Name of the Department/Centre: Physics

Course Type (Please tick appropriate box):

Major		Discipline Specific Core	X	Ability Enhancement	
Minor		Multidisciplinary		Skill Enhancement	
Value Added		Any other			

Course Title: MECHANICS I

Semester: I

Total Credits: 3 **Lecture-Tutorial-Practical (LTP) breakup:** NOT APPLICABLE

Maximum Marks: 100 **No of seats:** ……

Course Advisor Name: Dr. Arun Singh

Course Advisor's Email: asingh@jmi.ac.in

Prerequisites: Class XII Physics

Special Requirements (if any): No

Expected Learning Outcomes: The objective of this course is to impart the fundamental knowledge on mechanics. The course first teaches the fundamentals of linear and rotational motions to understand any dynamical systems. The laws of motion, the laws of conservations and other fundamental ideas will be given. The students will also learn about different kind of oscillations.

Course Syllabus (Unit wise):

Unit I: Fundamentals of Dynamics

Reference frames. Inertial frames; Galilean transformations; Galilean invariance. Newton's Laws of motion, dynamics of a system of particles, centre of mass, conservation of momentum, impulse, variable mass system. Work-energy theorem, potential energy, conservative and non-conservative forces, force as gradient of potential energy. Stable and unstable equilibrium, Work done by non-conservative forces. Law of conservation of Energy.

Unit II: Rotational Dynamics

Angular momentum of a system of particles, torque and conservation of angular momentum, rotation about a fixed axis, moment of inertia tensor: its calculation for regular bodies, kinetic energy of rotation; Elastic and inelastic collisions between particles, centre of mass and laboratory frame. Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

Unit III: Simple Harmonic Oscillations

Simple Harmonic Motion, Simple pendulum, Compound pendulum, Linearity and Superposition Principle, Superpositions of two and N collinear oscillations, Superposition of two perpendicular oscillations, Graphical and Analytical method, Lissajous Figures.

Unit IV: Damped, Forced and Coupled Oscillations

Free Damped oscillation. Forced oscillations: Transient and steady states; Resonance, Power Dissipation and Quality Factor, Coupled oscillations, normal modes.

References Books:

1. An introduction to mechanics : Kleppner & Kolenkow.
2. Feynman Lectures-Volume I,
3. Newtonian Mechanics : A.P.French,
4. Mechanics : Berkeley Physics Course
5. Vibrations and Waves : A. P. French.
6. The Physics of Waves and Oscillations : N.K. Bajaj