**Second Year Mechanical Engineering: Course Outcomes**

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| **BSH – 201: Engineering Mathematics – III** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | BSH 201.1 | Apply linear differential equation and Laplace transform? |
| CO 2 | BSH 201.2 | Define probability distribution, mean, mode, vector point function and divergent? |
| CO 3 | BSH 201.3 | Describe C.F. and P.I. in linear differential equation? |
| CO 4 | BSH 201.4 | Solve linear differential equation, there application and Laplace transform? |
| CO 5 | BSH 201.5 | Study statistics and vector differentiation? |
| CO 6 | BSH 201.6 | Understand Fourier transform &probability? |

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| **MED 202: Fluid Mechanics** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 202.1 | Describe the general trends in fluid properties. |
| CO 2 | MED 202.2 | Draw free body diagrams on fluid elements to show the magnitude and direction of forces acting on submerges surfaces. |
| CO 3 | MED 202.3 | Determine the pressure exerted by fluid on the submerged object, and the location and magnitude of the resultant force of the fluid on the object. |
| CO 4 | MED 202.4 | Know the conditions of stability of floating body and determine the magnitude of unknown forces in a system, using force and moment balances. |
| CO 5 | MED 202.5 | Identify the most appropriate control volume for a fluid system and the direction of flows of mass, momentum and energy into and out of control volume. |
| CO 6 | MED 202.6 | Use the control volume approach to determine the velocity, flow rate, mass, force or energy within a system. |

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| **MED 203: Strength of Materials** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 203.1 | Explain Stresses and strains. |
| CO 2 | MED 203.2 | Describe Shear force and bending moments. |
| CO 3 | MED 203.3 | Describe Theory of pure bending and Shear stress distribution and axial loads. |
| CO 4 | MED 203.4 | Understand Principal stresses and strains and theory of torsion. |
| CO 5 | MED 203.5 | Apply the stresses to thin cylindrical and Spherical pressure shells. |
| CO 6 | MED 203.6 | Analyze the strain energy and deflection of beams. |

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| **MED 204: Machine Drawing** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 204.1 | Identify various machine parts and their shapes. |
| CO 2 | MED 204.2 | Understand the representation of two dimensional views of various machine parts and various engineering curves. |
| CO 3 | MED 204.3 | Interpret three views of objects from a given condition of their arrangement. |
| CO 4 | MED 204.4 | Apply the technique of orthographic projection to draw the views of various machine parts and their assemblies. |
| CO 5 | MED 204.5 | Draw various engineering curves, fasteners, threads, pulleys, various welded and riveted joints and conventions. |
| CO 6 | MED 204.6 | Construct an assembly drawing of various machine parts from a given set of machine parts drawing. |

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| **MED 205: Manufacturing Processes – I**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 205.1 | Explain the taxonomy of manufacturing processes, list the various materials used for the given manufacturing process and give the working principle of the given manufacturing processes. |
| CO 2 | MED205.2 | Understand the various economical aspects in a manufacturing system, the basis of classification, advantages and limitations of the given manufacturing processes, the process variables relationships and process time calculations.  |
| CO 3 | MED205.3 | Choose an appropriate manufacturing method for any given product. |
| CO 4 | MED205.4 | Analyze the material properties and process defects. |
| CO 5 | MED205.5 | Evaluate the manufacturing processes.  |
| CO 6 | MED205.6 | Design the gating system in sand casting and do roll pass design. |

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| **MED 206: Engineering Thermodynamics** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 206.1 | Understand the basic concepts, properties and thermodynamic processes of ideal gas. |
| CO 2 | MED206.2 | Use steam table and Mollier chart to calculate thermal properties of steam. |
| CO 3 | MED206.3 | Apply the first law of thermodynamics to the thermal system to know total change in internal energy of system. |
| CO 4 | MED206.4 | Apply the second law of thermodynamics to thermal systems to know total change in entropy of system. |
| CO 5 | MED206.5 | Explain different types of steam and their properties in different region. |
| CO 6 | MED206.6 | Calculate the properties of working substance at different working conditions. |

