

SL No of QP : 13594

Name of Course : B.Sc. (H) – (Physics-GE)_NEP: UGCF-2022
Semester : VII
Name of Paper : Mechanics (GE Paper)
Unique Paper Code : 2224001003
Duration : 3 Hours

Maximum Marks: 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on the receipt of this question paper.
 2. Question No. 1 is compulsory
 3. Answer any four of remaining five.
 4. Use of non-programmable calculator is allowed.
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1. Attempt any 6 parts of this question.
(a) If $A = xzi - y^2j + 2x^2yk$, then find the value of $\nabla \times A$ at (1, 1, 1). (6x3)
(b) Find a general solution of the differential equation $\frac{dy}{dx} = 3x^3$.
(c) What is the displacement of a particle executing S.H.M from the mean position, when it's instantaneous kinetic and potential energies are equal?
(d) Show that the angular momentum is conserved for a central force field.
(e) Find the mass of electron whose velocity is $0.99c$. Where c is velocity of light.
(f) State Newton's Laws of motion. Show that Newton's first law of motion is a special case of second law.
(g) What do you understand by the inertial mass and gravitational mass?
 2. (a) Define the Centre of mass. Show that in the absence of external forces the velocity of the center of mass remains constant. (10)
(b) Show that a conservative force can be written as the negative gradient of a scalar potential. (8)
 3. (a) Derive the equation of motion of a simple harmonic motion and obtain the expression for its displacement, velocity and time period. (10)
(b) Show that average kinetic and potential energies are equal for S.H.M. (8)
 4. (a) State the Newton's law of gravitation. Derive the equation of motion of a particle in central force field. (10)
(b) Define the Hooke's law. Derive an expression for the torsional rigidity of a wire. (8)
 5. (a) Define Angular momentum. State and prove law of conservation of Angular Momentum. (10)
(b) Obtain relations between elastic constants.
$$K = \frac{Y}{3(1-2\sigma)}$$
, where each term has it's usual meaning. (8)
 6. (a) Write the Postulates of special theory of relativity. Derive the Lorentz transformation equations. (10)
(b) Explain the time dilation and derive the expression for the time dilation using the help of the Lorentz transformation equations. (8)