

Answers

ME206 Midterm-2
25.03.2022

$$\textcircled{1} \quad \frac{1}{2} (4) (0.3)^2 + 0 \overset{mgh}{=} - 2 (0.2 + 8) = - (4) (9.81) (0.2 + 8) + \frac{1}{2} 14000 \delta^2$$

$$\textcircled{2} \quad 0 + \int_0^9 (0.11) 3t \, dt = 4m (7.33) (0.380) (0.380) \left\{ 70 \frac{2\pi}{60} = 7.33 \frac{\text{rad}}{\text{s}} \right.$$

$$\frac{0.33}{2} g^2 = 4.2338 \, \text{m} \quad m = 3.16 \, \text{kg}$$

$$\textcircled{3} \quad 10(3) + \int_0^{4.5} F(t) \, dt = 10 \, V_2$$

$$\text{Area} \quad \frac{3(20)}{2} - \frac{(4.5-3) 20}{2} = 30 - 15 = 15$$

$$30 + 15 = 10 V_2 \quad V_2 = 4.5 \frac{\text{m}}{\text{s}}$$

$$\textcircled{4} \quad \vec{a}_G = \vec{a}_A + \vec{\omega} \times (\vec{\omega} \times \vec{R}_{G/A}) + \vec{\alpha} \times \vec{R}_{G/A}$$

$$\vec{R}_{G/A} = -0.11547 \cos(10) \vec{u}_x + 0.11547 \sin(10) \vec{u}_y$$

$$= -0.1137 \vec{u}_x + 0.0201 \vec{u}_y$$

$$\vec{a}_G = -0.9 \vec{u}_y + 0.8 \vec{u}_z \times [0.8 \vec{u}_z \times (-0.1137 \vec{u}_x + 0.0201 \vec{u}_y)]$$

$$+ (-2.1 \vec{u}_z \times (-0.1137 \vec{u}_x + 0.0201 \vec{u}_y))$$

$$\vec{a}_G = -0.9 \vec{u}_y + 0.8 \vec{u}_z \times (-0.0910 \vec{u}_y - 0.016 \vec{u}_x) + (0.2388 \vec{u}_y + 0.0421 \vec{u}_x)$$

$$= -0.9 \vec{u}_y + 0.0728 \vec{u}_x - 0.0128 \vec{u}_y + (0.2388 \vec{u}_y - 0.0421 \vec{u}_x)$$

$$\vec{a}_G = 0.1149 \vec{u}_x - 0.6740 \vec{u}_y$$

$$\textcircled{5} \quad x = 2b \cos \theta$$

$$\dot{x} = -2b \dot{\theta} \sin \theta$$

$$\ddot{x} = -2b \ddot{\theta} \sin \theta - 2b \dot{\theta}^2 \cos \theta$$

$$60 \times \frac{2\pi}{60} = 6.28$$

$$\ddot{x} = -2(0.3)(-8) \sin(30) - 2(0.3) 6^2 \cos(30)$$

$$\ddot{x} = -16.31 \frac{\text{m}}{\text{s}^2}$$