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| **MED 225: Development of Skills – II**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 225.1 | Apply the rules of English Grammar, Communication and Soft Skills |
| CO 2 | MED225.2 | Understand the importance of non-verbal communication |
| CO 3 | MED225.3 | Deliver presentations confidently |
| CO 4 | MED225.4 | Write job application & resume accurately and effectively |
| CO 5 | MED225.5 | Answer the questions in mock interview successfully |
| CO 6 | MED225.6 | Present their opinion in debate and group discussion effectively |

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| **MED 251: Engineering Mathematics – IV**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | BSH - 251.1 | Are you able to apply numerical methods to give the solutions to algebraic and transcendental equations? |
| CO 2 | BSH -251.2 | Are you able to evaluate the real integrals in application of complex variables? |
| CO 3 | BSH -251.3 | Are you able to solve numerical on Z- Transform? |
| CO 4 | BSH -251.4 | Are you able to solve the numerical on functions of complex variables? |
| CO 5 | BSH -251.5 | Are you able to solve the numerical on application of partial differential equations? |
| CO 6 | BSH -251.6 | Are you able to solve the numerical on vector integration by using different theorems? |

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| **MED 252: Applied Thermodynamics** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 252.1 | Understand the combustion reaction on mass and volume basis. |
| CO 2 | MED252.2 | Compare different power absorbing and producing thermodynamic cycle. |
| CO 3 | MED252.3 | Use the steam table and Moller Chart to solve the problems of VPC. |
| CO 4 | MED252.4 | Classify different ways to improve performance of power cycles. |
| CO 5 | MED252.5 | Analyze a power cycles under given set of operational parameter. |
| CO 6 | MED252.6 | Design the different thermodynamic system such as boiler draught, condenser, and steam nozzle. |

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| **MED 253: Theory of Machines – I**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 253.1 | Describe the various mechanisms, brakes, dynamometers and cams used in different machines.  |
| CO 2 | MED253.2 | Classify the basic mechanisms, brakes, dynamometers and cams used in different machines.  |
| CO 3 | MED253.3 | Determine analytically and graphically the centrifugal forces, couples, velocity and acceleration of various mechanism, cams and different types of engines.  |
| CO 4 | MED253.4 | Construct various cam profiles, velocity and acceleration diagrams. |
| CO 5 | MED253.5 | Analyse the unbalanced forces in various rotating and reciprocating machines. |
| CO 6 | MED253.6 | Design various types of cams and mechanisms for a given set of conditions. |

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| **MED 254: Metrology and Mechanical Measurements** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 254.1 | Identify measuring system, measuring devices, errors, sensors and transducers |
| CO 2 | MED254.2 | Define the different terms used in metrology |
| CO 3 | MED254.3 | Select proper measuring devices for measurement of force, torque, pressure and strain |
| CO 4 | MED254.4 | Explain the time and temperature related measurement |
| CO 5 | MED254.5 | Illustrate working, principle of linear and angular measuring devices |
| CO 6 | MED254.6 | Explain comparators, surface finish measurement and interferometry |

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| **MED 255: Manufacturing Processes – II**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 255.1 | Explain the principle of metal cutting and different conventional and unconventional machining and welding processes. |
| CO 2 | MED255.2 | Explain construction, operations and specification of different machine tools. |
| CO 3 | MED255.3 | Select the appropriate metal cutting process and machine tool for producing given component. |
| CO 4 | MED255.4 | Identify tool type, tool materials and cutting parameters for different machining processes. |
| CO 5 | MED255.5 | Calculate the cutting forces, power required and machining time for producing given component. |
| CO 6 | MED255.6 | Calculate tool life for a range of different operations and work piece materials. |

