

## CH 11

Q.1

$$\Delta\theta = ?$$

$$r = 20 \text{ cm}$$

$$\Delta\theta = \left( \frac{\omega_0 + \omega}{2} \right) t$$

$$\Delta\theta = \left( \frac{42 + 0}{2} \right) 10 = 210 \text{ rad}$$

Q.2

$$\tau_{\text{net}} = I\alpha$$

$$(15 \times 0.12 - 10 \times 0.06) = 0.036 \alpha$$

$$\Rightarrow \alpha = 33.3 \text{ rad/s}^2$$

$$\omega_0 = 0, t = 3 \text{ s}, \omega = ?$$

$$\omega = \omega_0 + \alpha t \Rightarrow \omega = 33.3 \times 3$$

$$\omega = 100 \text{ rad/s}$$

Q.3

$$\Delta U + \Delta K = 0 \quad (\text{Isolated})$$

$$\text{to find } I = I_{\text{com}} + Mh^2$$

$$= \frac{1}{12} ML^2 + M\left(\frac{L}{2}\right)^2 = \frac{1}{12} (3) (0.98)^2 + 3\left(\frac{0.98}{2}\right)^2$$

(For the rod)

$$I = 0.96 \text{ kg}\cdot\text{m}^2$$

$$mg\Delta y + \frac{1}{2} I (\omega_f^2 - \omega_i^2) = 0$$

$$\text{where } \Delta y = -\frac{L}{2} \quad (\text{According to C.O.M.})$$

$$= 3 \times 9.8 \times \left(-\frac{0.98}{2}\right) + \frac{1}{2} (0.96) (\omega_f^2 - 4^2) = 0$$

$$\omega_f = 6.78 \approx 6.8 \text{ rad/s}$$

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Q.4

$$\begin{aligned} I &= \sum m r^2 \\ &= 4(9) + 3(9) \\ &= 63 \text{ kg}\cdot\text{m}^2 \end{aligned}$$

Q.5  $5 \text{ rev} = 5(2\pi) = 10\pi \text{ rad}$   
 $\Rightarrow \Delta\theta = 10 \times 3.14 = 31.4 \text{ rad}$

$$\begin{aligned} \Rightarrow \omega^2 - \omega_0^2 &= 2\alpha \Delta\theta \\ 6^2 - 5^2 &= 2\alpha(31.4) \\ \Rightarrow \alpha &= 0.175 \text{ rad/s}^2 \end{aligned}$$

$$\begin{aligned} \Rightarrow \tau_{\text{net}} &= I\alpha = 12 \times 0.175 \\ \tau &= 2.1 \text{ N}\cdot\text{m} \end{aligned}$$

Q.6  $W = \tau_{\text{net}} (\Delta\theta)$   
 $\Delta\theta = \omega_0 t + \frac{1}{2} \alpha t^2 = 0 + \frac{1}{2} (2) (5)^2$   
 $\Delta\theta = 25 \text{ rad}$   
 $\tau = I\alpha = 6 \times 2 = 12 \text{ N}\cdot\text{m}$   
 $\therefore W = 12 \times 25 = 300 \text{ J}$

Cont.  $\rightarrow$   
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Q. 7

$$\Delta\theta = 8 \text{ rev} = 8 \times 2\pi = 16\pi \text{ rad}$$

$$\omega_0 = 0, t = 17 \text{ s}, \omega = ?$$

$$\Delta\theta = \left( \frac{\omega + \omega_0}{2} \right) t$$

$$16 \times 3.14 = \left( \frac{\omega + 0}{2} \right) 17$$

$$\Rightarrow \omega = 5.9 \text{ rad/s}$$

Q. 8

$$I = ma^2 + ma^2 + m(2a)^2$$

$$= 2 \times 1 + 2 \times 1 + 2 \times (2)^2$$

$$I = 12 \text{ kg}\cdot\text{m}^2$$

Q. 9  $W = \tau(\Delta\theta)$

$$\tau = I\alpha = Fr = 2 \times 0.25 = 0.5 \text{ N}\cdot\text{m}$$

$$1 \text{ rev} = 2\pi \text{ rad}$$

$$\Rightarrow \Delta\theta = 2 \times 3.14 \text{ rad}$$

$$= W = 0.5 \times 2 \times 3.14$$

$$W = 3.14 \text{ J}$$

CH. 11, end.

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