

2894

(Pages : 2)

Name.....

51

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2014

(CUCSS)

Physics

PHY 1C 01—CLASSICAL MECHANICS

(2012 Admission onwards)

Three Hours

Maximum : 36 Weightage

Part A

Answer all questions.

Each question carries 1 weightage.

1. Is the Lagrangian formulation more advantageous than the Newtonian formulation ? Why ?
2. Explain what Kepler's first law implies when it is coupled with the second law ?
3. What is gauge transformation ? What arbitrariness does it introduce ?
4. Write down the Jacob's form of the least action principle.
5. Give the Lagrangian for the Kepler problem.
6. What is linear transformation ? Give example.
7. How is generalized potential defined ? How is it different from the conventional potential ?
8. What is meant by impact parameter ? What is its magnitude for a head on collision ?
9. When does the CM system coincide with the lab system in the case of two body collision ?
10. What is Chaos ? How does it arise ?
11. Define degree of freedom. Give example.
12. Write down the Lagrangian for a dumb bell.

(12 × 1 = 12 weightage)

Part B

Answer any two questions.

Each question carries 6 weightage.

1. What is differential scattering cross section ? Derive the Rutherford formula for scattering cross section in a Central force field scattering.
2. What is meant by action and angle variable ? Discuss the Harmonic oscillator problem using action and angle variable technique.

Turn over

3. Obtain the non-linear equation for a pendulum. Derive the exact solution of the equation in terms of elliptic integral.
4. Derive Euler's equation of motion for rigid bodies. Explain the force free motion of a symmetric top. (2 × 6 = 12 weightage)

Part C

Answer any **four** questions. Each question carries 3 weightage.

1. Show that the transformation $Q = \sqrt{2q} e^{\cos p}$ and $P = \sqrt{2q} e^{-\cos p} \sin p$ is a canonical transformation.
2. Find the horizontal component of the Coriolis force acting on a body of mass 1.5 kg moving northward with horizontal velocity of 100 m/sec at 30° N latitude on earth.
3. Show that for a single particle with constant mass the equation of motion implies the following differential equation for the kinetic energy. $\frac{dT}{dt} = F \cdot V$ while if the mass varies with time the corresponding equation is $\frac{d(mt)}{dt} = F \cdot P$.
4. For the following Poisson bracket prove that $[a.r, b.p] = a.b$ and $[J, (r.p)] = 0$.
5. A person in a jet plane is flying along the equator due East with a speed of 540 m/sec. What is the Coriolis acceleration?
6. $Q = aq + bp$ and $P = cq + dP$. Prove that the above transformation is canonical only if $ad - bc = 1$. (4 × 3 = 12 weightage)