Sardar Patel University

T.Y.B.Sc (5th semester [CBCS]) Examination 2018

22/10/2018, Monday

10:00 a.m. to 1:00 p.m.

US05CPHY01

Classical Mechanics

Maximum Marks: 70

Note: Figures to right indicates the full marks.

Q-1   Multiple Choice Questions. (10)

1. Electric field of a dipole falls as a _____ of a distance.
    (a) Square   (b) Cube
    (c) Fourth   (d) Fifth Power

2. In a spherically symmetrical potential the angular momentum L=_____
    (a) Angular velocity   (b) constant
    (c) proportional to r   (d) proportional to r^2

3. Shape of an orbit of a planet around the sun is _____.
    (a) circular   (b) parabolic
    (c) elliptical   (d) triangular

4. Force of friction is _____ force.
    (a) linear   (b) always constant
    (c) conservative   (d) non-conservative

5. A space with N dimension is called _____.
    (a) configuration space   (b) universal space
    (c) common space   (d) real space

6. Orientation of a rotating body is specified by _____ angles.
    (a) Newton's   (b) Euler's
    (c) Maxwell   (d) Chasle's

7. _____ is the same in fixed and rotating coordination system.
    (a) linear acceleration   (b) momentum
    (c) Angular acceleration   (d) velocity

8. The variation principle is also called _____ principle.
    (a) linear   (b) differential
    (c) logarithmic   (d) integral

9. Lagrangian formulation is equivalent to _____.
    (a) Newton formulation   (b) Schrodinger formulation
    (c) Einstein formulation   (d) Heisenberg formulation

10. The shortest distance between two points in a plane is a _____.
    (a) circle   (b) straight line
    (c) hyperbola   (d) ellips

Q-2   Answer in short. (Any Ten) (20)

1. State Newton's law of gravitation and Coulomb's law of electrostatic forces.

2. What is central force? Show that the angular momentum is conserved in such force Field.

3. Write down quantum mechanical nature of motion.

4. Show the rate of dissipation of energy is twice the Rayleigh dissipation function.

5. Obtain expression for D'Alembert's principle containing generalized force.

6. What are the requirements of generalized coordinates?

7. What do you meant by Pseudo forces? Give an example.

8. What is inertia tensor? Express momentum and kinetic energy in terms of inertial tensor.

9. Explain briefly weight less condition of an observer in a satellite.

10. Briefly discuss configuration space.

11. What are the advantages of Hamilton's formulations?

12. Define holonomic and non-holonomic constraints.

Q-3 **A** Derive Gauss law in electrostatics and gravitational fields. (06)

B State and prove kepler's three law of planetary motion and prove the third law. (04)

OR

C Discuss the motion of particle in an inverse potential field. (06)

D For equivalent one body problem obtain $\mu\vec{\ddot{r}}=\vec{F}^{\,int}$. (04)

Q-4 **A** Obtain Langrangian's equation of motion from D'Alembert's principle. (06)

B Discuss the Atwood machine and derive equation of motion of the machine. (04)

OR

C Obtain expression of kinetic energy containing generalized velocity. (06)

D Explain spherical pendulum and obtain expression of its energy. (04)

Q-5 **A** Explain the effect of coriolis force on a freely falling body under the action of gravity. (06)

B State Eular's theorem for a rigid body and prove it. (04)

OR

C Explain motion on the earth. (06)

D Obtain the relation between angular momentum and kinetic energy. (04)

Q-6 **A** Apply Lagrangian formulation to a circuit having series and parallel combination of L, C, R and obtain expression of kinetic and potential energies. (10)

OR

B Discuss the techniques of calculus of variation and derive the Euler's equation. Also derive second form of it. (10)

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