K20U 1546

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.) Examination, November 2020
(2014 Admn. Onwards)
CORE COURSE IN PHYSICS
5B08 PHY – Classical Mechanics and Relativity

Time : 3 Hours

Max. Marks : 40

SECTION – A

(Very short answer type – **Each** question carries **1** mark. Answer **all** questions).

1. A rigid body has _____ number of degrees of freedom.
2. Write down an example for inertial and non inertial frame of reference.
3. The expression for escape velocity is _____.
4. The presence of which elementary particle on earth's surface experimentally verified time dilation ? **(4×1=4)**

SECTION – B

(Short answer type – **Each** question carries **2** marks. Answer **7** questions out of 10).

5. Explain the terms "Proper length" and "proper time".
6. What is central force ? Give two examples for central force.
7. Explain D'Alembert principle.
8. What is meant by an equipotential surface ?
9. Derive Galilean transformation equations.
10. Write down Kepler's laws of planetary motion.
11. Explain pair production and pair annihilation.

12. Explain "relativity of simultaneity".

13. Write a short note on cyclic or ignorable coordinates. Explain its significance.

14. Two photons approach each other. What is the velocity of one proton with respect to the other ? **(7×2=14)**

SECTION – C

(Short essay/problem type – **Each** question carries **3** marks. Answer **any 4** questions out of 6).

15. Solve Simple pendulum using Lagrange equation of motion.

16. Four particles of masses 2 kg, 4 kg, 5 kg and 8 kg are placed in order at the corners of a square of side 0.2 m. Locate the center of mass.

17. What are constraints ? Write a note on the classification of constraints.

18. Derive an expression for the escape velocity for a body of mass m from the surface of a planet of mass M and radius R. Hence evaluate the escape velocity for earth. Given the radius of earth $R = 6.4 \times 10^6$ m.

19. Derive the relation $E^2 = p^2c^2 + m^2c^4$.

20. Prove that the force given by $\vec{F} = (2xy + yz^2)\hat{i} + (x^2 + xz^2)\hat{j} + (2xyz)\hat{k}$ is a conservative force.

(4×3=12)

SECTION – D

(Long essay type – **Each** question carries **5** marks. Answer **2** questions out of 4).

21. Solve the problem of a bead sliding on a uniformly rotating wire in a force free space using Lagrangian formulation.

22. Derive Kepler's Laws of planetary motion.

23. Establish the relationship between displacements, velocities and angles in the Lab and Centre of mass frame of reference.

24. Derive Lorentz transformation equations. Explain its significance.

(2×5=10)