I Semester B.Sc. Degree CBCSS(OBE)-Regular Examination, November - 2019

(2019 Admission)

CORE COURSE IN PHYSICS

1B01PHY : MECHANICS - I

Time : 3 Hours

Max. Marks : 40

PART - A

All questions are compulsory. Each question carries 1 mark. **(6×1=6)**

1. Define centre of mass of a body.
2. State the law of conservation of linear momentum.
3. What is escape velocity on earth?
4. What is the potential energy due to an inverse square law force?
5. Define torque.
6. Define moment of inertia of a rigid body.

PART - B

Answer any **six**. Each question carries **2** marks. **(6×2=12)**

7. When does a man standing on an accelerated elevator feel weightlessness? Explain.
8. What is called a contact force? Explain with two examples.
9. Obtain the expression for change in acceleration due to gravity with height.
10. State work - energy theorem for a conservative system. How does dissipative force modify the description?
11. Show that the work done by a central force is path independent.
12. Define power of a mechanical system. Calculate the expression for power of an object falling from a height, assuming acceleration due to gravity a constant.
13. Explain elastic collision and inelastic collision.
14. Obtain the expression for time period of a physical pendulum.

PART - C

Answer any **four**. Each question carries **3 marks**. (4×3=12)

15. For a spring gun system the spring constant is k, the maximum displacement is L, mass of the spring is m and the mass of the marble is M. Calculate the maximum possible speed of the marble.

16. A mass of 30 Kg has velocity $3i + 4j$ m/sec. During flight it splits into two masses 10 Kg and 20 Kg. If the velocity of the larger mass is $4i + 5j + 6k$ m/sec, find the velocity of the smaller mass.

17. A force $F = 4i + 6j$ Newton acts on a particle of mass 1 Kg initially at rest. What is the final position of the particle after 5 seconds, if the initial position of the particle is $r_o = 5i + 8k$. Also calculate the work done.

18. Analyze the molecular vibration of a diatomic molecule and calculate the fundamental frequency. Draw the potential energy curve.

19. A gun can fire bullets of masses 0.05 Kg at a velocity 10 m/sec. How many bullets need to be fired to stop a stone of mass 15 Kg coming towards the gun with a velocity 5 m/sec?

20. A uniform rod of length 1 m and mass 24 Kg is rotating about an axis perpendicular to its length and passing through its centre. The time period of rotation is 1 sec. Calculate the angular momentum of the rod. A uniform torque is applied for 10 seconds such that the rod stops rotating. Calculate the torque.

PART - D

Answer any **two**. Each question carries **5 marks**. (2×5=10)

21. State Newton's laws of motion. Apply Newton's laws of motion for a block of mass whirling at the end of a string
    a) on a horizontal plane (in the absence of gravity or friction) and
    b) in a vertical plane in the gravitational field of the earth.

22. Describe the stability of motion of a particle with a general one dimensional potential energy. Hence describe small oscillations and write down Newton's equation for small oscillations.

23. Briefly discuss the dynamics of a rigid body with translational and rotational motions. Hence explain the work-energy theorem for a rigid body.

24. State and explain law of conservation of angular momentum for a system of particles. Express the torque acting on a rigid body in a uniform gravitational field in terms of position of centre of mass and the weight of the body.