M SC DEGREE END SEMESTER EXAMINATION 2014 -15
SEMESTER -1: SUBJECT-PHYSICS
COURSE : CODE : P1PHYT02 TITLE : CLASSICAL MECHANICS

Time: 3Hours   Max. Marks: 75

Part A (Objective Type)
(Answer **all** questions) Each question carries 1 Mark

1. For a charged particle in an electromagnetic field, the canonical momenta are

    (a) $mv+\dfrac{q}{c}A$ (b) $\dfrac{1}{2}mv^2+\dfrac{q}{c}A$ (c) $mv-\dfrac{q}{c}A$ (d) $\dfrac{1}{2}mv^2-\dfrac{q}{c}A$

2. A particle of mass m, moves under the action of a central force whose potential is V(r) = kmr^3 (k > 0), then the angular frequency is

    (a) $\sqrt{3ka}$(b) $\sqrt{ka}$)   (c) $\sqrt{5ka}$$(d)\sqrt{15ka}$

3. Normal frequency for free vibration of the parallel pendula is given by

    (a) [(g/l)-(2k/m)]$^{1/2}$ (b) [(g/l)+(2k/m)]$^{1/2}$ (c) [(g/l)-(m/2k)]$^{1/2}$ (d) [(g/l)+(m/2k)]$^{1/2}$

4. A sphere of mass M and radius r slips on a rough horizontal surface. At some instant, it has horizontal velocity v and rotational velocity v/2r. The translational velocity after the sphere starts pure rolling is   (a) v (b) 6v/7   (c) zero   (d) v/2

    (a) Energy (b) Linear momentum (c) Angular momentum (d) Both (b) & (c).

5. Stable limit cycle in phase space is an example of

    (a) Attractor   (b) strange attractor (c) neither attractor nor strange attractor (d) both attractor nor strange attractor

                                                                                                    (5 x 1 = 5)

Part B (Short answer)
(Answer **any 5** questions)Each question carries 2 marks

6. What is Hamilton's principle?
7. What is a cyclic coordinate?
8. What are Kepler's laws of planetary motion?

9. What is the significance of Hamilton's principal function?
10. Define Coriolis force.
11.   What are fractals?
12.   State and explain Virial theorem.
13.   What do you mean by energy momentum tensor?

     (5 x 2 = 10)

Part C (Problems/short essay)
(Answer **any 3** questions) Each question carries 4 marks

14.   The homogeneity of space implies that the linear momentum is a constant of motion. Justify the statement.
15.   How does the value of eccentricity and energy determine the shape of the orbit in a central force problem?
16.   Write a note on logistic map.
17.   Show that the transformation $Q = 1/p$ is a canonical transformation.
18. State and explain Euler's geometrical equations.

     (3 x 4 = 12)

Part D (Essay)
(Answer **all** questions) each question carries 12 Marks

19.   (a) Discuss calculus of variation and derive Euler-Lagrange's equations of motion
                         (OR)
   (a) Explain the canonical transformations. Find the transformations for the generating function F2 (q, P, t).
20.   (a) What is an inverse square law force? Derive keplers laws with its help
                         (OR)
   (b) Discuss the vibrations of a linear triatomic molecule
21.   (a) Discuss the force free motion of a symmetric top.
                         (OR)
    (a) What are action angle variables? Explain how they can be used to obtain the frequencies of periodic motion? Determine the frequency of a linear harmonic oscillator.
22.   (a) Explain the Principle of equivalence
   (b) Write a note on the energy momentum tensor.
                         (OR)
23.   (a) Explain Feigenbaum diagram.
    (b) Explain the concept of attractors in chaos.
                ******   (4 x 12 = 48)