K16U 1726

Reg. No.: ....

Name: ....

Fifth Semester B.Sc. Degree (CBCSS – 2014 Admn. – Regular) Examination, November 2016
CORE COURSE IN PHYSICS
5B08PHY : Classical Mechanics and Relativity

Time : 3 Hours Max. Marks : 40

***Instruction :** Answer the questions in **English** only.*

SECTION – A

(Very short answer type-**each** carries **1** mark – answer **all 4** questions.)

1. The dimensional formula for torque is same as that for ______
2. The rest mass of photon of frequency v is ______
3. The fundamental law of physics involved in Kepler's second law is ______
4. The Lagrangian equation for simple pendulum is given by ______

(4×1=4)

SECTION – B

(Short answer type-**each** carries **2** marks – answers **7** questions out of **10**)

5. Define a centre of mass frame of reference.
6. Explain why moving clock appears to go slow.
7. What was the aim of Michelson-Morley experiment ?
8. Is it possible for a body to have energy without momentum ? Explain.
9. Prove that angular momentum remains same for motion under central forces.
10. Explain the term gravitational self-energy.
11. How does mass vary with velocity ?
12. Why hydrogen escapes from earth's surface more readily than oxygen ?

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13. What are cyclic or ignorable coordinates ?

14. Show that in the absence of an external force, the velocity of centre of mass is a constant. **(7×2=14)**

SECTION – C

(Short essay/problem type-**each** carries **3** marks – answers **4** out of 6)

15. Write a short note on conservation of angular momentum and its importance in physics.

16. Using Lagrange's equation derive Newton's second law.

17. In the Michelson-Morley experiment what was the expected fringe shift if the effective length of each path is 6 m and light has 6000 Å wavelength. (speed of earth = 3×10^4 m/s, c = 3×10^8 m/s).

18. Show that the escape velocity of earth is $\sqrt{2}$ times the velocity of projection of an artificial Satellite orbiting close around the sun.

19. A particle of mass m_1 and velocity u_1 collides directly with another particle of mass m_2 at rest. Find the velocities after collision.

20. Derive relativistic law of addition of velocities and hence show that the law is in conformity with the principle of constancy of speed of light. **(3×4=12)**

SECTION – D

(Long essay type-**each** carries **5** marks – answers **2** out of 4)

21. On the basis of Lorentz transformation equations, discuss the following kinematics 1) Length Contraction 2) Time dilation.

22. Show that the conservation of angular momentum of a system in a consequences of the rotational Invariance of its potential energy. Derive the expression for the distance of closest approach of a proton projected into Coulomb field of a heavy nucleus.

23. Deduce Kepler's laws of planetary motion from Newton's law of gravitation.

24. Write down Lagrange's equation of motion. Using Lagrangian formulation, find the equation of motion for the following systems 1) Atwood's machine 2) Simple pendulum. **(2×5=10)**

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