

PHE-DSE-2 - CLASSICAL DYNAMICS

F.M. 70

TIME-3 hours

Answer from all the sections as per instructions.

Section 1.

Compulsory multiple type questions

10x2=20

1. (a) The degree of freedom for a free particle in space are

- (i) One (ii) two (iii) three (iv) zero

Ans (iii) Three

(b) A frame of reference moving with constant velocity relative to a fixed frame is called

- (i) Inertial (ii) noninertial (iii) Real (iv) Imaginary

Ans: Inertial

(c) In a rotational motion centripetal acceleration is directed to — of the circle

- (i) Upward (ii) outward (iii) inward (iv) Centre

Ans: (iv) Centre

(d) A rigid body have — degree of freedom

- (i) One (ii) two (iii) three (iv) six

Ans: (iv) six

(e) The shortest distance between two points in a plane

- (i) circular (ii) hyperbolic (iii) parabolic
(iv) straight line

Ans: (iv) Straight line

(P.T.O)

①

7) The equation of constraint for a simple pendulum is

(i) $r\dot{\theta} - l = 0$ (ii) $r + l = 0$ (iii) $r\dot{\theta} + l = 0$

(iv) $r - l = 0$

Ans (iv) $r - l = 0$.

8) The Lagrangian function is defined by

(i) $L = F + V$ (ii) $L = T - V$ (iii) $L = T + V$ (iv) $L = F - V$

Ans (iii) $L = T + V$

9) The Hamiltonian function is given by

(i) $H = F + V$ (ii) $H = T - V$ (iii) $H = T + V$ (iv) $H = F - V$

Ans (iii) $H = T + V$

10) As an object approaches speed of light, its mass becomes

(i) Zero (ii) Double (iii) Remains same (iv) Infinity

Ans (iv) Infinity

11) For Einstein's relation $E^2 - p^2 c^2 =$

(i) $m_0 c^2$ (ii) $m_0^2 c^4$ (iii) $m_0 c^4$ (iv) $m_0^2 c^6$

Ans (ii) $m_0^2 c^4$.

PART B (Short answer type questions)

Answer any four in brief. $4 \times 5 = 20$.

2. Define constraint motion with examples.
3. Write the ~~Lagrangian~~ Lagrange's equation of motion for conservative system.
4. Define cyclic coordinates.

5. Write the expression of components of angular momentum
6. Derive the expression of angular momentum and kinetic energy.
7. Write the Hamilton's equation of motion and discuss.
8. Write the Lagrangian of a cylinder rolling on inclined plane.
9. Write the equation of a cycloid when a particle is moving in a constant conservative force field.

PART C

Long answer type questions
Answer any two questions

15 × 2 = 30

10. State the Hamilton's principle and derive the Lagrange's equation of motion.
11. Explain length contraction and time dilation.
12. Define Hamiltonian. When is it equal to the total energy of the system. When is it conserved?
13. Show that the shortest distance between two points in a plane is a straight line.

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