2023

Time - 3 hours

Full Marks - 60

*Answer **all groups** as per instructions.*
Figures in the right hand margin indicate marks.

GROUP - A

1. Answer all questions and fill in the blanks as required. [1 × 8

(a) Write the equation of rotational motion with constant $\vec{\alpha}$.

(b) Write the relation between $\vec{v}, \vec{w}$ and $\vec{a}, \vec{\alpha}$.

(c) _____ force exists in the non intertial frame of reference.

(d) Energy stored per unit volume in a stretched wire is $\frac{1}{2}$ _____ × _____.

(e) Surface tension of liquid _____ with rise in temperature.

(f) Write the expression for central force.

(g) Write the Kepler's law for Arial velocity.

(h) Write the differential equation of SHM.

GROUP - B

2. Answer any eight of the following within two or three sentences each. [1½ × 8

(a) State Routh's rule.

(b) Explain Euler's equation of rigid body motion.

(c) Calculate the torque when angular momentum changes from L to 4L in 4 min.

(d) Define Poisson's ratio.

(e) Calculate the M.I. of a ring about its diameter.

(f) Calculate the M.I. of a disc about its diameter.

(g) Show that Gravitational force is conservative.

(h) Find the velocity at which mass of electron is $\sqrt{2}$ times its rest mass.

(i) In SHM, displacement $y = 3 \sin 2t + 4 \cos 2t$. Find its amplitude.

(j) Write the relation between Half life and Mean life of radioactive substance.

GROUP - C

3. Answer any eight of the following within 75 words each. [2 × 8

(a) Discuss about Lab frame and centre of mass frame.

(b) State and explain Law of conservation of linear momentum of system of particle.

(c) State and explain perpendicular axis theorem of M.I.

(d) Explain hollow cylinder is a better shaft than a solid cylinder.

(e) Derive the expression for Bending moment.

(f) Write a short note on Gravity waves and ripples.

(g) State postulates of special theory of relativity.

(h) Show that total energy of particle is SHM is constant.

(i) Explain central force.

(j) Explain elastic constants.

GROUP - D

*Answer **any four** questions within 500 words each.*

4. Derive the expression for moment of inertia of solid sphere about its axis of symmetry. [6

5. Establish the relation between Elastic constants Y, K and σ and Y, K, η. [6

6. Derive expression for Gravitational field and potential due to solid sphere at external and internal points. [6

7. Write the differential equation of Force Harmonic Oscillator and find its solution. [6

8. Derive Lorentz transformation equation and find its consequences. [6

9. Write notes on within 250 words each. [3 × 2

   (a) Length Contraction

   (b) Time Dilation

10. Derive expression for M.I. of a Fly wheel. [6