

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 $q = \sqrt{2P} \sin Q$ and $p = \sqrt{2P} \cos Q$ 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 $J = I\omega$, 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.