

**Nirma University  
Institute of Technology  
School of Engineering  
Mechanical Engineering Department**

**M.Tech. Mechanical Engineering (Design Engineering)**

**3ME3108                      Advanced Mechanics of Solids                      [3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1     apply the concepts of stress and strain at a point, stress strain relationship and equilibrium equations for structural mechanics problems,
- 2     decide the stress function for two dimensional problems for solution of stress, strain and displacement field,
- 3     analyze various stresses in thick cylinder and bending of curved beams,
- 4     evaluate the failure of the components using the energy methods.

**3ME3109                      Kinematics and Dynamics of Machines                      [3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1     analyze the motion characteristics of various mechanism analytically,
- 2     develop the mechanisms according to the motion requirement,
- 3     assess the solution of engineering problems in rigid body dynamics,
- 4     apply the recent methods for dynamic analysis of machines.

**3ME3110                      Robotics and Automation                      [3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1     decide the kinematic and dynamic model of robotic manipulator and simulate it,
- 2     analyze the mathematical models of control systems,
- 3     select the suitable sensors and actuators for development of automation system,
- 4     develop the program for industrial manipulators.

**3ME3111**

**Advanced Mechanical Design**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 evaluate various mechanical systems incorporating the effect of fatigue, creep and fracture mechanics,
- 2 apply the tribological considerations in the design of machine components,
- 3 analyze the stress in rotating discs and cylinder,
- 4 develop the components of material handling equipment.

**3ME3112**

**Applied Numerical Methods**

**[2 0 0 2]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 develop mathematical models pertaining to various engineering problems,
- 2 solve linear and nonlinear system of equations,
- 3 analyze experimental data using curve fitting and interpolating techniques,
- 4 evaluate the integrals and differential of functions and equations using numerical methods.

**3ME3113**

**Design Laboratory – I**

**[0 0 4 2]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 apply computer programming for solving engineering problems,
- 2 develop 3D model of mechanical components with basic features like extrude, revolve,, sweep, hole, rib, datum plane, datum axis, pattern etc,
- 3 examine the 3D models, assembly and drawings of mechanical components with different basic and advanced features,
- 4 assess the multi body dynamic system model using tools like computer programming and CAD/CAE software.

**3ME3209                  Finite Element Analysis and Mesh Free Methods    [3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 build the engineering problems into finite element model,
- 2 solve the stiffness matrix, displacement matrix and load vectors for one/two dimension problems,
- 3 estimate the structural mechanics solution using the mesh free methods for engineering problems,
- 4 analyze the mechanical engineering systems using the FEA method

**3ME3210                  Applied Mechanical Vibration                                  [2 0 0 2]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 evaluate the vibration modes and natural frequencies and their estimation for multi-degree-of-freedom systems,
- 2 develop the model for vibration of continuous system and nonlinear systems,
- 3 select the vibration measurement system and interpret the vibration signal,
- 4 analysis of rotary system to ensure balancing

**3ME3211                  Design Laboratory – II    [0 0 4 2]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 analyze the mechanical engineering systems for various applications,
- 2 evaluate finite element models to estimate structural strength and vibration parameters of mechanical components,
- 3 develop the mechanical systems to satisfy the stated purpose,
- 4 construct the production drawings using CAD software.

**3ME3212**

**Minor Project**

**[0 0 8 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 compile information related to recent trends of research in the industry and society,
- 2 formulate the problem definition,
- 3 design, implement, test and verify the proposed solution related to problem definition,
- 4 compile, comprehend and present the work carried out,
- 5 prioritize the project activities for timely completion.

**3ME3302**

**Major Project Part – I**

**[0 0 0 14]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 determine the issues related to the recent trends in the field of engineering and its applications,
- 2 formulate the problem definition, analyze and propose the solutions,
- 3 design, verify, test, and implement the solution,
- 4 compile and conclude the work carried out.

