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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEARS 2024-26 ONLY)

SUBJECT CODE 24 PPS 102

REG.NO.

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : NOVEMBER – 2024

M.Sc. – PHYSICS **MAXIMUM MARKS: 75**

I SEMESTER **TIME : 3 HOURS**

CLASSICAL MECHANICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. (K1)

1. The other name for cyclic coordinates is---------coordinates.

   (a) rotational (b) ignorable (c) normalized (d) orthogonal

2. The Hamiltonian H =-------.

   (a) T + V (b) T – V (c) T / V (d) T X V

3. The Hamilton's Principal function as the generating function which gives rise to a canonical transformation involving constant------and constant-----.

   (a) velocities, momenta (b) momenta, forces
   (c) momenta, coordinates (d) speeds, velocities

4. The expression for Rotational K.E. of a rigid body is---------.

   (a) $1/2\ I\omega^2$ (b) $I\omega$ (c) $3/4\ I\omega^2$ (d) $1/2I\omega$

5. The state of Stable equilibrium corresponds to----------P.E..

   (a) minimum (b) maximum (c) medium (d) zero

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. Define: Degrees of freedom.

7. What is known as Phase Space?

8. What are called Action and Angle variables?

9. State Euler's Theorem.

10. Give examples for the systems with few degrees of freedom.

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SECTION – B (5 X 5 = 25)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K3)

11. (a) Get the Generalized notation for generalized (i)Displacement and (ii) velocity.

(OR)

(b) Deduce Lagrange's equations of motion from Hamilton's Principle.

12. (a) Explain the physical significance of Hamiltonian H.

(OR)

(b) Obtain equations of motion in Poisson Bracket form.

13. (a) Derive Hamilton-Jacobi partial differential equation.

(OR)

(b) Obtain the equation of path of a particle which is falling freely?

14. (a) What are the Generalized coordinates for a rigid body and discuss them.

.(OR)

(b) Obtain the equations of motion about a fixed axis.

15. (a) Write a note on normal coordinates and normal frequencies.

(OR)

(b) Show that the "Eigen frequencies are all real and the motion for a given ω_l^2 will be completely oscillatory about the position of stable equilibrium".

SECTION – C (5 X 8 = 40)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4/K5)

16. (a) Derive the equations of motion for (i) Linear Harmonic Oscillator (ii) Simple Pendulum.

(OR)

(b) Obtain equations of motion for Isotropic Oscillator for (i)Cartesianand (ii) Spherical Polar coordinates.

17. (a) State and prove Principles of Least Action.

(OR)

(b) Deduce the Hamilton's equations of motion for
(i) Particle in a central field of force and
(ii) a charged particle in an EM field.

18. (a) Obtain the solution of Harmonic Oscillator problem by Hamilton- Jacobi method.

(OR)

(b) Get solution of Kepler's problem by Hamilton-Jacobi method.

19. (a) What are Euler's angles? Derive the Euler's equation in terms of Euler's angles.

(OR)

(b) Discuss the motion of Symmetric Top under the action of gravity.

20. (a) Describe the free vibrations of Linear Triatomic molecule.. Set up the Lagranges equation and deduce expression for normal frequency with normal co-ordinates.

(OR)

(b) Set up the Lagrangian equations of motion for two coupled oscillator and deduce the expressions for normal frequencies and normal co-ordinates.

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