

C.U.SHAH UNIVERSITY

Summer Examination-2019

Subject Name : Classical Mechanics

Subject Code : 5SC01CLM1

Branch: M.Sc. (Physics)

Semester : 1

Date : 14/03/2019

Time : 02:30 To 05:30

Marks : 70

Instructions:

- (1) Use of Programmable calculator and any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

SECTION – I

- Q-1 Attempt the Following questions (07)**
- a. Define constraints. 01
 - b. Define: Generalised Coordinates. 01
 - c. Differentiate Newtonian and Lagrangian for system of particles giving two points only. 01
 - d. Write the general expression of Euler-Lagrange's equation of motion. 01
 - e. What is the mathematical expression for the conservation of angular momentum? 01
 - f. Why is the Hamilton Principle also known as the 'Variational Principle'? 01
 - g. State two significances of the Hamilton over Lagrangian 01
- Q-2 Attempt all questions (14)**
- A Name different types of constraints. Define each and discuss with suitable examples. 07
 - B Discuss in detail: Generalised coordinates. 07
- OR**
- Q-2 Attempt all questions (14)**
- A Deduce the expression for D'Alembert's Principle. 07
 - B Derive the Euler-Lagrange's equation of motion. 07
- Q-3 Attempt all questions (14)**
- A List various applications of Lagrangian formula. Discuss any one of them obtaining its Lagrangian. 07
 - B Discuss Hamilton's principle. Derive its proof. 07
- OR**
- Q-3 Attempt all questions (14)**
- A Derive Hamiltonian formula for a simple pendulum moving with a support. 07
 - B Derive formula for the Hamiltonian of a charged particle in an EM field. 07



SECTION – II

- Q-4** **Attempt the Following questions** **(07)**
- a. Express Poisson Bracket for two dynamic variables \mathbf{u} and \mathbf{v} . 01
 - b. Write an identity followed by Poisson brackets. 01
 - c. What is Stable Equilibrium? 01
 - d. What are the Generating Functions? 01
 - e. Give some examples where small oscillation theory is applicable. 01
 - f. What is Gauge transformation? 01
 - g. What is orthogonality of eigen vectors? 01
- Q-5** **Attempt all questions** **(14)**
- A Discuss in detail: Hamilton-Jacobi theory 07
 - B Explain Canonical Transformation. Obtain the Hamilton's canonical equations. 07
- OR**
- Q-5** **Attempt all questions** **(14)**
- A Justify the statement: Gauge transformation is invariant for expressions in electrostatics. 07
 - B Enumerate on Poisson Bracket and derive canonical equations in terms of Poisson bracket notation. 07
- Q-6** **Attempt all questions** **(14)**
- A What is meant by infinitesimal transformation? Derive the relation between infinitesimal transformation and Poisson brackets. 07
 - B Explain the working of Generating functions in obtaining new Hamiltonian for a system. 07
- OR**
- Q-6** **Attempt all Questions** **(14)**
- A Write a brief note on: Eigen vectors and Eigen frequencies. 07
 - B Explain the theory of small oscillations and General case of coupled oscillations. 07

