UNIVERSITY OF MADRAS

M.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MECHANICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">528C3B</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td>--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">UG level Calculus and Differential equations.</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To study mechanical systems under generalized coordinate systems, virtual work, energy and momentum, to study mechanics developed by Newton, Langrange, Hamilton Jacobi and Theory of Relativity due to Einstein.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I : Mechanical Systems : The Mechanical system- Generalised coordinates – Constraints - Virtual work - Energy and Momentum
Chapter 1 : Sections 1.1 to 1.5</td></tr>
<tr><td colspan="6">UNIT-II : Lagrange's Equations: Derivation of Lagrange's equations- Examples- Integrals of motion.
Chapter 2 : Sections 2.1 to 2.3 (Omit Section 2.4)</td></tr>
<tr><td colspan="6">UNIT-III : Hamilton's Equations : Hamilton's Principle - Hamilton's Equation - Other variational principle.
Chapter 4 : Sections 4.1 to 4.3 (Omit section 4.4)</td></tr>
<tr><td colspan="6">UNIT – IV : Hamilton-Jacobi Theory : Hamilton Principle function – Hamilton-Jacobi Equation - Separability
Chapter 5 : Sections 5.1 to 5.3</td></tr>
<tr><td colspan="6">UNIT-V : Canonical Transformation : Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets.
Chapter 6 : Sections 6.1, 6.2 and 6.3 (omit sections 6.4, 6.5 and 6.6)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
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Recommended Text	D. Greenwood, *Classical Dynamics*, Prentice Hall of India, New Delhi, 1985.
Reference Books	1. H. Goldstein, *Classical Mechanics,* (2nd Edition) Narosa Publishing House, New Delhi. 2. N.C.Rane and P.S.C.Joag, *Classical Mechanics*, Tata McGraw Hill, 1991. 3. J.L.Synge and B.A.Griffth, *Principles of Mechanics* (3rd Edition) McGraw Hill Book Co., New York, 1970.
Website and e-Learning Source	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, www.physicsforum.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Demonstrate the knowledge of core principles in mechanics.

CLO2: Interpret and consider complex problems of classical dynamics in a systematic way.

CLO3: Apply the variation principle for real physical situations.

CLO4: Explore different applications of these concepts in the mechanical and electromagnetic fields.

CLO5: Describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1