

OCTOBER 2018 / IN - SEM (T1)

F. Y. M. TECH. (Design Engineering) (SEMESTER - I)

COURSE NAME: Advanced Vibrations and Acoustics

COURSE CODE: MEPA11182

(PATTERN 2018)

Time: [1 Hour]

[Max. Marks: 20]

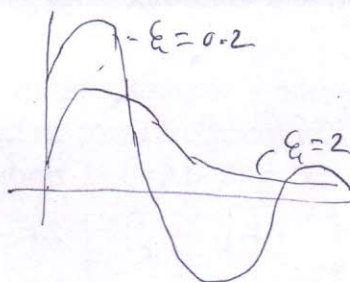
SOLUTION

Q.No 1 (a)

For $\xi = 2$ $x = 0.288 A [e^{-0.27\omega_n t} - 3.73\omega_n t]$ [2 marks]

For $\xi = 0.2$ $x = 1.02 A e^{-0.2\omega_n t} \sin(0.98\omega_n t)$ [2 marks]

Graph



[2 marks]

Q.No 1 (b)

Fig. — 1 marks

$$\omega_n = \sqrt{\frac{k}{(m + \frac{m_0}{3})}} \quad \text{— 3 marks}$$

Q.No 2 (a)

Logarithmic decrement $\delta = 0.405$ [2 marks]

Force per unit velocity $C = 32.8 \text{ Nm/sec rad}$ [2 marks]

frequency $= 6.75 \text{ Hz}$ [2 marks]

Q. no 2 (b)

$$\text{magnification factor } M.P. = \frac{X}{X_{st}} = \frac{1}{\sqrt{[1 - (\frac{\omega}{\omega_n})^2]^2 + [2\zeta(\frac{\omega}{\omega_n})]^2}}$$

$$\frac{X_s}{X_{st}} = \frac{1}{2\zeta}$$

$$\omega_p = \omega_n \sqrt{1 - 2\zeta^2}$$

Q. no 3 a

$$\left. \begin{aligned} m_1 \ddot{x}_1 + (k_1 + k_2)x_1 - k_2 x_2 &= 0 \\ m_2 \ddot{x}_2 + k_1 x_1 + (k_1 + k_2)x_2 - k_2 x_3 &= 0 \\ m_3 \ddot{x}_3 - k_2 x_2 + k_3 x_3 &= 0 \end{aligned} \right\} \text{2 mark}$$

$$\left. \begin{aligned} [M][\ddot{x}] + [K][x] &= 0 \\ [M]^{-1}[M][\ddot{x}] + [K][M]^{-1}[x] &= 0 \\ [I][\ddot{x}] + [C][x] &= 0 \end{aligned} \right\} \text{2 marks}$$

$$[\lambda I - C] = 0 \quad \left. \right\} \text{2 mark}$$

$$\left. \begin{aligned} \begin{bmatrix} m & 0 & 0 \\ 0 & m & 0 \\ 0 & 0 & m \end{bmatrix} \begin{bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \\ \ddot{x}_3 \end{bmatrix} + \begin{bmatrix} 2k & -k & 0 \\ -k & 2k & k \\ 0 & -k & -k \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} &= 0 \end{aligned} \right\} \text{2 marks}$$

$$\omega_1 = \sqrt{\lambda_1}, \omega_2 = \sqrt{\lambda_2}, \omega_3 = \sqrt{\lambda_3}$$

$$\lambda_1 = 0.198 \frac{k}{m}, \lambda_2 = 0.55 \frac{k}{m}, \lambda_3 = 3.24 \frac{k}{m} \quad \left. \right\} \text{2 marks}$$

Q. 4 (a)

$$\omega_{n1} = \sqrt{\frac{T}{m_1}}, \omega_{n2} = \sqrt{\frac{3T}{m_2}}, \text{ mode shape } \left. \right\} \text{2 marks each}$$

① ② ③

Q. no 4 (b)

Method + explanation + equation [4 marks.]