

B.Sc. F.Y. (CBCS Pattern) Sem-I
USPHT01 - Physics Paper-I (Mechanics and Relativity)

P. Pages : 2

Time : Three Hours



GUG/W/22/11560

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw neat and well labelled diagram wherever necessary.

Either:

1. a) i) Distinguish between Inertial and Non-inertial frame of reference. 4
ii) Obtain an expression for radial and transverse components of velocity. 3
iii) The path of projectile is given by an equation $3t^2 - \frac{t^2}{20}$ Meter. Find the velocity and acceleration after the time of 10 sec. 3

OR

- b) a) State Newton's laws of motion and write the limitations. 2½
b) Obtain an expression for Centripetal force. 2½
c) Derive the equation of motion of Centre of mass. 2½
d) Two particles of masses 5gm and 7gm are at a distance of 2cm and 3cm respectively from the origin. Calculate the position of Center of mass. 2½

Either:

2. a) i) Discuss the phenomenon of Collision in one dimension between two particles when the Collision is elastic. hence find velocities after collision. 6
ii) State and prove law of conservation of linear momentum. 2
iii) If the two bodies having masses 10kg and 8kg and their respective initial velocities are 5 m/sec. and 6m/sec. Find the final velocities of the two bodies after elastic collision in one dimension. 2

OR

- b) a) When masses of colliding particle are same and when one of the particle is initially at rest. 2½
b) State and prove the work-energy principle. 2½
c) Explain the terms elastic and inelastic collision. With examples. 2½
d) A gun of mass 10kg fires a bullet of 100gm with a velocity 1500cm/s. Find the velocity with which gun is recoiled. 2½

Either:

3. a) i) Derive an expression for moment of inertia of a solid sphere. 5
a) About its diameter b) About a tangent

- ii) State the principle of perpendicular and parallel axes about M.I. of body. Give their mathematical equations. 3
- iii) Calculate the radius of gyration of a solid sphere rotating about its diameter whose radius is 5cm. 2

OR

- b) a) Derive an expression for moment of inertia of thin ring about an axis passing through its Centre and perpendicular to its plane. 2½
- b) Explain the moment of inertial and radius of gyration. 2½
- c) State and prove law of conservation of angular momentum. 2½
- d) Assuming earth to be solid sphere of uniform density 5520kg/m^3 and radius 6400km, Calculate the moment of inertia about its axis of rotation. 2½

Either:

- 4. a) i) Derive the relativistic formula for variation of mass with velocity. 5
- ii) Derive an expression for length contraction. Give its interpretation. 3
- iii) A Rocket of rest mass 7000kg is travelling with a velocity of 0.6C. Find the relativistic mass. 2

OR

- b) a) Explain constancy of speed of light. 2½
- b) Derive an expression for time dilation and discuss the result. 2½
- c) Derive an expression for relativistic mass energy relation. 2½
- d) At what velocity a particle will moves if it's mass become equal to 4 times its rest mass. 2½

5. Attempt **any ten** from following.

- a) Show that Newton's second law is a special case of first law. 1
- b) Write the names of forces acting on a moving particle in rotating frame. 1
- c) What is frame of reference? 1
- d) What is rocket? 1
- e) Name the fuel used in the rocket. 1
- f) State the principle of rocket. 1
- g) What is torque? 1
- h) Write the relation between τ and L. 1
- i) Define angular impulse. 1
- j) Write down the postulates of special theory of relativity. 1
- k) What is meant by proper time? 1
- l) Write down the Lorentz transformation equations. 1
