yohandi - Assignment 13

3. $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$

$k = (2\pi f_\cdot)^2 . m$

$k_T = k_L + k_R$

$\Rightarrow f_T = \frac{1}{2\pi}\sqrt{\frac{k_L + k_R}{m}}$

$= \sqrt{f_L^2 + f_R^2}$

$= \sqrt{30^2 + 50^2}$ Hz

$= 10\sqrt{34}$ Hz

7a. $I = \sum k_i . m_i . R_i^2$

$= \frac{1}{2}mr^2 + \frac{1}{12}ML^2 + M(\frac{L}{2})^2 + m(L+r)^2$

$= 0.20\bar{3}$ kg m^2

b. $y_{com} = \frac{m_1 . y_1 + m_2 . y_2}{m_1 + m_2}$

$= \frac{0.5(-0.6) + 0.25(-0.25)}{0.5 + 0.25}$ m

$= -0.48\bar{3}$ m

$d = |y_{com}| = 0.48\bar{3}$ m

c. $T = 2\pi\sqrt{\frac{I}{(\sum m_i) g . d}}$

$= 1.5$ s

12a. $k = \frac{F}{\Delta x} = \frac{mg}{\Delta x} = 58800$ N/m

b. damping ratio $= \frac{b}{2\sqrt{mk}}$

$\frac{1}{2} = \frac{b}{2\sqrt{600 . 58800}}$

$b = 5939.7$ kg/s

13a. $m_1 v_1 + m_2 v_2 = (m_1 + m_2) v'$

$v' = \frac{m_1 v_1}{m_1 + m_2} = 1.19$ s

b. $\frac{1}{2}(m_1 + m_2) v'^2 = \frac{1}{2} k x_m^2$

$x_m = \sqrt{\frac{(m_1 + m_2) v'^2}{k}}$

$= v' \sqrt{\frac{m_1 + m_2}{k}}$

$= 0.036$ m

14. $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$

$f_T = \frac{1}{2\pi}\sqrt{\frac{2500}{0.490}}$ Hz

$= 11,368$ Hz

29. $d = |\Delta x| = |x_f - x_i|$

$= \left|\frac{Mg}{k} - \frac{(M+4m)g}{k}\right|$

$= \frac{4mg}{k}$

$= \frac{4mg}{(M+4m)\omega^2}$

$= \frac{4mg}{M+4m} \cdot \left(\frac{d}{2\pi v}\right)^2$

$= 0.0776$ m

53a. $f = \frac{1}{2\pi}\sqrt{\left|\frac{a}{x}\right|} = 5.582$ Hz

b. $\left|\frac{a}{x}\right| = \frac{k}{m}$

$m = k . \left|\frac{x}{a}\right| = 0.3455$ kg

c. $E_1 = E_2$

$\frac{1}{2}k x_m^2 = \frac{1}{2}kx^2 + \frac{1}{2}mv^2$

$x_m = \sqrt{x^2 + \frac{m}{k} . v^2} = 0.400$ m

59a. $\Omega_{max} = \omega . \theta_m = (\frac{2\pi}{T})\pi = 32.90$ rad/s

b. $\Omega = \left|\frac{d(\theta(t))}{dt}\right|$

$= |-\omega \theta_m \sin(\omega t + \varphi)|$

when $\cos(\omega t + \varphi) = \frac{x}{x_m} = \frac{\pi/2}{\pi} = \frac{1}{2}$

$\Rightarrow \sin(\omega t + \varphi) = \sqrt{1 - (\frac{1}{2})^2} = \frac{1}{2}\sqrt{3}$

$\Omega = |-\omega . \theta_m . \frac{1}{2}\sqrt{3}| = 28.49$ rad/s

c. $\alpha = \frac{d(\Omega)}{dt}$

$= -\omega^2 \theta_m . \cos(\omega t + \varphi)$

$= -\omega^2 . \theta$

when $\theta = \frac{\pi}{4}$

$\Rightarrow \alpha = -\omega^2 . \frac{\pi}{4} = -86.13$ rad/s^2