

SARDAR PATEL UNIVERSITY

B.Sc. EXAMINATION

(Semester- 5)

Monday, 11th November 2019

10:00 a.m. to 01:00 p.m.

Subject: PHYSICS

Course: US05CPHY01

Title: Classical Mechanics

Total Marks:70

N.B: (i) All the symbol have their usual meanings

(ii) Figures at the right side of questions indicate full marks

Q-1 Multiple Choice Questions (Attempt All)

(10)

- (1) The field intensity of a dipole varies as _____
 (a) r^2 (b) $1/r^3$
 (c) $1/r^2$ (d) $1/r$
- (2) The electrostatic force between two like charges are _____
 (a) zero (b) attractive
 (c) repulsive (d) infinity
- (3) The value of the permittivity of the vacuum ϵ_0 is _____
 (a) $8.1 \times 10^{12} \text{ coul/Nm}^2$ (b) $8.1 \times 10^{12} \text{ coul}^2/\text{Nm}^2$
 (c) $8.9 \times 10^{12} \text{ coul}^2/\text{Nm}^2$ (d) $8.9 \times 10^{-12} \text{ coul}^2/\text{Nm}^2$
- (4) The Lagrangian equations of motion are _____ order differential equations
 (a) first (b) second
 (c) forth (d) zero
- (5) _____ constraints are time dependent
 (a) Holonomic (b) Non-Holonomic
 (c) Rheonomous (d) Scleronomous
- (6) The Hamiltonian function is define by _____
 (a) $H = F + V$ (b) $H = T - V$
 (c) $H = F - V$ (d) $H = T + V$
- (7) The term $\vec{\omega} \times (\vec{\omega} \times \vec{r})$ is called _____
 (a) linear acceleration (b) angular acceleration
 (c) centripetal acceleration (d) coriolis acceleration
- (8) If $I_1 = I_2$ and $I_3 = 0$, then the body is called _____
 (a) asymmetrical top (b) rotator
 (c) symmetrical top (d) spherical top
- (9) The shortest distance between two points in a plane is _____
 (a) straight line (b) hyperbolic
 (c) circular (d) parabolic
- (10) The equation of constraints for a simple pendulum is _____
 (a) $r d\theta + l = 0$ (b) $r - l = 0$
 (c) $r d\theta - l = 0$ (d) $r + l = 0$

Q-2 Short Questions (Attempt any Ten)

(20)

- (1) State the inverse square law force
- (2) State the Kepler's second law of planetary motion
- (3) Define parabolic orbit
- (4) What is degree of freedom?
- (5) State the D'Alembert's principle in words

- (6) Construct the Lagrangian for Spherical pendulum
- (7) State the Chasles' theorem
- (8) Define symmetrical top and rigid rotator
- (9) What you mean by torque free motion
- (10) Define geodesic line
- (11) State the Hamilton's principle
- (12) State the variational principle

Q-3 Explain the laws of gravitational and electromagnetic forces and show that electromagnetic forces are much stronger than the gravitational forces in the interaction of atomic and subatomic particles **(10)**

OR

Q-3 Derive the equation of motion of equivalent one body and explain why apple falls toward the earth and not the earth towards the apple? **(10)**

Q-4 (a) What are constraints? Explain, giving examples **(3)**

(b) Derive the Lagrange's equation of motion for a conservative system from D'Alembert's principle **(7)**

OR

Q-4 (a) Discuss the concept of generalized coordinates with illustrations **(3)**

(b) What is cyclic coordinates? Show that total energy is conserved **(7)**

Q-5 (a) Explain the coordinates with relative translational motion **(5)**

(b) Write note on Coriolis force **(5)**

OR

Q-5 (a) Derive the expression of angular momentum for rigid body **(5)**

(b) State and prove Euler's theorem **(5)**

Q-6 (a) Derive the Euler's equation using variational principle **(5)**

(b) Discuss the shortest time problem for a motion of a particle in a constant conservative force field **(5)**

OR

Q-6 (a) Derive the Hamilton's principle from Newton's equation **(5)**

(b) Find the acceleration for a cylinder rolling on inclined plane using undetermined multiplier **(5)**

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 (2)