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| **MED 256: Electrical Technology** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 256.1 | Describe the basic concept, construction, working and behaviour of DC Generator. |
| CO 2 | MED256.2 | Describe the basic concept, construction, working and behaviour of DC Motor. |
| CO 3 | MED256.3 | Describe the basic concepts, constructions, working of single phase induction motors. |
| CO 4 | MED256.4 | Describe the basic concepts, construction, and working of special machines. |
| CO 5 | MED256.5 | Describe the concept of three phase transformer, various connection types, merits & demerits. |
| CO 6 | MED256.6 | Demonstrate the application of servo motor and stepper motor. |

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| **MED 275: Development of Skills – III**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 275.1 | Explain the concepts of problem solving and its resolution styles |
| CO 2 | MED275.2 | Identify Different problem solving tools for real life scenarios |
| CO 3 | MED275.3 | Solve actual problems by identifying various problem solving tools |
| CO 4 | MED275.4 | Define the concept and orientation of entrepreneurship  |
| CO 5 | MED275.5 | Demonstrate and adapt the personality development activities |
| CO 6 | MED275.6 | Analyse professional report writing skills |

**Third Year Mechanical Engineering: Course Outcomes**

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| **MED 301: Design of Machine Elements – I**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 301.1 | Describe the fundamental aspects of design. |
| CO 2 | MED 301.2 | Select proper materials depending on their properties. |
| CO 3 | MED 301.3 | Explain the concept of application of fluctuating loads on various machine elements. |
| CO 4 | MED 301.4 | Evaluate the different theories of failure. |
| CO 5 | MED 301.5 | Design various joints such as cotter and knuckle joint, welded and riveted joint. |
| CO 6 | MED 301.6 | Design various machine elements such as shafts, keys, couplings screws and fasteners, power screws and springs. |

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| **MED 302: Theory of Machines – II**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 302.1 | Identify the terms related to governors, gears, gyroscope, flywheel and vibrations |
| CO 2 | MED 302.2 | Memorize terminology related to governors, toothed gearing, gyroscope, flywheel and vibrations. |
| CO 3 | MED 302.3 | Understand theory related to governors, toothed gearing, gyroscope, flywheel, friction and vibrations |
| CO 4 | MED 302.4 | Solve numerical on governors, toothed gearing, gyroscope, flywheel, friction and vibrations. |
| CO 5 | MED 302.5 | Compare and analyze stability of governor, types of gears and systems of vibration |
| CO 6 | MED 302.6 | Design flywheel, screw threads and system under vibration under different conditions. |

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| **MED 303: CAD/CAM/CAE**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 303.1 | Explaining 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. |
| CO 2 | MED 303.2 | Executing the knowledge in representation and transformation techniques to create programming codes to generate and transform geometric entities. |
| CO 3 | MED 303.3 | Producing the simple geometric model of engineering parts using basic modeling operations and to produce typical tool paths using CAD/CAM software. |
| CO 4 | MED 303.4 | Checking visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring, etc. |
| CO 5 | MED 303.5 | Organizing the CAD system and the CAM system for modeling design information and converting the CAD model into a CAM model for modeling the manufacturing information. |
| CO 6 | MED 303.6 | Summarize the basic and entry level theories and terminology of Finite Element Method. Be able to design and implement a computer program of moderate complexity for CAD/CAM/CAE tasks. |

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| **MED 304: Production Management**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 304.1 | Understand the concept of production, product design and development, materials management. |
| CO 2 | MED 304.2 | Understand the concept of job evaluation, merit rating, work and motion study. |
| CO 3 | MED 304.3 | Describe the importance of training, motivation, merit rating. |
| CO 4 | MED 304.4 | Select plant layout, type of product design and material handling equipment. |
| CO 5 | MED 304.5 | Classify forecasting, cost overheads, material handling equipment. |
| CO 6 | MED 304.6 | Apply break even analysis, forecasting methods, depreciation calculation methods. |

