63 (FY)SEM–1/MIN1/PHYMIN1014B

2024

PHYSICS

Paper : PHYMIN1014B

(Mechanics)

Full Marks : 50

Pass Marks : 20

Time : Two hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct answer : 1×5=5

(a) If $\vec{A}$ and $\vec{B}$ are opposite to each other, then the angle between them is

(i) 0°

(ii) 180°

(iii) 360°

(iv) 90°

Contd.

(b) If 'm' be the mass and 'p' be the linear momentum of a body then the Kinetic Energy is given by

(i) mp

(ii) $\frac{2p^2}{m}$

(iii) p^2/m

(iv) $p^2/2m$

(c) The dimensional formula for Torque is

(i) $[ML^2T^{-2}]$

(ii) $[MLT^2]$

(iii) $[ML^{-2}T^2]$

(iv) $[ML^{-2}T^{-2}]$

(d) The Equation for Simple Harmonic motion is given by

$\left(\frac{d^2x}{dt^2}\right)+16x=0$. Then the angular velocity is

(i) $4m/sec$

(ii) $4radian/sec$

(iii) $16radian/sec$

(iv) $(16/2\pi)radian/sec$

(e) An artificial satellite returns back to the earth surface if the orbital velocity

(i) is less than $7{\cdot}9kM/sec$

(ii) is greater than $7{\cdot}9kM/sec$

(iii) is equal to $7{\cdot}9kM/sec$

(iv) has no correlation with $7{\cdot}9kM/sec$

2. Answer ***any five*** of the following questions : 2×5=10

(a) What is degree and order of differential equation ? Find the degree and order of the equation

$$\left(d^2y/dx^2\right)+5\left(\frac{dy}{dx}\right)-2y=0$$

(b) Find the impulse and its magnitude developed on a particle of mass $1kg$ which changes its velocity from $\left(\hat{i}-2\hat{j}+4\hat{k}\right)m/sec$ to $\left(4\hat{i}+2\hat{j}+4\hat{k}\right)m/sec$.

(c) Deduce the relation between Torque $(\vec{\tau})$ and angular momentum $(\vec{L})$ of a rotating body about its axis of rotation.

(d) What is inertial frame of reference? What are the characteristics of inertial frame of reference?

(e) Write down the laws of Keplar's planetary motion.

(f) If a particle executing Simple Harmonic motion, then the displacement equation is given by $y = a\sin\omega t$, where symbols have their usual meanings. Find the expression for angular velocity 'ω'.

(g) Define Poisson's ratio. Also find the expression of it.

Mention the dimensional formula for Poisson's ratio.

3. Answer ***any five*** of the following questions : 5×5=25

(a) Define centre of mass. Establish the expression for position vector of centre of mass of a system of N-particles. 1+4=5

(b) Derive the expression for total energy of a particle when the particle executing simple harmonic motion.

(c) What is Geo-staitonary satellite? Mention *two* essential features of a Geo-Stationary Satellite.

Find the expression for height of Geo-Stationary Satellite. 1+1+3=5

(d) Define Elastic Potential Energy of a deformed body.

Show that

Elastic Potential Energy

$= \frac{1}{2} \times$ tension × Extension. 1+4=5

(e) Mention the basic postulates of Einstein's special theory of relativity. Discuss about time dilation. 2+3=5

(f) Define power. Mention its SI unit. If 'P' be the instantaneous power, 'E' be the mechanical energy and 't' be the time then show that $P = dE/dt$. 1+1+3=5

(g) Explain Searle's method for determination of Young's modulus of Elasticity 'Y'.

(h) What is ordinary differential equation ? Solve the differential equation $Y' = X\tan(Y - X) + 1$. 1+4=5

4. Answer ***any one*** of the following questions : 10

(a) What is Elastic limit ?

Establish the expression for torsional couple per angular twist of the hollow cylinder. 2+8=10

(b) Derive expression for

(i) Work-Energy principle

(ii) Angular momentum of system of particles 5+5=10
