MSc Degree Examination
Branch II Physics
PH 211 – Classical mechanics

Duration: 3 hours **Maximum marks 75**

Part A

Answer any five questions. Each question carries 3 marks

1 Show that phase trajectory of one dimensional harmonic oscillator is an ellipse.

2 State and explain Liouville's theorem

3 Represent Lorrentz transformation in matrix form.

4 What are Euler angles

5 Explain cyclic coordinates with example.

6 Show that for a central force problem, angular momentum is a constant of motion.

7 Discuss the principle of least action

8 Define stable and unstable equilibrium.

5x3=15 marks

Part B

Answer three questions. Each question carries 15 marks

9

(a) State and explain Hamilton's principle 5

(b) Derive Lagrange's equations of motion from Hamilton's principle 10

OR

10

(a) Define Poisson bracket and derive its important properties 5

(b) Prove that Poisson bracket of two integrals of the equations of motion is also an integral of motion. 10

15 marks

11

(a) Write down Hamilton Jacobi's equation and prove Jacobi's theorem 6

(b) Explain HJ method taking the example of a one dimensional harmonic oscillator 9

OR

12

(a) Explain generalised coordinates of a rigid body 6

(b) Discuss the problem of the motion of a heavy symmetrical top 9

15 marks

13

(a) State the principle of equivalence and general principle of covariance 6

(b) Write down Einstein's equation of general relativity and explain its physical meaning 9

OR

14

(a) Explain linear and non linear systems 5

(b) Discuss the dynamics of Logistics map and explain its transition to chaos. 10

15 marks

Part C

Answer any three questions. Each question carries 5 marks

16 Obtain the equation of motion of a system of two masses, connected by an inextensible string passing over a small smooth pulley.

17 Determine the differential scattering cross section and the total scattering cross section for the scattering of a particle by a rigid elastic sphere.

18 A particle of mass ***m*** is attracted towards a given point by a force of the form , where k is a constant. Write down the expression for the Hamiltonian of the system and derive Hamilton's equations of motion.

19 Show that the transformation is canonical

20 Determine the normal mode frequency of the Lagrangian, given by

21 Determine the length and the orientation of a rod of length 10 metres in a frame of reference which is moving with 0.6c velocity in a direction making 30^0 angle with the rod.

3x5=15 marks