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| **MED 305: IC Engines and Turbines**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 305.1 | Describe fundamentals of IC engines and turbines and their components such as carburettor, fuel injector, etc.  |
| CO 2 | MED 305.2 | Understand the working of various components like carburettor, fuel injector, ignition systems, etc.  |
| CO 3 | MED 305.3 | Explain the stages of combustion, exhaust emissions carried out of engine to environments and its effect on environment and human health. |
| CO 4 | MED 305.4 | Analyze the performance of SI and CI engines and evaluation of heat dissipation in engines and making heat balance sheet.  |
| CO 5 | MED 305.5 | Evaluate the performance of the steam turbine of different types and gas turbines working on different cycles.  |
| CO 6 | MED 305.6 | Design of various components of IC engines like design of carburettor, design of combustion chamber.  |

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| **MED 306: Industrial Management**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 306.1 | Describe management and its types, management process, types of business organization, |
| CO 2 | MED 306.2 | Learn the principles of Accounting System, financial System, Industrial Acts, and Standard Wages Plans. |
| CO 3 | MED 306.3 | Understand the various aspects of concept of management, organization, factors affecting an organization, |
| CO 4 | MED 306.4 | Comprehend the various aspects finance management, and administrations of an industry |
| CO 5 | MED 306.5 | Explain the various aspects Accident & safety Management |
| CO 6 | MED 306.6 | Analyze certain case studies based on certain organizations, factors affecting an organization, finance management, and administrations of an industry. |

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| **MED 325: Seminar**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 325.1 | * + - 1. Choose current topics relevant to mechanical engineering.
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| CO 2 | MED 325.2 | * + - 1. Illustrate literature review on a topic allotted for detailed study
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| CO 3 | MED 325.3 | * + - 1. Make use of search engines and internet facility for subject preparation
 |
| CO 4 | MED 325.4 | * + - 1. Analyse techniques, skills, and engineering tools necessary for engineering practice
 |
| CO 5 | MED 325.5 | * + - 1. Justify the gain of knowledge to a student, of what each other is doing in order to establish a sense of community
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| CO 6 | MED 325.6 | * + - 1. Develop/improve confidence in presentation skills and techniques
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| **MED 351: Design of Machine Elements – II**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 351.1 | Explain design considerations of gears, frictional clutches, belt drives and bearings. |
| CO 2 | MED 351.2 | Describe the Tribological aspects and optimum design concept involved in design. |
| CO 3 | MED 351.3 | Understand the theories of gear design. |
| CO 4 | MED 351.4 | Understand the theories of bearings design. |
| CO 5 | MED 351.5 | Design different types of gears, gear trains and different types of bearings. |
| CO 6 | MED 351.6 | Design frictional clutches and belt drives |

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| **MED 352: Fluid Mechanics and Machinery**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 352.1 | Calculate the fluid flow measurement and forces in fluid. |
| CO 2 | MED 352.2 | Demonstrate the methods of dimensional analysis and develop prediction equations. |
| CO 3 | MED 352.3 | Perform vector analysis of the flow in turbo-machines. |
| CO 4 | MED 352.4 | Compare performance of turbo machines. |
| CO 5 | MED 352.5 | Calculate flow of fluids through different types of orifices. |
| CO 6 | MED 352.6 | Calculate the forces exerted by the jet in various conditions. |

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| **MED 353: Engineering Metallurgy**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 353.1 | Describe various properties of metals. |
| CO 2 | MED 353.2 | Classify the phases of steel using iron carbon equilibrium diagram. |
| CO 3 | MED 353.3 | Illustrate various heat treatments and their effects on metal properties. |
| CO 4 | MED 353.4 | Distinguish various steel alloys, cast iron and nonferrous alloys according to their properties & applications. |
| CO 5 | MED 353.5 | Predict effect of rate of change of temperature on the structure and properties of metals. |
| CO 6 | MED 353.6 | Design suitable surface heat treatment method for improvement in properties of metals. |

