Roll No…….. **Total No. of Printed Pages: [01]**
Total No. of Questions: [09]

B.Sc. (Hons. Math) (Semester – 5th)
MECHANICS-II
Subject Code: BMATS1-501
Paper ID: [19131225]

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

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 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 **(2 marks each)**

Q1. Attempt the following:

a) Find the degrees of freedom of five particles moving in a plane
b) State and prove principle of virtual work.
c) Define the generalized coordinates?
d) What is the Hamiltonian for a simple pendulum?
e) Write the Hamilton's equation of motion
f) What is the Hamiltonian equation of motion for a conservative system?
g) What is the differential scattering cross-section?
h) Show that the motion of a particle under central force takes place in a plane?
i) What is variational principle?
j) Fill in the blank: Hamilton's principle function is …….?

Section – B **(5 marks each)**

Q2. Write down the Lagrange's equation of motion for a particle of mass m falling freely under gravity near the surface of earth?

Q3. Describe the Hamiltonian and Hamilton's equations for an ideal spring-mass arrangement.

Q4. What are the Hamilton's equations in Cartesian coordinates?

Q5. The eccentricity of the earth's orbit is 0.0167. Calculate the ratio of maximum and minimum speeds of the earth in its orbit.

Q6. We take a curve passing through the fixed points (x_1, y_1) *and* (x_2, y_2) and revolve it about Y-axis to form a surface of revolution. Find the equation of the curve for which the surface is minimum.

Section – C **(10 marks each)**

Q7. Write the Hamiltonian for a simple pendulum and deduce its equations of motion.

Q8. Use the Hamilton's equation to find the differential equation for planetary motion and prove that the areal velocity is constant.

Q9. Apply the variational principle to find the equation of one dimensional harmonic oscillator.