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[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1566

I

Unique Paper Code : 222511101

Name of the Paper : Mechanics

Name of the Course : B.Sc. Prog.

Semester : I

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **Four** questions in all.
3. Question number **one** is Compulsory.

1. Attempt any five :

- (a) What is the velocity of n -mesons whose observed mean life is 2.5×10^{-7} sec. The proper mean life of these π -mesons is 2.5×10^{-8} sec.
- (b) Find the value of a if the vector force field $F = (y^2z^3 - \alpha xz^2) \mathbf{i} + 2xyz^3 \mathbf{j} + (3xy^2z^2 - 6x^2z) \mathbf{k}$ is conservative.
- (c) Write the formula for Lorentz and inverse Lorentz transformations.
- (d) State the law of gravitational attraction and hence define the gravitational constant G . Also write its dimensions.
- (e) A light and heavy body has equal kinetic energies of translation. Which one has the larger momentum?
- (f) State Newton's Laws of motion. Show that Newton's first law of motion is a special case of second law.

(5×3=15)

P.T.O.

2. (a) Prove that $\nabla^2 (\ln r) = 0$. (8)
- (b) Solve : $(D^2+4)y = \sin 3x$. (7)
3. (a) What are central forces? Show that angular momentum of particle moving under the influence of central forces is always conserved. (8)
- (b) A neutron moving with a velocity of 106 m/s collides with a deuteron at rest. After collision, the combined mass (tritron) moves with a certain velocity. Calculate the velocity, if the mass of neutron is 1.67×10^{-27} kg and the mass of the deuteron is 3.34×10^{-27} kg. (7)
4. (a) Derive a general differential equation of motion of a simple harmonic oscillator and obtain its solution. (8)
- (b) State Kepler's laws of planetary motion. Show that areal velocity of a planet around the sun is constant. (7)
5. (a) Describe Michelson-Morley experiment with suitable mathematical expression. (10)
- (b) Atomic particles in the form of a beam have a velocity of 95% speed of light. What is their relativistic mass compared with their rest mass? (5)