Vitthalbhai Patel & Rajratna P.T.P.SCIENCE COLLEGE

VALLABH VIDYANAGAR

B.Sc. (Semester - 5)

Subject: Physics

Course: US05CPHY01 (Classical Mechanics)

Internal Examination

Date: 29/09/2018 **Time: 10:00 a.m. to 12:00 Noon**

Saturday **Total Marks: 50**

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) **(08)**

(1) The potential due to point charge falls off as _____

(a) r (b) r^2

(c) 1/r (d) $1/r^2$

(2) For elliptical orbit the values of energy E and eccentricity ϵ are _____

(a) E=0 and ϵ>1 (b) E>0 and ϵ>1

(c) E>0 and ϵ=0 (d) E<0 and ϵ<1

(3) _____ constraints are independent of time

(a) Scleronomous (b) Rheonomous

(c) Holonomic (d) Non-Holonomic

(4) The Hamiltonian function is define by _____

(a) $H = F - V$ (b) $H = T + V$

(c) $H = F + V$ (d) $H = T - V$

(5) In a cyclone the wind whirls in the _____ sense in the southern hemisphere

(a) upwards (b) downwards

(c) clockwise (d) anticlockwise

(6) _____ must be applied to maintain the rotation of the system about given axis

(a) force (b) momentum

(c) velocity (d) torque

(7) The path of a particle is _____when it is moving under constant conservative force field

(a) cycloid (b) hyperbolic

(c) parabolic (d) straight line

(8) The angle of flies off for a particle moving on spherical surface is _____

(a) $\phi_c = cos^{-1}\left(\frac{3}{2}\right)$ (b) $\phi_c = cos^{-1}\left(\frac{2}{3}\right)$

(c) $\phi_c = sin^{-1}\left(\frac{3}{2}\right)$ (d) $\phi_c = sin^{-1}\left(\frac{3}{2}\right)$

Q-2 Short Questions (Attempt any Five) **(10)**

(1) Define electric dipole

(2) Define hyperbolic orbit

(3) What is degree of freedom?
(4) What is virtual displacement?
(5) Define spherical top and asymmetric top
(6) Define precessional velocity
(7) State the variational principle
(8) State the Hamilton's principle

Q-3 Derive the expressions for gravitational and electrostatic fields and potentials **(08)**

OR

Q-3 Discuss the motion of a particle in a central force field and prove the conservation laws of linear momentum and total energy **(08)**

Q-4 (a) What are constraints? Explain, giving examples, the meaning of holonomic and nonholonomic constraints **(05)**

(b) What do you understand by cyclic coordinates? Show that the generalized momentum corresponding to a cyclic coordinate is a constant of motion **(03)**

OR

Q-4 (a) Derive the Lagrange's equation of motion for a conservative system from D'Alembert's principle **(05)**

(b) Discuss the concept of generalized coordinates with illustrations **(03)**

Q-5 Explain the rotating coordinate system and derive the necessary expressions of velocity and acceleration of the particle **(08)**

OR

Q-5 (a) Derive the Euler's equations of the motion and find the relation between the rate at which work done by the torque and the rate of change of kinetic energy **(05)**

(b) State and prove Euler's theorem **(03)**

Q-6 (a) Discuss the technique of calculus of variation and derive the general Euler's equation **(05)**

(b) To show that the shortest distance between two points in a plane is a straight line **(03)**

OR

Q-6 (a) Derive the Hamilton's equation of motion **(05)**

(b) Construct the Lagrangian for series connection of inductance L, resistance R and capacitor C with an external electromotive force $\varepsilon(t)$ **(03)**