

Enrollment No: \_\_\_\_\_

Exam Seat No: \_\_\_\_\_

# C.U.SHAH UNIVERSITY

## Summer Examination-2020

Subject Name: Classical Mechanics

Subject Code: 5SC01CLM1

Branch: M.Sc. (Physics)

Semester : 1

Date : 26/02/2020

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.
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### SECTION – I

- Q-1**      **Attempt the Following questions**      **(07)**
- a. Define cyclic coordinates
  - b. Give the expression for Legendre's Dual Transformation for two functions  $F(v)$  and  $G(u)$
  - c. State two importance of Hamiltonian
  - d. Write the general expression for D'Alembert's Principle.
  - e. State conservation of Linear momentum for a system of particles.
  - f. List the importance of Generalized coordinates
  - g. What do you mean by constraints in motion of particles?
- Q-2**      **Attempt all questions**      **(14)**
- Explain in detail the Kepler's problem used to comment on eccentricity of orbits.      **08**
- Quote some points to show the significance or advantages of Hamiltonian over Lagrangian.      **06**
- OR**
- Q-2**      **Attempt all questions**      **(14)**
- 'Routhian function is intermediate to Lagrangian and Hamiltonian'. Justify      **06**
- Derive the Euler-Lagrange's equation of motion      **08**
- Q-3**      **Attempt all questions**      **(14)**
- Explain in detail constraints and its types with suitable examples      **07**
- Deduce the expression for D'Alembert's Principle      **07**
- OR**
- Q-3**      Find the expression for Lagrangian for a Spherical Pendulum      **07**
- Enumerate on the Hamilton or Variation principle      **07**



## SECTION – II

- Q-4**      **Attempt the Following questions**      **(07)**
- a. State the uses of Generating Functions
  - b. Write the expression for Poisson bracket for two dynamic variables  $u$  and  $v$ .
  - c. How one can use infinitesimal transformations for momenta and position representation?
  - d. Write two identities followed by Poisson brackets.
  - e. Write an expression which uses Gauge transformation.
  - f. Give some examples where small oscillation theory is applicable.
  - g. Mention two canonicity conditions used in Classical Mechanics.
- Q-5**      **Attempt all questions**      **(14)**
- Explain Canonical transformation in detail and obtain the Hamilton's canonical equations.      **07**
- Explain the working of Generating functions in obtaining new Hamiltonian for a system.      **07**
- OR**
- Q-5**      Enumerate on Poisson Bracket and its importance.      **07**
- Explain the Hamilton-Jacobi theory      **07**
- Q-6**      **Attempt all questions**      **(14)**
- Deduce the characteristic equation for the case of two coupled oscillators.      **07**
- Comment on the usefulness of Infinitesimal Transformation in Classical Mechanics      **07**
- OR**
- Q-6**      **Attempt all Questions**
- Obtain the expression for potential energy for a system of  $n$  particles of mass ' $m$ ' connected by linear springs.      **08**
- "Gauge transformations are widely used in EM theory". Comment on this statement.      **06**