**3ME3402**

**Major Project Part – II**

**[0 0 0 14]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 determine the issues related to the recent trends in the field of engineering and its applications,
- 2 formulate the problem definition, analyze and propose the solutions,
- 3 design, verify, test, and implement the solution,
- 4 compile and conclude the work carried out.

## Department Elective Courses

**3ME32D201      Design for Manufacturing and Assembly      [3 0 0 3]**

### Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

- 1      determine the quality aspects of design for manufacture and assembly,
- 2      apply the concept of DFM for casting, welding, forming, and assembly,
- 3      analyze the design factors and processes as per customer specifications,
- 4      appraise the DFM consideration for a given product.

**3ME32D202      Product Design and Development      [3 0 0 3]**

### Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

- 1      examine the opportunity for product design and development,
- 2      organize the steps of design process for a given product,
- 3      assess the products with different constraints and goals,
- 4      develop the product as per the set specifications.

**3ME32D203      Rotor dynamics      [3 0 0 3]**

### Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

- 1      model mathematically variety of rotating bearing system and understand the role of damping, stiffness and inertia effects,
- 2      determine the critical speed of the rotors,
- 3      analyze the stability limits of the rotors using transfer matrix method,
- 4      discover the faults in rotor bearing system with condition monitoring techniques.

**3ME32D204      Computer Aided Design**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1    select input and output devices for computer systems for mechanical engineering requirements,
- 2    apply knowledge of mathematical concepts for geometry manipulation and modeling of curves, surface and solids,
- 3    make use of CAD packages to prepare solid model of components, assemble them to represent complex mechanical systems,
- 4    analyze the computer algorithms for design and analysis of mechanical systems.

**3ME32D205      Mechanics of Smart Materials**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1    analyze the micromechanical and macro mechanical behavior of composite materials,
- 2    select the suitable method of manufacturing for composite materials,
- 3    evaluate the utility of smart materials for given applications,
- 4    choose suitable parameters and modules for development of smart systems.

**3ME32D206      Pressure Vessel Design**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1    apply the fundamental concepts for the design of pressure vessel and piping systems,
- 2    decide the specifications of the pressure vessels using the existing codes (ASME section VIII),
- 3    analyse pressure vessels for internal as well as external pressure, and other combined loading condition,
- 4    develop various elements of the piping system.

**3ME32D207 Applied Fracture Mechanics**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 choose the criterions for safe and reliable functioning of cracked components,
- 2 apply the concepts of elasto plastic fracture mechanics,
- 3 analyze the stress intensity factor for cracked components,
- 4 analyze the failure of a structures containing a defect.

**3ME32D208 Design of Machine Tools**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 decide the specifications of structure of machine tools such as bed, column, housing etc,
- 2 select the configuration of speed and feed regulation for required application,
- 3 estimate the functional parameters of spindles and guideways,
- 4 analyse the dynamic response of machine tool structures.

**3ME32D209 Supply Chain Management**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 apply the concepts of supply chain management for logistic planning,
- 2 categorize the role of network design in supply chain,
- 3 decide the appropriate demand forecasting method,
- 4 select the production planning and inventory control policies in a supply chain.

**3ME32D210 Theory of Elasticity**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 solve basic field equations of linear elastic solids, force, stress, strain and equilibrium in solids, (BL3)
- 2 develop the two dimensional Problems in Rectangular and polar Coordinates, (BL5)
- 3 analyse the deformation, internal force, failure in structural components, axisymmetric structural problems and torsion problems, (BL4)
- 4 determine strain and stress in the components using experimental techniques. (BL5)

**3ME32D211 Theory of Plasticity**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 appraise effect of various factors on stress strain behavior of metals beyond yield point,
- 2 analyze elasto-plastic behavior of metals under different states of stresses,
- 3 solve the industrial problems related to plastic deformation,
- 4 apply different analytical methods to solve plastic deformation problems.