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| **MED 354: Modern Management Techniques**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 354.1 | Recognize the concept of Modern Management System. |
| CO 2 | MED 354.2 | Understand the concept and theory of various manufacturing support systems and manufacturing management systems. |
| CO 3 | MED 354.3 | Understand the concept of flow of information and money in a supply chain, and Kanban system to implement JIT. |
| CO 4 | MED 354.4 | Carry out the implementation process of 5S, value engineering through various case studies. |
| CO 5 | MED 354.5 | Find out the machine maintenance routines and compare with standard TPM pillars to understand lean manufacturing process. |
| CO 6 | MED 354.6 | Justify the decision making procedures and types of thinking processes for given problem. |

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| **MED 355: Computational Techniques** |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 355.1 | Understand the use of numerical methods in modern scientific computing. |
| CO 2 | MED 355.2 | Solve for numerical solutions of linear and nonlinear equations. |
| CO 3 | MED 355.3 | Solve for numerical solutions of interpolation and approximation of functions. |
| CO 4 | MED 355.4 | Solve for numerical solutions of integration and differential equations. |
| CO 5 | MED 355.5 | Discriminate different numerical methods and errors in numerical methods. |
| CO 6 | MED 355.6 | Write C Program for various numerical methods. |

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| **MED 391: Mechatronics (Elective – I)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 391.1 | Demonstrate the basics mechanical systems signal conditioning and output devices. |
| CO 2 | MED 391.2 | Explain the types of sensors and their usage like linear, nonlinear, temperature and proximity. |
| CO 3 | MED 391.3 | Describe the data acquisition system and pin configuration used in microprocessors. |
| CO 4 | MED 391.4 | Outline working and usage of various types of motors such as AC, DC and Stepper motors. |
| CO 5 | MED 391.5 | Describe the various types of hydraulic and pneumatic systems. |
| CO 6 | MED 391.6 | Demonstrate selection criteria of sensors, actuators and PLC's for case study of simple mechatronics systems. |

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| **MED 392: Reliability and Maintenance Engineering (Elective – I)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 392.1 | Deduce system reliability from component reliability data. |
| CO 2 | MED 392.2 | Apply the appropriate methodologies and tools for enhancing the reliability of components and systems |
| CO 3 | MED 392.3 | Apply reliability theory to assessment of reliability in engineering design. |
| CO 4 | MED 392.4 | Apply and recommend a maintenance system for specified equipment. |
| CO 5 | MED 392.5 | Design the models for replacement policies |
| CO 6 | MED 392.6 | Demonstrate the applications of RAM analysis |

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| **MED 393: Mechanical Vibration (Elective – I)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 393.1 | Explain the causes and effects of vibrations and their types using D’ Alembert principle and Dunkley’s method. |
| CO 2 | MED 393.2 | Analyze types of damping for free damped vibrations, determine natural frequencies and obtain equation of motion for under damped, critically damped and over damped systems. |
| CO 3 | MED 393.3 | Determine amplitude of vibrations at various ratios for harmonic, constant amplitude and eccentric excitations. |
| CO 4 | MED 393.4 | Determine critical speed of shafts having one and two rotors and to analyse principle modes of vibrations. |
| CO 5 | MED 393.5 | Analyse multi-degree freedom system using natural frequencies, mode shaped and node points. |
| CO 6 | MED 393.6 | Determine and form numerical solutions using Dunkerleys, Stodola and Rayleigh- Ritz methods. |

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| **MED 394: Introduction to Aircraft Industry & Aircraft Systems (Elective – I)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 394.1 | Understand difference between airline and aircraft industry, and history and development of Aviation. |
| CO 2 | MED 394.2 | Understand the aircraft industry supply chain, Tier 1 suppliers, OEM, strategies and latest trends.  |
| CO 3 | MED 394.3 | Understand key aircraft systems including flight control system, fuel system, propulsion system, hydraulic system, electrical systems, avionics system, environmental control system, pneumatic system, and emergency system. |
| CO 4 | MED 394.4 | Explain the relationship among major aviation systems. |
| CO 5 | MED 394.5 | Understand air traffic management, flight standards, airworthiness provided by regulatory bodies. |
| CO 6 | MED 394.6 | Appreciate the difficulties in the actual designing and manufacturing an aircraft. |

