechanisms.
		C315.4	Examine the forces and motions involved in a system.
		C315.5	Evaluate the dynamic forces in a mechanism and determine the various factors affecting it.
		C315.6	Predict the dimensions, masses of various components of a given mechanism.
Modern Manufacturing Processes / **ME-608**	**C316**	C316.1	Demonstrate the need for development of newer/ non-traditional machining processes.
		C316.2	Compare the traditional machining processes with non-traditional machining processes with respect to the advantages, applications.
		C316.3	Identify different energy sources like fluid motion, electric current, electrochemical, high speed electrons, high energy radiation, etc.
		C316.4	Understand the working principle of different processes.
		C316.5	Analyze the concept, mechanism, parameters, advantages, applications, limitations associated with the processes.
		C316.6	Evaluate and design manufacturing processes to maximize value-add and equipment utilization.

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Maintenance and Reliability / **ME-609**	**C317**	C317.1	Describe various maintenance philosophies and non-destructive techniques.
		C317.2	Distinguish between various maintenance philosophies and non-destructive techniques.
		C317.3	Examine the maintenance strategy (CBM, RCM, TPM) being followed by organizations.
		C317.4	Analyze basic ingredients of maintenance planning and control and their impact on productivity.
		C317.5	Plan reliability, safety and availability improvement techniques to be used by an organization.
		C317.6	Recommend the maintenance strategy to be followed by an organization under given set of objectives and resource constraints.
Computer Aided Design and Manufacturing (CAD/CAM) Lab / **ME-611**	**C318**	C318.1	Summarize one's performance in the form of project or assignment.
		C318.2	Apply basic concept to drawing, edit, dimension, hatching etc. to develop 2D and 3D modelling.
		C318.3	Use CAD software to create model of parts.
		C318.4	Write the G and M codes for various machining operations like facing, turning, threading etc.
		C318.5	Create assemblies and assembly models using CAD.
		C318.6	Develop basic aptitude of 3D modelling and viewing.
Theory of Machine Lab / **ME-612**	**C319**	C319.1	Classification of various types of links, chains and mechanisms.
		C319.2	Construction of velocity and acceleration diagram for single slider mechanism.
		C319.3	Measurement of coefficient of friction between belt and pulley.
		C319.4	Construction of performance characteristic curves of different governors.
		C319.5	Examine gyroscopic effect and measure its value.
		C319.6	Evaluation of static and dynamic balancing.

B.Tech 7th Sem		**CO**	**Course Outcomes**
Course Name / Course Code	**Course Code (as per NBA-SAR)**		
Industrial Automation and Robotics / **ME-701**	**C401**	C401.1	Explain automation and have the basic knowledge of various automated machines.
		C401.2	Determine the effect of manufacturing automation strategies.
		C401.3	Establish the robotic strategies.
		C401.4	Analyze the kinematics, inverse kinematics & dynamics of robot manipulator.
		C401.5	Evaluate vision and sensing characteristics of robots.
		C401.6	Perform task programming of robots.
Refrigeration & Air Conditioning / **ME-702**	**C402**	C402.1	Understand the principles and applications of refrigeration systems.
		C402.2	Analyze the performance of vapor compression refrigeration systems.
		C402.3	Analyze the air conditioning processes using principle of psychrometry.

		C402.4	Study the working principles of vapor absorption, Electrolux refrigeration, steam jet refrigeration system and air refrigeration systems.
		C402.5	Evaluate cooling and heating loads in air conditioning systems.
		C402.6	Create capacity to compute heating/cooling load.
Power Plant Engineering / ME-703	**C403**	C403.1	Understand the various sources of energy.
		C403.2	Understand basic power generation types and steam cycles.
		C403.3	Distinguish between various power generation units and choose one that meets desired economic, environmental and social requirements.
		C403.4	List the principal components and types of nuclear reactors.
		C403.5	Illustrate power plant economics, environmental and regulatory issues related to power generation.
		C403.6	Understand and distinguish between renewable energy resources.
Industrial Engineering & Production Management / ME-704	**C404**	C404.1	Define various concepts related to management, organizational behaviour, industrial engineering and production management.
		C404.2	Bring out the contrast between various concepts and principles learned.
		C404.3	Identify the issues involved in a given real life scenario and develop the solution accordingly.
		C404.4	Analyze a given situation based upon given data and facts.
		C404.5	Recommend the course of action to be taken in a given scenario giving reasoned argument for the same.
		C404.6	Estimate the profit/cost involved with respect to the proposed course of action.
Material Handling and Plant Layout / ME-708	**C405**	C405.1	Define plant location, plant layout, group technology and line balancing.
		C405.2	Select the plant location and layout for a given product out of a number of possible alternatives.
		C405.3	Plan the plant layout and the material handling system to be incorporated by an organization.
		C405.4	Describe the objectives and benefits of an efficient material handling system.
		C405.5	Describe the various material handling equipments and their characteristics.
		C405.6	Apply the concept of line balancing and travel chart in real life situations.
Automation and Robotics Lab / ME-712	**C407**	C407.1	Explain automation and have the knowledge of various automated machines.
		C407.2	Demonstrate the effect of manufacturing automation strategies.
		C407.3	Articulate or use the various machines, devices, instruments or equipments in automation system.
		C407.4	Correlate/Compare the various machines, devices, instruments or equipments in automation system
		C407.5	Prioritize or reframe the various machines, devices, instruments or equipments in automation system.
		C407.6	Design the automation system and perform the task programming.
Thermal Engineering Lab / ME-713	**C408**	C408.1	Measure COP of refrigeration and air conditioning system and performance of air compressor.
		C408.2	Conduct a test to find the humidification and various other parameters in Refrigerating & Air Conditioning System.

		C408.3	Review and prepare a report on the safety, emissions.
		C408.4	Study and prepare report on working of industrial boilers.
		C408.5	Measure the various parameters, operation of the automotive tyres & wheel.
		C408.6	Study and prepare report on the constructional details, working principles and operation of automotive brake.