**20P106** (Pages: 2) Name: …….

Reg. No……...

**FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2020**

(CBCSS-PG)

(Regular/Supplementary/Improvement)

**CC19P PHY1 C01 – CLASSICAL MECHANICS**

(Physics)

(2019 Admission onwards)

Time: Three Hours Maximum: 30 Weightage

## Section A

Answer ***all*** questions, each question has a weightage of 1.

1. Discuss the effect of constraints on a mechanical system.
2. State and explain Hamilton's principle.
3. Show that the matrix for infinitesimal rotation is antisymmetric.
4. Show that the momentum conjugate to a cyclic coordinate is a constant of motion.
5. What is the physical significance of Hamilton's principal function?
6. What are normal coordinates?
7. Show that Poisson bracket $[L_x, L_y] = L_z$.
8. What are limit cycles?

**(8 x 1 = 8 Weightage)**

## Section B

Answer any ***two*** questions, each question has a weightage of 5.

9. i) Define a) scattering cross section b) angle of scattering c) impact parameter.
   ii) Derive Rutherford formula for scattering cross section in a central force field scattering.
10. i) Derive Hamilton Jacobi equation. ii) solve the Kepler problem using Hamilton Jacobi method.
11. i) Explain Euler's equation of motion of a rigid body.
    ii) Using Euler's equation, prove that a symmetric top can have stable rotation only about a principal axis.
12. Discuss in detail the free vibrations of a linear triatomic molecule.

**(2 x 5 = 10 Weightage)**

## Section C

Answer any ***four*** questions, each question has a weightage of 3.

13. By using variational principle, prove that the minimum surface of revolution is a catenary.
14. Find under what conditions $Q = \alpha p/x$, $P = \beta x^2$ where $\alpha$ and $\beta$ are constants represents a canonical transformation. Also obtain a suitable generating function.
15. What are pseudo forces? Arrive at the expressions for centrifugal force and Coriolis force.
16. Find the moments and products of inertia of a homogeneous cube of side 'a' for an origin at one corner, with axes directed along the edges.
17. Prove that Lagrange Bracket of two dynamical variables is invariant under canonical transformation
18. Obtain the non linear equations of a pendulum.
19. Establish the relation between angular momentum and inertia tensor.

**(4 x 3 = 12 Weightage)**

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