No. of Printed Pages : 4

Sem-I-Phy-CC-II
(Reg&Back)

2020-21

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 / Fill in the blanks / Write true or false as required. [1 × 8

   (a) The point about which the sum of moments of mass of all the particles of a system vanishes is called _____.

   (b) A rolling sphere consists of only the 'rotational K.E'. Write True or False.

   (c) The Young's modulus of elasticity of a material is Y. If there is no lateral strain on it, then its modulus of rigidity will be _____. $(Y / 2Y / \frac{Y}{2} / \frac{Y}{3})$ (Choose the correct answer.)

   (d) The excess pressure across a curved liquid membrane is due to _____.

   (e) Inertial mass and Gravitational mass of a body are _____.

   (f) Relativistic time interval is _____ than the proper time interval.

P.T.O.

(g) Constellation of 24 numbers of GPS satellites requires at least _____ number of satellites within line-of-sight of any location on earth at all times.

(h) The distance between 'point of suspension' and 'centre of oscillation' defines _____ of Bar-pendulum.

GROUP – B

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

(a) State the law of conservation of angular momentum.

(b) State Routh rule for the MI of spherical bodies.

(c) Write the expression for Flexual rigidity and explain each quantity used.

(d) Draw the displacement~time graphs for 'Damped vibration' and 'Forced vibration' after acquiring steady state.

(e) Explain how does a raindrop become spherical.

(f) Write the relation between three elastic modulii (Y, K, η).

(g) Explain why astronauts experience weightlessness inside a satellite.

(h) What is the relation between time-average values of K.E. and P.E. of a body in SHM ?

(i) Define Q-factor in oscillation.

(j) State Lorentz transformation equations for relative motion along x-axis. Under what condition, they reduce to Galilean transformation equations ?

GROUP – C

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

(a) A solid cylinder is rolling on the floor with mass 2 kg and angular velocity 1 rad/s. If its radius is 10 cm, then find its K.E.

(b) Distinguish between 'ripples' and 'gravity waves'.

(c) Prove that areal velocity remains constant under central force.

(d) Identify the real force and fictitious force : (i) centrifugal force on rotating body ; (ii) centrifugal force on the body at the centre of rotational motion.

(e) Calculate the velocity at which relativistic length is 20% less than the proper length.

(f) Two photons are travelling each with velocity 'c' in same direction. Find the relative velocity between them.

(g) Derive the expression for the 'momentum' of a massless particle.

(h) State the two postulates of special theory of relativity.

(i) Draw the gravitational field intensity (F)~distance (r) graph for a hollow sphere.

(j) Calculate the excess pressure in a soap bubble of radius 2 cm. Take surface tension of soap solution to be 50 dyn/cm.

GROUP – D

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

4. What is centre of mass ? Derive the expression for its position vector in lab-frame considering the motion of centre of mass. [6

5. What is Coriolis force ? Derive the expression for it. [6

6. Derive the exprerssion for depression at one end of a single cantilever whose own weight is effective and load is applied at free end. [6

7. State the features of central force. Derive the expression for 'reduced mass' of a two-body system under central force. [6

8. Derive the expression for 'energy equation' in central force and hence obtain the first two integrals considering gravitational force between sun and planet. [6

9. Set up differential equation of motion for forced vibration. Solve it for transient and steady states. Obtain the expression for amplitude at resonance. [6

10. Derive the expression for apparent frequency of light considering relativistic Doppler's effect. Hence obtain it for longitudinal Doppler's effect. [6