Syllabus for M.Tech in Mechanical Engineering (Design Engineering)

Semester I

3ME3101 MECHANICAL DESIGN I **L T P C**
3 0 0 3

General Design Procedure, Creep, Tribology, Rotating Discs and Rotating Cylinder, Design of Circular and Non-Circular Plates.

3ME1104 COMPUTER AIDED DESIGN **L T P C**
3 0 2 4

CAD Hardware and Software, Computer Graphics, Standards in CAD, Computer Aided Design of Mechanical Elements with Animation, Capabilities of various Commercially Available Software, Various Techniques of Rapid Prototyping.

3ME3102 APPLIED DYNAMICS AND VIBRATIONS **L T P C**
3 0 2 4

Dynamics of rigid bodies, Gyro dynamics, Euler's equations, Lagrange's equation, Hamilton's principles, Vibrations of multiple degrees of freedom systems, Vibration of continuous system, Longitudinal vibrations of bars, lateral vibration of straight and curved beans, Rayleigh-Ritz and Galerkin's methods, non-linear and random vibrations.

3ME3103 STRESS ANALYSIS **L T P C**
3 0 0 3

Components of stress and strain; Generalised Hooke s law, General 3-D problems, Classical theorems, Plane stress and plane strain, Airy's stress function,. Complex variable approach, Different methods of solution of 2-d problems for finite and infinite plates with simply and multiply connected regions, Experimental methods of stress analysis. Strain gages.

3ME3104 APPLIED COMPUTATIONAL METHOD **L T P C**
3 0 0 3

Mathematical Modeling and Engineering Problem Solving, Roots of Equations, Linear Algebraic Equations, Curve Fitting, Numerical Differentiation and Integration, Ordinary Differential Equations, Partial Differential Equations.

Elective I

3ME3116 RAPID PROTOTYPING **L T P C**
3 0 0 3

Introduction, Rapid Prototyping Processes, CAD Requirements in RP, Materials for Rapid Prototyping, Rapid Tooling Techniques, Reverse Engineering, Rapid Manufacture.

3ME3126 ROTOR DYNAMICS **L T P C**
3 0 0 3

Torsional vibration analysis of rotating machines, Response to excitation, Critical speed of shafts, response of rotors, Gyroscopic of a spinning disk, synchronous and non synchronous whirl, Analysis of rotors mounted on hydrodynamics bearings, Analysis of shaft with dissimilar moments of area, Instability due to fluid film forces and hysteresis Balancing of rigid rotors and flexible rotors.

3ME3136 MECHANICS OF COMPOSITE MATERIAL **L T P C**
3 0 0 3

Introduction, Behavior of Unidirectional Composites, Analysis of Orthotropic Lamina, Analysis of Laminated Composites, Hygrothermal Effects.

3ME4116 PRODUCT LIFE CYCLE MANAGEMENT **L T P C**
3 0 0 3

Introduction to Product Design, Product Design Practice and Industry, Economic Factors Influencing Design, Human Engineering Considerations in Product Design, Value Engineering and Product Design, Life-Cycle Management, Concurrent Engineering.

3SP1101 COMMUNICATION SKILLS FOR ENGINEERS **L T P C**
2 2 0 0

Meaning and importance of communication skills, process, types of communication, barriers to effective communication, non-verbal communication, Difference between verbal and non-verbal communication. Psychological and cultural influence on communication, Characteristics of technical writing, Summarizing technical writing, Writing research papers

Semester II

3ME3201 FINITE ELEMENT AND BOUNDARY ELEMENT METHODS **L T P C**
3 0 2 4

Finite Element Formulation, One Dimensional Finite Element Analysis, Two Dimensional Finite Element Analysis, Dynamic Analysis, Fluid Flow and Heat Transfer Problems, Boundary Element Methods.

3ME3202 FRACTURE MECHANICS **L T P C**
3 0 0 3

Introduction, Griffith's Theory, Mathematical Formulation of Energy Release Rate, Stress Intensity Factors, Elastic Plastic Fracture Mechanics, J-Integral, Crack Tip Opening Displacement, Fatigue Crack Growth, Life Estimates for Constant amplitude loading and variable amplitude loading, Plasticity Aspects and limitations of LEFM for Fatigue crack growth.

3ME3203 DESIGN OF MECHANISMS AND MANIPULATORS **L T P C**
3 0 2 4

Basic Concept, Matrix Method in Kinematics, Kinematic Analysis of Spatial Mechanism, Mobility Analysis, Rigid Body Guidance, Function Generation, Dynamics of Mechanism.

3ME3204 MECHANICAL DESIGN – II **L T P C**
3 0 0 3

Design and analysis of crane structure, Design of main girder of overhead traveling crane, Testing of crane structure as per BIS, Design of Machine Tool, Pressure Vessel Design.

3ME3205 OPTIMIZATION METHODS IN ENGINEERING DESIGN **L T P C**
3 0 0 3

Introduction, Classical Optimization Techniques, Linear Programming, Nonlinear Programming, Stochastic Programming, Unconventional Optimization, Software related to optimization.

Elective II

3ME3216 PRESSURE VESSELS AND PIPING DESIGN	**L T P C** **3 0 0 3**

Factors influencing the design of vessels, design criterion of elliptical, hemispherical, conical, toriconical and torispherical heads, Stresses in pressure vessels, Autofrettage, Thermal stresses, Design of pressure vessel components such as shell, heads, Nozzles, Flanges as per ASME & IS codes, Design of externally pressurized vessels, Fatigue of various components of pressure vessels, Piping Elements, Dynamic analysis of piping.

3ME3226 NON LINEAR VIBRATION AND CHAOS	**L T P C** **3 0 0 3**

Introduction, Variable mass system, Perturbation method, Iterative method, jump phenomena, Ritz Galarkin method, Sub harmonic – super harmonic oscillation, Methiew and Hill equation, stability analysis, singular points, limit curve attractors, Poincare section, bifurcation, strange attractors, chaotic behaviors of the Duffing's equation with and without the forcing terms.

3ME4245 MICRO ELECTRO MECHANICAL SYSTEMS	**L T P C** **3 0 0 3**

Introduction, Micro-fabrication and Micromachining, Physical Micro Sensors and Micro Actuators, Surface Micromachining, MEMS, MEMS-Characterization

Semester III

3ME3301 MAJOR PROJECT PART I – FULL TIME	**L T P C** **0 0 0 15**

The Major Part I is aimed at training the students to analyze independently any problem in the field of Design Engineering. The project may be analytical or computational or experimental or combination of them based on the latest developments in the said area.

Semester IV

3ME3401 MAJOR PROJECT PART II – FULL TIME	**L T P C** **0 0 0 15**

Major Project Part II is a continuation of the work done by the student during semester III. The student is required to submit thesis as a partial fulfillment of the M. Tech degree.