(6 pages)

Reg. No. : .....

Code No.: 10028 E **Sub. Code: SMPH 11**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023.

First Semester

Physics – Core

MECHANICS AND RELATIVITY

(For those who joined in July 2017 – 2019)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer :

1. The gradient of a scalar point function is a

(a) Vector (b) Scalar

(c) 0 (d) None

2. The value of $\nabla.r =$ _____

(a) 0 (b) 1

(c) 3 (d) None

3. The rocket is based on the principle of low of conservation of _____

(a) Energy (b) Momentum

(c) Angular momentum (d) None

4. Change of momentum is called

(a) Pressure (b) Impulse

(c) Force (d) None

5. By perpendiculam axes theorem $I_z =$ _____

(a) $I_x I_y$ (b) $I_x + I_y$

(c) I_x / I_y (d) I_x

6. The moment of inertia of a solid sphere about its diameter is

(a) $2/5 MR^2$ (b) $2/10 MR^2$

(c) $1/5 MR^2$ (d) None

7. The unit for pressure is

(a) N/m (b) NM^{-2}

(c) NM^{-1} (d) Nm

8. In continuity equation $a_1 v_1 =$ _____

(a) a_2/v_2 (b) v_2/a_2

(c) $a_2 v_2$ (d) $v^2 a^2$

9. Lorentz transformation equation shows that, length of an object along its direction of motion _____

(a) Increases (b) Decreases

(c) Constant (d) None

10. The velocity of light in free space is _____

(a) Constant (b) Not constant

(c) Zero (d) None

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).
Answer should not exceed 250 words.

11. (a) Prove that $\nabla \times r = 0$ $\left(r = x\vec{i} + y\vec{j} + z\vec{k}\right)$.

Or

(b) Prove that $\overline{\nabla}.\overline{r} = 3$ $\left(\overline{r} = x\vec{i} + y\vec{j} + z\vec{k}\right)$.

12. (a) Discuss the two body problem and define reduced mass.

Or

(b) State and explain work energy theorem.

13. (a) Derive the expression for kinetic energy of a rolling body on a smooth horizontal plane.

Or

(b) State and prove the perpendicular axis theorem.

14. (a) Derive the expression for the centre of pressure on a rectangular lamina.

Or

(b) State and explain equation of continuity.

15. (a) Explain time dilation due to relativistic effect.

Or

(b) Obtain Einsteins Mass-Energy relation.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) State and prove Stoke's theorem.

Or

(b) State and prove Gauss divergence theorem.

17. (a) Explain the Kepler's III law of planetary motion.

Or

(b) Explain the working of a multistage rocket.

18. (a) Derive the expression for moment of inertia of a solid cylinder

(i) About its own axis

(ii) About an axis passing through its centre and perpendicular to its length.

Or

(b) Explain the working of a Gyrostat. Give its application.

19. (a) Describe and explain the working of venturi meter.

Or

(b) Explain the determination of metacentric height of a ship.

20. (a) Describe the Michelson-Morley experiment.

Or

(b) Derive the Lorentz transformation equations.

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