Roll No……..….. **Total No. of Printed Pages: [01]**

Total No. of Questions: [11]

M.Sc. (Physics) (Semester – 1st)
CLASSICAL MECHANICS
Subject Code: MPHYS1101
Paper ID: [18220701]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It carries 16 marks. It consists of 4 questions of 4 marks each.
2. Section B consist of 4 questions of 8 marks each. The student has to attempt any 3 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(4 marks each)**

Q1. Give the advantages of variational principle formulation..

Q2. Explain inertia tensor and coriolis force in brief.

Q3. What do you mean by principle of least action? Explain it.

Q4. Show that the transformation $q = \sqrt{2P}\, sinQ$ and $p = \sqrt{2P}\, cosQ$ is canonical.

Section – B **(8 marks each)**

Q5. What is D'Alembert principle? Derive Lagrange's equation of motion from it for conservative system. How will the result will be modified for non- conservative system?

Q6. Find the kinetic energy of rotation of a rigid body with respect to principal axis in terms of Euler's angles and interpret the result when $I_1 = I_2$

Q7. Deduce the eigenvalue equation for small oscillations. How will you obtain the eigen value (ω^2) and eigenvectors from this equation.

Q8. Discuss the Hamilton- Jacobi theory. In what circumstances is the characteristic function W more useful than the special function S.

Section – C **(10 marks each)**

Q9. (a) Derive Hamiltonian formalism and obtain Hamilton equation of motion.
(b) Show that if a given co-ordinate is cyclic in Lagrangian, it will also be cyclic in Hamiltonian

Q10. (a) Obtain the condition that a heavy symmetrical top in a gravitational field which starts spinning initially with its symmetry axis vertical may continue to spin in the same way for the indefinite period.
(b) Show that angular momentum J of a rotating rigid body is given by J = Iω, where ω is the angular velocity. Show that I is the tensor of second rank.

Q11. (a) Discuss the action angle variables for systems with one degree of freedom.
(b) Prove that result of two or more successive canonical transformations is also canonical.