Roll No…….. **Total No. of Printed Pages: 1**

Total No. of Questions: [09]

B.Sc. (Non-Medical) (Semester – 1st)

MECHANICS

Subject Code: BSNMS1102

Paper ID: [22131402]

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. What do vectors and scalars have in common? How do they differ?
b. If three vectors sum up to zero, what geometric condition do they satisfy?
c. What is the orbital period of rotation of an artificial satellite in a geostationary orbit?
d. Moon has no atmosphere on its surface. Why?
e. For a mechanical spring mass system how does spring constant affect the logarithmic decrement?
f. Differentiate between Young's modulus and modulus of rigidity.
g. Write down the postulates of special theory of relativity.
h. Define the Quality factor of a damped oscillator. What is its physical significance?
i. Write the Lorentz transformations equations for a particle moving with velocity 'v' along y- direction.
j. Write the formula for escape velocity of a particle on a planet of mass 'M' and radius 'R'. What is the value of escape velocity on earth?

Section – B **(5 marks each)**

Q2. A body executing S.H.M. describes 180 oscillations per minute and has a maximum velocity of 6 m/s. Determine its amplitude and velocity when it is half way between its mean and extreme positions.

Q3. Show that the reduced mass of a two-body system is less than the mass of any of the two bodies.

Q4. A particle of mass 'm' is moving under the action of central force with potential $V(r) = kr^3$. Calculate the time period of circular motion of the mass.

Q5. A bullet is fired with velocity c/3 from a spaceship moving with velocity c/2 in stationary frame of reference. Determine the velocity of the bullet in stationary frame of reference. ('c' is the speed of light in vacuum).

Q6. A particle of mass 'm' is thrown upwards from the surface of a planet. Mass and radius of the planet are 'M' and 'R', respectively. If the velocity of the fired mass is $\sqrt{(GM/2R)}$, find the maximum height which the particle attains.

Section – C **(10 marks each)**

Q7. State Kepler's laws of planetary motion and deduce the first law for inverse square law force $f(r) = -K/r^2$.

Q8. Show that the time slows down for a moving frame of reference with respect to the stationary one. Give an experimental verification of time dilation.

Q9. Establish the differential equation for damped oscillator and find its solution. Using this solution, explain various types of damping with suitable schematic diagrams.