(i) Printed Pages : 4 Roll No. .....

(ii) Questions : 7 Sub. Code : 0 0 4 6

Exam. Code : 0 0 0 1

B.A./B.Sc. (General) 1st Semester

(2122)

PHYSICS

Paper–A : Mechanics–I

Time Allowed : Three Hours] **[Maximum Marks : 44**

Note :—(1) Attempt **FIVE** questions in all, selecting **TWO** each from Unit–I and Unit–II.

(2) Unit–III is compulsory.

(3) Use of Non-programmable Scientific Calculator is allowed.

UNIT—I

1. (a) Define Centre of mass and show that the velocity of Centre of mass remains constant in the absence of external forces. 6

(b) The motion of a particle is expressed by the equations, $x = (5t - 9)$, $y = 2 \cos (3t)$, $z = 2 \sin (3t)$. Calculate velocity and acceleration of particle. 3

2. (a) What are spherical polar coordinates ? Derive an expression for the Volume element of a sphere in this system. 5

(b) Define Solid angle and its S.I. units. Find Solid angle subtended by a sphere at its centre. 4

3. (a) Discuss the relationship of conservation laws of linear and angular momenta with symmetry properties of space and time. 6

(b) Find the Centre of mass of a system of particles of masses 0.5 kg, 1 kg and 2 kg placed at the corners of an equilateral triangle of 1 metre side. 3

UNIT—II

4. (a) State Kepler's laws of planetary motion and use them to justify that the force between the sun and the planet obey inverse square law. 5

(b) Find the force field associated with the potential energy $V = Ae^{\alpha(x+y+z)}$, where A and α are constants. 4

5. (a) Explain the term reduced mass. How does it help to reduce the two-body problem into one body problem ? Give example. 6

(b) Mention the various forces existing in nature and arrange them in increasing order of their strength. 3

6. (a) Derive relation between angles of scattering in lab. & C.M. system in two body elastic collisions. 6

(b) A neutron having mass of 1.67×10^{-27} kg and moving at 10^7 ms^{-1} collides with a deuteron at rest and sticks to it. Given that the mass of deuteron is 3.34×10^{-27} kg. Calculate the velocity of the combination. 3

UNIT—III

7. Attempt any **EIGHT** parts. Each part carries **1** mark :

(a) How does air friction affect the speed of a satellite ?

(b) Is area a scalar or vector ? What do you know about Volume ?

(c) What will happen to the angular momentum of a particle, when net torque acting on the particle is zero ?

(d) Mention the conditions under which property of flatness of free space holds good.

(e) What is space-time invariance principle ?

(f) How is conservative force related to the potential energy of the system ?

(g) Why are the gravitational and columbic forces called the inverse square forces ?

(h) Distinguish between elastic and inelastic scattering.

(i) What are the assumptions involved in the derivation of Rutherford scattering formula ?

(j) Define impact parameter. $8 \times 1 = 8$