**3ME32D212 Failure Analysis**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1 appraise effect of various factors on stress strain behavior of metals beyond yield point,
- 2 compare loading condition with failure of a component,
- 3 choose the methodology for prevention of failures,
- 4 analyze the failure of mechanical engineering components.



**3ME32D213      Tribo Design and Analysis**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      classify types of wear mechanism in the machine element,
- 2      identify suitable bearing materials with their properties,
- 3      choose correct lubricant and lubrication techniques,
- 4      assess the mechanical components such as Journal bearing, rolling element bearing, gear considering tribological aspects.

**3ME32D214      Design of Precision Machines**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      apply the concepts of positional repeatability, accuracy and error modelling for design of precision machines,
- 2      make use of the principles and techniques used to design precision machines and mechanisms,
- 3      select bearings, actuators, and sensors used in precision machine design,
- 4      analyze the power transmission systems used in the design of precision machines.

**3ME32D215      Experimental Methods**

**[3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      analyse the experimental data and apply statistical tools,
- 2      apply the concepts of error and uncertainty analysis,
- 3      develop experimentation techniques for design engineering applications,
- 4      appraise the data acquisition systems for experimentation.

**3ME32D216      Design of Micro Electro Mechanical Systems      [3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      decide the avenues for Micro electro mechanical systems(MEMS) in mechanical engineering,
- 2      analyze different sensing and actuation methods of MEMS,
- 3      apply the concepts of fabrication methods of microstructure,
- 4      determine the applications of polymers in MEMS.

**3ME32D217      Optimization Methods in Engineering      [3 0 0 3]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      apply the fundamental knowledge of optimization,
- 2      choose the various methods of optimization based on linear programming, nonlinear programming and stochastic programming for decision making,
- 3      analyze hard engineering problems which are interdisciplinary in nature using unconventional optimization techniques like genetic algorithm, simulated annealing, neural network based optimization techniques,
- 4      evaluate the capabilities of software tools used in the optimization process.

**3ME32D301      Condition Monitoring of Mechanical Equipment      [3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      appraise the role of condition monitoring in maintenance of machinery,
- 2      analyse the knowledge of machinery vibrations and signal processing techniques to monitor the condition of machines,
- 3      select the suitable instruments for condition monitoring,
- 4      determine the mechanical fault in machinery by using wear, oil analysis and vibration monitoring.

**3ME32D302      Production and Quality Management**

**[3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1    apply principles of production management,
- 2    solve forecasting and scheduling problems for the given situation using computational tools,
- 3    evaluate the inventory models for various applications,
- 4    analyze and interpret the quality issues using statistical software.

**3ME32D303      Design of Mechatronic Systems**

**[3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1    identify the need of mechatronics system,
- 2    explain functionality of various sensors, actuators and controllers used in mechatronics system,
- 3    select the mechatronics components for the given application,
- 4    analyze the mechatronic systems.

**3ME32D304      Manufacturing Processes for Composite  
Materials**

**[3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1    choose the suitable manufacturing process for composite materials
- 2    evaluate the suitability of form of reinforcement, manufacturing process parameters, for derived qualities of composite components,
- 3    assess the potential of composite manufacturing in different industrial sectors,
- 4    compare the mechanical properties of the component manufactured by different processes.

**3ME32D305      Machine Learning for Design Engineering      [3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      apply the concepts of machine learning methods,
- 2      analyze the applicability of linear and non-linear machine learning models to solve problems in design engineering,
- 3      make use of unsupervised machine learning problems for classification and regression,
- 4      assess the machine learning algorithm for specific area of design engineering.

**3ME32D306      Additive Manufacturing      [3 0 2 4]**

**Course Learning Outcomes (CLOs):**

After successful completion of the course, the student will be able to: -

- 1      analyze the effect of process parameters of additive manufacturing process on the mechanical properties of the product
- 2      evaluate the suitability of various additive manufacturing processes for a given application,
- 3      assess the potential of additive manufacturing in different industrial sectors,
- 4      select the suitable additive manufacturing processes for the desired performance of product.