



K17U 1708

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.)

Examination, November 2017

(2014 Admn. Onwards)

CORE COURSE IN PHYSICS

5B08 PHY : 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 expression for relativistic energy of a photon is \_\_\_\_\_ .
2. A rigid body moving freely in space has degrees of freedom is \_\_\_\_\_ .
3. The total linear momentum in the centre of mass frame is \_\_\_\_\_ .
4. The dimensional formula for the universal gas constant is \_\_\_\_\_ . (4×1=4)

SECTION – B

Short answer type. **Each** carries 2 marks. Answer 7 questions out of 10.

5. Give two examples for conservation of angular momentum.
6. Explain how time dilation was verified experimentally ?
7. Explain the significance of the negative result of Michelson-Morley experiment.
8. A light and heavy body have equal kinetic energy of translation which one has greater momentum ?
9. State and explain superposition principle.
10. Explain why moon has no atmosphere ?
11. Show that when  $v \ll c$  relative kinetic energy becomes classical one.

P.T.O.





12. Why is the velocity of satellite the maximum when it is closest to the sun and the minimum when it is farthest from it in its orbit around the sun ?
13. What is the significance of virtual work ?
14. Distinguish between elastic and inelastic collisions with examples. (7×2=14)

## SECTION – C

Short essay/problem type. **Each** carries 3 marks. Answer 4 out of 6.

15. Show that the conservation of angular momentum applied to planetary motion leads to the law of conservation of areal velocity.
16. Setup Lagrange's equation of a simple pendulum and hence obtain the time period.
17. Derive the equation  $E = mc^2$ .
18. Calculate the escape velocity from the surface of moon ( $G = 6.67 \times 10^{-11}$  SI units, radius of moon =  $1.74 \times 10^6$  m,  $m = 7.36 \times 10^{22}$  kg).
19. What is the momentum of a photon of energy  $10^{-19}$  J ?
20. Find the speed of the particle at which the mass of the particle is double of its rest mass,  $c = 3 \times 10^8$  m/s ? (4×3=12)

## SECTION – D

Long essay type. **Each** carries 5 marks. Answer 2 out of 4.

21. Explain the basic postulates of Einstein's special theory of relativity and hence obtain the Lorentz space-time transformation equations.
22. What precisely is meant by the term collision ? Derive an expression for the final velocities of colliding particles inelastic one dimensional collision and discuss different cases.
23. From Kepler's law of planetary motion deduce Newton's law of gravitation.
24. What is D'Alembert's principle ? Derive Lagrange's equation from it for conservative system. (2×5=10)