FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2023
(Regular/Improvement/Supplementary)

PHYSICS
GPHY1B01T: MECHANICS - I

Time: 2 Hours   **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 Marks)

1. What is a non-inertial frame of reference? Give one example.

2. What is a force diagram? Explain with an example.

3. Write down an expression for gravitational force of a sphere on its surface and inside the sphere.

4. What is a simple harmonic oscillator? Explain with an example.

5. State and explain the law of conservation of linear momentum.

6. What is potential energy? Write down the relation between conservative force and potential energy.

7. Using work energy theorem find the final velocity of a body of mass 'm' dropped from h height h from earth's surface.

8. Draw energy diagram for the interaction between two atoms.

9. Define power. What is its unit?

10. Obtain the angular momentum about the origin of a block of mass m and negligible size moving parallel to x axis at $y = h$ inpositive x direction with velocity *v*.

11. Explain briefly the work-energy theorem associated with a rigid body executing rotation and translation.

12. State and explain the general law of conservation of angular momentum.

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 Marks)

13. Briefly discuss the everyday forces of physics. Compare its magnitude.

14. If the centre of mass of three particles of mass 1 kg, 2 kg and 3 kg to be the point (2,2,4). Then where should be the fourth particle of mass 4 kg placed so that the combined new centre of mass be at (0, 0, 0).

15. Discuss the working principle of a bola.

16. Calculate the work done by a uniform force.

(PTO)

17. Explain the oscillatory behaviour of a particle in a field, when its energy is less than the binding energy.

18. Calculate the total angular momentum of a system consisting of two particles whose mass, position vector, and velocity is as given in the following table.

Mass (kg)	Position vector (m)	Velocity (m/s)
2.0	$4\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$	$2\hat{\imath} + 4\hat{\jmath} - 2\hat{k}$
3.0	$5\hat{\imath} + \hat{\jmath} - 6\hat{k}$	$3\hat{\imath} - 10\hat{\jmath} - 5\hat{k}$

19. A bob of mass of 500 g is tied to a string of length 60 cm and the other end is fixed. The pendulum rotates in such a manner that the bob traces a circular path of radius 20 cm, twice in one sec. Find the angular momentum about the center of the circle and about the fixed point.

SECTION C: Answer any *one* question. Each carries *ten* marks.

20. Explain how Newton's second law is applied to a connected body system. Take freight train as example.

21. Derive the general expression for moment of inertia of a rigid body and hence obtain the expression for moment of inertia of (i) a ring and (ii) a disk of mass M and radius R about an axis passing through its centre and perpendicular to the plane of the disk.

(1 x 10 = 10 Marks)