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Reg. No.....

Name.....

**M.Sc. DEGREE (C.S.S.) EXAMINATION, MARCH 2015**

**First Semester**

Faculty of Science

Branch II-Physics-(A)-Pure Physics

PH 1C 02—CLASSICAL MECHANICS

(2012 Admissions)

Time : Three Hours

Maximum Weight : 30

**Part A**

*Answer any six questions.*

*Weight 1 each.*

1. Explain cyclic coordinates.
2. State the principle of least action and use it to obtain principle of least time.
3. What is variational principle ? Explain.
4. Explain stable and unstable equilibrium in the case of small oscillations.
5. What are canonical transformations ?
6. When is Hamilton- Jacobi theory more useful ? Explain.
7. What are first integrals ?
8. What are Coriolis Forces ?
9. Explain time dilatation.
10. What is logistic map ? Explain.

(6 × 1 = 6)

**Part B**

*Answer any four questions.*

*Weight 2 each.*

11. The homogeneity of space implies that the linear momentum is a constant of motion. Establish.
12. Express D' Alenberts principle in the integral form. What is its advantage over the one in the differential form ?
13. A simple pendulum has a bob of mass  $m$  with a mass  $m_1$  at the moving support. Mass  $m_1$  moves on a horizontal line in the vertical plane in which the pendulum oscillates. Find the Lagrangian and Lagranges equation of motion.

**Turn over**



14. Use action angle variables to obtain the energy levels of the hydrogen atom.
15. Obtain the equation for Poinso's ellipsoid of inertia.
16. How fast must an unstable particle move to travel 20 m before it decays? The mean life time of the particle at rest is  $2.6 \times 10^{-8}$  sec.

(4 × 2 = 8)

### Part C

*Answer all questions.*

*Weight 4 each.*

17. (a) Obtain Lagrange's equations of motion from Hamilton's principle.

*Or*

- (b) Using the calculus of variation derive the Lagrangian equations from Hamilton's principle and find the shortest distance between two points in a plane.

18. (a) Discuss the general theory of small oscillations.

*Or*

- (b) Outline Hamilton-Jacobi theory.

19. (a) State and prove Kepler's law of planetary motion.

*Or*

- (b) Describe the motion of a body in terms of direction of cosines and Euler angles.

20. (a) Discuss on (i) principle of general covariance; (ii) bending of light in gravitational field; (iii) Einstein field equations.

*Or*

- (b) Explain integration of linear second order equations by the method of quadrature with the help of an example.

(4 × 4 = 16)