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| **MED 375: Project – I**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 375.1 | 1. Define, formulate and solve engineering problems
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| CO 2 | MED 375.2 | 1. Outline the need for, and an ability to engage in life-long learning
 |
| CO 3 | MED 375.3 | 1. Identify contemporary issues
 |
| CO 4 | MED 375.4 | 1. Take part in designing a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability
 |
| CO 5 | MED 375.5 | 1. Measure the performance on multi-disciplinary teams
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| CO 6 | MED 375.6 | 1. Develop the ability to communicate effectively
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**B.Tech Final Year Mechanical Engineering: Course Outcomes**

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| **MED 401: Refrigeration and Air Conditioning**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 401.1 | Describe the fundamentals of refrigeration and air conditioning systems such as vapour compression and vapour absorption system. |
| CO 2 | MED 401.2 | Understand the thermodynamics and psychometric processes carried out during refrigeration and air conditioning. |
| CO 3 | MED 401.3 | Apply knowledge of fundamentals of thermodynamic and psychometric processes to understand concept of working principle of various refrigeration and air conditioning cycles.  |
| CO 4 | MED 401.4 | Thermodynamic analysis of refrigeration, air conditioning cycles and refrigerants. |
| CO 5 | MED 401.5 | Evaluate the performance of different refrigeration and air conditioning systems. |
| CO 6 | MED 401.6 | Develop concept of heating and cooling load calculations used partially in design and development of refrigeration and air conditioning systems.  |

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| **MED 402: Automatic Control Systems**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 402.1 | Explaining a mathematical model of a system and describe various mechanical, electrical control system components.  |
| CO 2 | MED 402.2 | Analysing a control system with the help of Block Diagram Analysis.  |
| CO 3 | MED 402.3 | Explaining working of different components of control systems. |
| CO 4 | MED 402.4 | Differentiating the use of different controllers in control systems. |
| CO 5 | MED 402.5 | Interpreting the response of different order systems for test signals. |
| CO 6 | MED 402.6 | Analyze the stability of the system. |

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| **MED 403: Heat Transfer**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 403.1 | State the fundamental laws of thermodynamics and heat transfer, different modes of heat transfer.  |
| CO 2 | MED 403.2 | Understand the concepts of steady & unsteady state heat transfer, theory of simple pin-fin, concepts of steady & unsteady state heat transfer, heat exchangers & thermal radiations. |
| CO 3 | MED 403.3 | Apply the electrical analogy, different empirical relations in all modes of heat transfer and LMTD, NTU methods to simplify the heat transfer problems. |
| CO 4 | MED 403.4 | Compare the heat transfer problems under different set of operational parameters. |
| CO 5 | MED 403.5 | Evaluate the temperature profiles and performance of fins and heat exchangers. |
| CO 6 | MED 403.6 | Design the fins and heat exchangers to suit different applications.  |

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| **MED 404: Tool Design**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 404.1 | Describe different tool materials, their properties, different tools and their geometry and necessary aspects related to the tools. |
| CO 2 | MED 404.2 | Describe fits, gauges, locating and clamping principles, elements of dies and factors affecting drawing operation |
| CO 3 | MED 404.3 | Classify all types of tools and explain tolerances, interchangeability, selective assembly, manufacturing of jigs & fixtures and elements used in various dies |
| CO 4 | MED 404.4 | Carry out all kinds of calculations in metal cutting and select appropriate type of tool for the machining process. |
| CO 5 | MED 404.5 | Analyze various cutting tools, jigs and fixtures and elements to be used for the purpose. |
| CO 6 | MED 404.6 | Design a gauge, jig or fixture, die, drawing die for the given component. |

