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(FOR THE CANDIDATES ADMITTED IN
DURING THE ACADEMIC YEAR 2018 ONLY)

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18 PPS 102

REG No.

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

END-OF-SEMESTER EXAMINATIONS : JUNE – 2021

M.Sc. - PHYSICS

MAXIMUM MARKS: 75

SEMESTER : I

TIME : 3 HOURS

CLASSICAL AND NONLINEAR DYNAMICS

SECTION – A

(10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS.

1. The $3N$ dimensional space in Hamilton's variational principle is called
a) Phase space b) configuration space c) both a) and b) d) None of these
2. The Poisson bracket $[p_i, p_j]$ is
a) δ_{ij} b) 0 c) $-\delta_{ij}$ d) none of these
3. The equation of motion of a free fall body is
a) $y = y_0 + \frac{1}{2}gt^2$ b) $y = \frac{1}{2}gt^2$ c) $y = y_0 - \frac{1}{2}gt^2$ d) $y = -\frac{1}{2}gt^2$
4. The condition for a sleeping top is
a) $\omega_z = \omega'_z < \omega_{\min}$ b) $\omega'_z = \omega_z < \omega_{\min}$ c) $\omega_{\min} = \omega_z < \omega'_z$ d) None of these
5. The potential energy of an LHO is
a) kx^2 b) $\frac{1}{2}kx^2$ c) $-\frac{1}{2}kx^2$ d) $\frac{1}{2}k/x^2$

SHORT ANSWERS.

6. Define angular momentum of a system of particles.
7. Define phase space.
8. What are action and angle variables?
9. What is meant by stable equilibrium?
10. What are linear systems?

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SECTION – B

(5 X 5 = 25 MARKS)

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

11. (a) Explain generalized velocity and generalized acceleration.

(OR)

(b) Deduce Newton's second law of motion from Hamilton's principle.

12. (a) Obtain the equations of motion in Poisson bracket form.

(OR)

(b) Deduce Hamilton's canonical equations from variational principle.

13. (a) Use Hamilton Jacobi method to determine the motion of a particle falling freely.

(OR)

(b) Obtain the HJ equation for Hamilton's characteristic function.

14. (a) Derive the expression for rotational kinetic energy of a rigid body.

(OR)

(b) Highlight the properties of T and V

15. (a) State and prove the linear superposition principle.

(OR)

(b) What are secondary resonances? Explain.

SECTION – C

(4 X 10 = 40 MARKS)

ANSWER ANY FOUR QUESTIONS.(Q. No 16 IS COMPULSARY AND ANSWER ANY THREE QUESTIONS FROM Q. No 17 – 21)

16. Obtain the solution for Kepler's problem by HJ method.

17. State Hamilton's variational principle and derive Lagrange's equations of motion.

18. State and prove the principle of least action.

19. Obtain the solution of harmonic oscillator problem by HJ method.

20. Explain the motion of a symmetric top under the action of gravity.

21. Discuss the mathematical implications of non linearity.
