K21U 1546

Reg. No. : ....

Name : ....

V Semester B.Sc. Degree (CBCSS – Sup./Imp.) Examination, November 2021 (2015 – '18 Admns.) CORE COURSE IN PHYSICS 5B08PHY : 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. The energy released during pair annihilation is approximately

2. Write down an example for non-holonomic constraint.

3. The velocities of two equal masses m_1 and m_2 are v_1 = 5m/s and v_2 = – 4m/s respectively. If they undergo a one dimensional elastic collision, what will be their velocities after the collision ?

4. The relation connecting torque and angular momentum is **(4×1=4)**

SECTION – B

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

5. What is length contraction ?

6. Explain any two properties of central force.

7. Solve one dimensional harmonic oscillator using Lagrange equation.

8. Explain mass – energy relation.

9. Differentiate lab and centre of mass frame of reference.

10. Explain Gravitational potential with mathematical expression.

11. Briefly explain the terms 'Degrees of freedom' and 'constraints'. How they are related ?

12. State and explain the postulates of special theory of relativity.

13. Locate the centre of mass of a thin uniform rod.

14. Explain spin and orbital angular momentum.

(7×2=14)

SECTION – C

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

15. Explain the principle of virtual work and hence obtain the "lever principle".

16. Write down 3 situations where the law of conservation of angular momentum holds well. Explain.

17. State and prove Kepler's second law.

18. A body of mass m is revolving around a planet of mass M in a circular orbit of radius 3R. Calculate the work done in shifting the body to a higher orbit of radius 5R.

19. The mean distance between the sun and the earth is 1.49×10^{11} m. The period of revolution of earth around sun is 365 days. Calculate the mass of the sun. Given $G = 6.67 \times 10^{-11}$ Nm^2/kg^2.

20. An electron ($m = 0.511$ MeV/c^2) and a photon ($m = 0$), both have momenta 2.000 MeV/c. Find the total energy of each.

(4×3=12)

SECTION – D

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

21. Starting from D'Alembert principle, obtain Lagrange equation of motion for an N particle system with 'k' constraints.

22. Derive velocity transformation equations from Lorentz transformation. How it is verified experimentally ?

23. State and prove Kepler's laws of planetary motion.

24. Explain Michelson Morley experiment. What is its significance ?

(2×5=10)

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