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(FOR THE CANDIDATES ADMITTED

DURING THE ACADEMIC YEAR 2024 ONLY)

24PMS208

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : MAY-2025

M.Sc .-MATHEMATICS **MAXIMUM MARKS: 75**

SEMESTER: II **TIME : 3 HOURS**

MECHANICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. (K1)

1 _____ is the number of coordinates minus the number of independent equations of constraint

(a) Applied force (b) The number of degrees of freedom (c) equation of motion (d) Virtual work

2. If the Lagrangian of the system does not contain the given co-ordinate q_j. Then the co-ordinate is said to be _____co-ordinates.

(a) Ignorable (b) Galilean (c) one dimensional (d) Generalized

3. The use of the _____ leads to incorrect dynamical equations for the general case of non holonomic constraints .

(a) Poisson rule (b) Multipliers rule (c) Lagrange's rule (d) configuration rule

4. $\frac{\partial S}{\partial t} + H\left(q, \frac{\partial S}{\partial q}, t\right) = 0$ is known as ____ equation

(a) Hamilton-Jacobi (b) Hamilton's (c) orthogonal (d) Keplar's

5. _____ is useful in testing whether a given transformation is canonical

(a) Covariant (b) Poisson brackets (c) Kronecker delta (d) Lagrange brackets

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

6. Define virtual displacement.
7. What is called Liouville's system?
8. State Hamiltonian principle
9. What is called Homogeneous canonical transformation?
10. Write short note on Lagrange brackets**.**

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Explain the principle of virtual work.

(OR)

b) Explain a nonholonomic constraint occurs when there is rolling contact without slippin

12. a) Evaluate the differential equations of motion for a spherical pendulum of length l.

(OR)

b) Show that the generalized momentum corresponding to each ignorable coordinate is constant.

(CONTD……2)

13. a) Explain the method of Lagrange's undetermined multipliers.

(OR)

b) Prove that the shortest distance between two points in space is a straight line.

14. a) Explain simple mass-spring system.

(OR)

b) Explain conservative systems.

15. a) Analyze the fundamental Poisson brackets are invariant under canonical transformation.

(OR)

b) Consider a system having n degrees of freedom . Obtain a generating function for the resultant transformation equivalent to a sequence of translation and rotation transformations.

SECTION – C (5 X 8 = 40 MARKS)

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

(K4 (Or) K5)

16. a) Analyze that a particle of mass m is suspended by a mass less wire of length $r = a + b\cos\omega t \quad (a > b > 0)$ to form a spherical pendulum. Find the equations of motion.

(OR)

b) Derive Lagrange's theorem from D'Alembert's principle

17. a) Derive the complete set of Lagrange's equation for non-holonomic systems.

(OR)

b) Derive the first integral of motion of central force.

18. a) Derive Euler-Lagrange's equation.

(OR)

b) Explain Brachistochrone problem.

19. a) State and prove Jacobi 's theorem.

(OR)

b) Make use the Hamilton-Jacobi method to analyze the Kepler problem.

20 (a) Show that the transformation $Q = \frac{1}{2}(q^2 + p^2)$, $P = -\tan^{-1}\frac{q}{p}$ is canonical.

(OR)

(b) State and prove Poisson's theorem.

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