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| **MED 441: Project Management & Operation Research (Elective – II)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 441.1 | Illustrate the need to optimally utilize the resources in various types of industries. |
| CO 2 | MED 441.2 | Develop operational research models from the verbal description of the real system. |
| CO 3 | MED 441.3 | Build and solve Transportation Models and Assignment Models. |
| CO 4 | MED 441.4 | Design new simple models, like: CPM, PERT to improve decision-making and develop critical thinking and objective analysis of decision problems.  |
| CO 5 | MED 441.5 | Apply mathematical optimization functions to various applications. |
| CO 6 | MED 441.6 | Implement practical cases, by using TORA/LINDO/LINGO software. |

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| **MED 442: Product Design (Elective – II)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 442.1 | Describe various design models, design methodologies & modern CAD techniques. |
| CO 2 | MED 442.2 | Explain the various market research techniques & concepts of industrial design.  |
| CO 3 | MED 442.3 | Implement the product plan & product position |
| CO 4 | MED 442.4 | Compare the project plans & process considerations during designing. |
| CO 5 | MED 442.5 | Apply problem solving technique. |
| CO 6 | MED 442.6 | Design leaflets & service manuals. |

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| **MED 443: Composite Materials and Technology (Elective – II)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 443.1 | Understand the basic features of composites and types |
| CO 2 | MED 443.2 | Describe various manufacturing techniques of PMC, MMC and CMC |
| CO 3 | MED 443.3 | Comprehend various effects of different materials |
| CO 4 | MED 443.4 | Select proper resin and materials combination |
| CO 5 | MED 443.5 | Apply various numerical analysis and modeling techniques |
| CO 6 | MED 443.6 | Design cycles of composite product |

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| **MED 444: Finite Element Analysis (Elective – II)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 444.1 | Introduce equilibrium conditions for elasticity, Lagrange’s equation for bar and beam, boundary conditions. |
| CO 2 | MED 444.2 | Understand the FEA and its applications in engineering, procedure to solve problems using FEA, formulation of stiffness matrix. |
| CO 3 | MED 444.3 | Employ boundary conditions, element type and solution method for appropriate problems in FEA. |
| CO 4 | MED 444.4 | Solve the engineering problems of 1D, 2D and 3D structural and 1D heat flux. |
| CO 5 | MED 444.5 | Examine the results of the FEA solutions in a post processing step, errors in the solutions. |
| CO 6 | MED 444.6 | Create, formulate and solve the engineering problems using FEA software. |

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| **MED 425: Project – II**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 425.1 | Relate necessary education to understand the impact of engineering solutions in fabrication and assembly context |
| CO 2 | MED 425.2 | Demonstrate and extend engineering techniques, skills, and tools  |
| CO 3 | MED 425.3 | Identifying professional and ethical responsibilities, and make use of them |
| CO 4 | MED 425.4 | Conduct experiments, as well as analyze and interpret data |
| CO 5 | MED 425.5 | Prove the ability to communicate effectively |
| CO 6 | MED 425.6 | Combine, test and apply knowledge of mathematics, science and engineering |

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| **MED 471: Inplant Training (IPT)**  |
| **CO No.** | **Code** | **Statement** |
| CO 1 | MED 471.1 | Recognize organizational functioning on the basis of theoretical concepts learned. |
| CO 2 | MED 471.2 | Describe working of an industrial organization. |
| CO 3 | MED 471.3 | Apply knowledge to solve industrial problem.  |
| CO 4 | MED 471.4 | Design and Estimate the processes parameters in order to increase productivity. |
| CO 5 | MED 471.5 | Choose appropriate mechanism for enhancing performance of an organization |
| CO 6 | MED 471.6 | Propose improvement in the existing setup for the growth an industry  |