UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN PHYSICS

SYLLABUS WITH EFFECT FROM 2023-2024

237C3A

COURSE	**THIRD SEMESTER – CORE COURSE – III**
COURSETITLE	**GENERAL MECHANICS AND CLASSICAL MECHANICS**
CREDITS	**5**
COURSE OBJECTIVES	This course allows the students: To have a basic understanding of the laws and principles of mechanics; To apply the concepts of forces existing in the system; To understand the forces of physics in everyday life; To visualize conservation laws; To apply Lagrangian equation to solve complex problems.

UNITS	COURSEDETAILS
UNIT-I	**LAWS OF MOTION:** Newton's Laws– Forces – Equations of Motion – Frictional Force – Motion of a particle in a Uniform Gravitational Field – Types of Everyday Forces in Physics. **Gravitation:**Classical Theory of Gravitation–Kepler's Laws, Newton's Law of Gravitation – Determination of G by Boy's Method – Earth-Moon System – Weightlessness – Earth Satellites – Parking Orbit – Earth Density – Mass of The Sun – Gravitational Potential – Velocity of Escape – Satellite Potential and Kinetic Energy –Einstein's Theory of Gravitation – Introduction –Principle of Equivalence – Experimental Tests of General Theory of Relativity – Gravitational Red Shift – Bending of Light – Perihelion of Mercury.
UNIT-II	**CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM:** Conservation of Linear and Angular Momentum – Internal Forces and momentum Conservation – Center of Mass – Examples – General Elastic Collision of Particles of Different Masses – System with Variable Mass – Examples – Conservation of Angular Momentum – Torque due to Internal Forces – Torque due to Gravity – Angular Momentum about Center of Mass – Proton Scatteringby Heavy Nucleus.
UNIT-III	**CONSERVATION LAWS OF ENERGY:** Introduction – Significance of Conservation Laws – Law of Conservation of Energy concepts of Work- Power – Energy – Conservative Forces – Potential Energy and Conservation of Energy in gravitational and Electric Field – Examples –Non-Conservative Forces – General Law of Conservation of Energy.

UNIT-IV	**RIGID BODY DYNAMICS:** Translational and Rotational Motion – Angular Momentum – Moment of Inertia – General Theorems of Moment of Inertia – Examples – Rotation About Fixed Axis – Kinetic Energy of Rotation – Examples – Body Rolling along aPlane Surface – Body Rolling Down an Inclined Plane – Gyroscopic Precision – Gyrostatic Applications.
UNIT-V	**LAGRANGIAN MECHANICS:** Generalized Coordinates –Degrees of Freedom – Constraints - Principle of Virtual Work and D' Alembert's Principle –Lagrange's Equation from D' Alembert's Principle – Application –Simple Pendulum – Atwood's Machine.
TEXT BOOKS	1.J.C.Upadhyaya, 2019, Classical Mechanics, Himalaya Publishing house, Mumbai. 2. P.DuraiPandian, LaxmiDuraiPandian, MuthamizhJayapragasam,2005, Mechanics, 6threvised edition, S.Chand& Co. 3.D. S. Mathur & P. S. Hemne,2000, Mechanics, Revised Edition, S.Chand& Co. 4. Narayanamurthi, M.&Nagarathnam. N, 1998, Dynamics. The National Publishing,Chennai. 5. Narayanamurthi, M. and Nagarathnam, N, 1982, Statics, Hydrostatics and Hydrodynamics, The National Publishers, Chennai.
REFERENCE BOOKS	1. Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesely. 2. Halliday, David & Robert, Resnick, 1995, Physics Vol.I. New Age, International, Chennai. 3. Halliday, David Robert Resnick and Walker Jearl, 2001, Fundamentals of Physics, John Wiley, New Delhi
WEBLINKS	1. https://youtu.be/X4_K-XLUIB4 2. https://nptel.ac.in/courses/115103115 3. https://www.youtube.com/watch?v=p075LPq3Eas 4. https://www.youtube.com/watch?v=mH_pS6fruyg 5. https://onlinecourses.nptel.ac.in/noc22_me96/preview 6. https://www.youtube.com/watch?v=tdkFc88Fw-M 7. https://onlinecourses.nptel.ac.in/noc21_me70/preview

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COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Understand the Newton's Law of motion, understand general theory of relativity, Kepler's laws and Realize the basic principles behind planetary motion
	CO2	Acquire the knowledge on the conservation laws
	CO3	Apply conservation law and calculate energy of various systems, understand and differentiate conservative and non-conservative forces
	CO4	Gain knowledge on rigid body dynamics and solve problems based on this concept
	CO5	Appreciate Lagrangian system of mechanics, apply D' Alemberts principle

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes**(CO)**for each course with program outcomes**(PO)** inthe3- point scale of STRONG(**S**), MEDIUM(**M**) andLOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	S	S	M	S	S
CO2	S	S	S	M	S	M	S	S	S	M
CO3	S	S	S	S	S	S	M	S	M	S
CO4	M	S	S	S	M	S	S	M	S	S
CO5	S	S	M	S	S	M	S	S	S	M