‘M’ denotes the module and ‘L’ the lecture under that module.

**M1 Basics of Statics**

L1 Fundamental principles & concepts: Vector algebra, Newton’s laws, gravitation, force (external and internal, transmissibility), couple, moment (about point and about axis), Varignon’s theorem, resultant of concurrent and non-concurrent coplanar forces, static equilibrium, free body diagram, reactions.

L2 Problem formulation concept; 2-D statics, two and three force members, alternate equilibrium equations, constraints and static determinacy; 3-D statics.

**M2 Analysis of Structures – I (Trusses, Frames, Machines)**

L3 Trusses: Assumptions, rigid and non-rigid trusses; Simple truss (plane and space), analysis by method of joints.

L4 Trusses (contd): Analysis of simple truss by method of sections; Compound truss (statically determinate, rigid, and completely constrained).

L5 Analysis of frames and machines.

**M3 Analysis of Structures – II (Beams, Cables)**

L6 Internal forces; Beams: types of loading and supports; shear force, bending moment, and axial force diagrams.

L7 Beams (contd): shear force and bending moment diagrams and equations relating them with external load.

L8 Cables (coplanar): assumptions, parabolic and catenary cables.

**M4 Friction - I**

L9 Coulomb dry friction laws, simple surface contact problems, friction angles, types of problems, wedges.

L10 Disk friction (thrust bearing); Belt friction (flat, V).

L11 Square-threaded screw (self locking, screw jack).

**M5 Friction - II**

L12 Journal bearings (axle friction).

L13 Wheel friction and rolling resistance.

**M6 Center of Mass & Area Moments of Inertia**

L14 First moment of mass and center of mass, centroids of lines, areas, volumes, composite bodies.

L15 Area moments- and products- of inertia, radius of gyration, transfer of axes, composite areas.

L16 Rotation of axes, principal area-moments-of-inertia, Mohr’s circle.

**M7 Mass Moment of Inertia**

L17 Second moment of mass, Mass moments- and products- of inertia, radius of gyration, transfer of axes, flat plates (relation between area- and mass- moments- and products- of inertia), composite bodies.

L18 Rotation of axes, principal mass-moments-of-inertia.

**M8 Virtual Work and Energy Method - I**

L19 Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.

L20 Active force diagram, systems with friction, mechanical efficiency.

**M9 Virtual Work and Energy Method - II**

L21 Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium.

L22 Applications of energy method for equilibrium.

L23 Stability of equilibrium.

**M10 Review of particle dynamics**
M10 Review of particle dynamics
L24 Rectilinear motion; Planè curvilinear motion (rectangular, path, and polar coordinates).
L25 3-D curvilinear motion; Relative and constrained motion; Newton’s 2nd law (rectangular, path, and polar coordinates).
L26 Work-kinetic energy, power, potential energy.
L27 Impulse-momentum (linear, angular); Impact (Direct and oblique).

M11 Plane kinematics of rigid bodies - I
L28 Rotation; Parametric motion.
L29 Relative velocity, instantaneous center of rotation.
L30 Relative acceleration, rotating reference frames.

M12 Plane kinematics of rigid bodies - II
L31 Rotating reference frames, 3-part velocity and 5-part acceleration relations, Coriolis acceleration.
L32 Applications of rotating reference frames.

M13 Plane kinetics of rigid bodies - I
L33 Kinetics of system of particles and derivation of moment equation.
L34 Translation.
L35 Fixed axis rotation; General planar motion.
L36 General planar motion.

M14 Plane kinetics of rigid bodies – II
L37 Work – kinetic energy, potential energy.
L38 Potential energy (contd.), power; Impulse-momentum.
L39 Impulse-momentum (contd.), impact; Combination problems.

M15 Introduction to vibration
L40 Free vibration (damped, undamped)
L41 Forced vibration (damped, undamped)
L42 Mechanical displacement meter and accelerometer; Vibration of rigid bodies
L43 Vibration of rigid bodies (contd.)
L44 Energy methods for undamped problems.

Books to be followed: