

2022

Physics (Hons)

[First Semester]

Paper - C2T

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group - A

- 1. Answer any five (05):** **5×2=10**
- (a) Prove that $\vec{F} = r^2\vec{r}$ is conservative. 2
 - (b) State the principle of conservation of momentum. 2
 - (c) What is Coriolis force? When it is maximum? 2
 - (d) Define modulus of rigidity. 2
 - (e) Define moment of inertia and explain its physical significance. 2

(Turn Over)

(2)

- (f) Justify the statment ‘Two streamlines can’t intersect. 2
- (g) What are the differences between true and the pseudo force? 2
- h) Prive that $\vec{\tau} = \frac{d\vec{J}}{dt}$, where J=angular momentum
 τ =torque. 2

Group - B

Answer any four (04).

4×5=20

2. Obtain an expression for torsional rigidity of a solid cylinder in terms of its length, radius and modulus of rigidity. 5
3. A 50 g mass vibrates in SHM at the end of a spring. The amplitude (A) of the motion is 12 cm and the period is 0.1 minutes. Find the maximum speed of the mass. What will be the speed at $x = \frac{A}{2}$? $2\frac{1}{2} + 2\frac{1}{2} = 5$
4. What is conservative force? Prove that the curl of a conservative force is zero. 2+3= 5

(3)

5. A particle, acted upon by a central force, describes an orbit given by $r=a(1+\cos\theta)$, 'a' being a constant. Show the nature of force and its diagrammatic representation. 3+2=5
6. What is laminar and turbulent flow? Explain briefly the idea of critical velocity and Reynolds number. 5
7. State the parallel and perpendicular axis theorem. What is radius of gyration? 3+2=5

Group - C

Answer any one (01) 1×10=10

8. (a) Calculate the moment of inertia of a solid cylinder about its own axis. Radius of a cylinder is R.
- (b) Show that a body dropped from rest from a height h above the earth's surface and a latitude λ , is deflected in the northern hemisphere towards east from the

vertical by an amount $d = \frac{1}{3} W g_e \cos \lambda \left(\frac{2h}{g_e} \right)^{3/2}$

Where g_e is effective acceleration due to gravity at latitude λ and W is the angular velocity of the earth.

5+5=10

(4)

9. (a) Find the velocity addition formula for a particle moving along $x-x'$ axis.
- (b) Prove the $E^2=p^2c^2+m^2c^4$, where m is the rest mass of the particle. Hence show that a massless particle with a speed less than that of light can have neither energy nor momentum. 5+(3+2)