

Roll No. 233112320049

Exam Code : D-23

Subject Code—60389

B. Sc. EXAMINATION

(First Semester)

(Batch 2019 Onwards) (Main/Re-appear)

PHYSICS

CPL-102

Mechanics-I

Time : 3 Hours

Maximum Marks : 80

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory.

1. (a) On what factors does the moment of inertia of a body depend ?
- (b) What is Gauss's Divergence theorem ?
- (c) What is meant by elastic collision ?
- (d) State Kepler's third law of planetary motion.
- (e) What is Coriolis force ?

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- (f) What is meant by "Flux of a vector field" ?
- (g) Explain the meaning of Bending moments.
- (h) Define angular momentum. Give its SI units. 2 each

Unit I

2. Explain the following : 16
- (i) Scalar and vector fields
 - (ii) Gradient of scalar field
 - (iii) Divergence
 - (iv) Curl of vector field.
3. (a) What is Laplacian operator ? Explain. 4
- (b) Explain the line, surface and volume integrals of vector fields in detail. 12

Unit II

4. (a) Explain the concepts of Cartesian, Polar and Spherical coordinate systems. 12

- (b) Derive the expression of acceleration in polar coordinate system. 4
5. (a) Explain the principle of conservation of momentum. 4
- (b) Explain the concept of center of mass (COM) using an example. Find an expression for COM coordinates. 6
- (c) Three particles of masses $m_1 = 1.2$ kg, $m_2 = 2.5$ kg and $m_3 = 3.4$ kg are placed on the vertices of an equilateral triangle of edge length $a = 140$ cm. Where is the center of mass of this system ? 6

Unit III

6. Find the moment of inertia of a rectangular lamina about : 16
- (i) an axis through its centre and parallel to one side,
 - (ii) an axis passing through its centre and perpendicular to its plane,
 - (iii) an axis passing through the mid-point of one side and perpendicular to its plane, and

- (iv) an axis passing through one of its corners and perpendicular to its plane.

7. Derive the formula for the moment of inertia of (i) a uniform solid sphere and, (ii) spherical shell about its diameter as well as about its tangent. 16

Unit IV

8. (a) What is central force ? Explain the basic properties of central forces. 4
(b) Explain how a two body problem can be equivalent to one body problem by using the concept of reduced mass. 8
(c) Prove that areal velocity is constant in case of motion under a central force field. 4
9. (a) State and explain Hooke's Law. Also explain Stress-Strain diagram. 8
(b) What is meant by Poisson's ratio ? Explain. 4
(c) Establish a relation between four elastic constants. 4