

**Subject Code: 02MA0502**
**Subject Name: CLASSICAL MECHANICS**
**M.Sc. (Mathematics) Year – II(Sem: 3)**

**Objective:** Classical mechanics is one of the core theoretical subject in the physics major and to develop mathematical skills applied to Physics.

**Credits Earned:** 5 Credits

**Course Outcomes:** After completion of this course, student will be able to

- Have a deep understanding of Newton's laws.
- Solve the Newton equations for simple configurations using various methods.
- Understand the foundations of chaotic motion.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	2	-	5	60	30	10	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	Lagrangian formulation, D'Alembert's principle, Principle of virtual work, Classification of constraints, Lagrange's equation for holonomic systems and Applications.	<b>14</b>
2	Euler-Lagrange equation, Hamilton's variational principle, Derivation of Lagrange's equation from Hamilton's variational principle- generalized momentum-mechanics in configuration space, General conservation theorem and applications.	<b>15</b>
3	Hamilton's canonical equation of motion, Relation with Lagrange's equation, Conservation theorems, Variational principle approach to Hamilton's equation of motion.	<b>16</b>
4	Canonical transformations, Generating functions, Symplectic conditions, Infinitesimal canonical transformations and its applications. Poissonbracket formulation, General equation of motion and its formal solution, Constants of motion, Symmetry group.	<b>15</b>
		<b>60</b>

**Recommended Books:**

1. V.I. Arnold, Mathematical methods of classical mechanics, Springer science & Business media, 1997
2. H. Goldstein, C.Poole, J.Safco, Classical Mechanics (3<sup>rd</sup> Edi.), Addison Wesley.
3. L.N. Hand, J.D. Finch. Analytical mechanics, Cambridge University Press, 1998
4. L. Landau, E. Lifshitz. Mechanics (3<sup>rd</sup> Edi.), Butterworth-Heinemann publication, 1969
5. Gupta and Kumar Sharma, Classical mechanics, Pragati Publication, Meerut, 2003

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Supplementary Resources**

- <http://ocw.mit.edu/courses/physics/8-01-physics-i-classical-mechanics-fall-1999/>
- <https://www.physicsforums.com/threads/best-online-resource-for-classical-mechanics.549044/>
- <http://www.nptel.ac.in/course.php?disciplineId=111>



## **Syllabus for Master of Science**

### **Mathematics**

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