CHAPTER 7

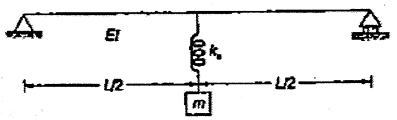
Structural Dynamics and Cables

Q.1 In which case the dynamic system has no oscillatory motion and returns to equilibrium position at a slower rate
(a) Critically damped (b) Overdamped
(c) Underdamped (d) Any of the above

Q.2 Transmissibility is not significantly affected by damping in the region
(a) $\frac{\bar{\omega}}{\omega_n} < 0.2$ (b) $\frac{\bar{\omega}}{\omega_n} \simeq 1.5$
(c) $\frac{\bar{\omega}}{\omega_n} > 1$ (d) $\frac{\bar{\omega}}{\omega_n} < 1$

Q.3 In normal mode method, after normalization
(a) $[K]$ becomes diagonal
(b) $[M]$ becomes diagonal
(c) $[K]$, $[M]$ and $[R(t)]$ becomes diagonal
(d) $[K]$ and $[M]$ become diagonal

Q.4 The equivalent stiffness for the system shown below is _____ units. If flexural rigidity of beam is unity and length of beam is 2 m. The stiffness of spring is 12 unit



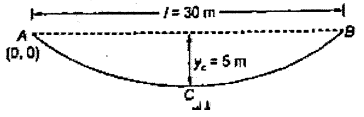
(a) 1 (b) 2
(c) 3 (d) 4

Q.5 A damped freely vibrating SDOF system weighs 25 kg, spring with stiffness 20 N/mm and damping ratio is 0.08. The damped coefficient of system is _____ Ns/m.
(a) 91.16 (b) 103.64
(c) 113.14 (d) 158.92

Q.6 For SDOF system, the amplitude of excitation force is 1000 N and the transmissibility of force is 0.25. The transmitted force is
(a) 250 N (b) 500 N
(c) 750 N (d) 1000 N

Q.7 Response of an undamped oscillator acting upon by a rectangular load is
(a) $\frac{F_0}{k}$
(b) $\frac{F_0}{k}\cos\omega t(t-t_d)$
(c) $\frac{F_0}{k}(\cos\omega t - \cos\omega t_d)$
(d) $\frac{F_0}{k}\{\cos\omega(t-t_d) - \cos\omega t\}$

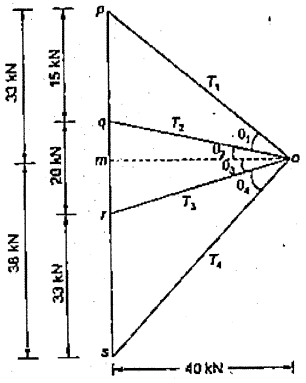
Q.8 Figure below show a cable suspended through simple supports. Assuming point A as origin, the equation of cable profile is



(a) $\frac{x}{45}(x-30)$ (b) $\frac{x}{30}(45-x)$
(c) $\frac{x}{30}(x-45)$ (d) $\frac{x}{45}(30-x)$

Q.9 A cable stretched between two supports 50 m apart with one end above the other by 5 m. The left support is above the right support. The cable is loaded with uniform distributed load of 10 kN/m and dip in the cable is 8 m. The distance of the lowest point measured from right support is
(a) 31 m (b) 45 m
(c) 63 m (d) 89 m

Q.10 Figure below is of force polygon of a loaded suspend cable. op, oq, or and os represent the tensions T_1, T_2, T_3 and T_4 in the segments of the cable. The value of T_1 is



(a) 30 kN (b) 50 kN
(c) 60 kN (d) 90 kN

Q.11 The funicular polygon is
(a) same as the shape of loaded cord
(b) of a triangular shape
(c) of a parabolic shape
(d) dependent on the type of loading on the cable.

Q.12 The maximum tension occurring in a suspended cable is 5 kN and horizontal tension is 4 kN. The inclination of the cable with the horizontal at the support is
(a) 23° (b) 37°
(c) 53° (d) 90°

■■■■

Answers Structural Dynamics and Cables

1. (b) 2. (a) 3. (d) 4. (d) 5. (c) 6. (a) 7. (d) 8. (d) 9. (a) 10. (b)
11. (a) 12. (b)

Explanations Structural Dynamics and Cables

3. (d)
Excitation force matrix may not be diagonal

4. (d)
Stiffness of beam,

$$k_b = \frac{48EI}{L^3}$$

$$k_b = \frac{48\times 1}{2^3} = 6 \text{ unit}$$

$$k_s = 12 \text{ unit}$$

Equivalent stiffness, k_{eq}

$$\frac{1}{k_{eq}} = \frac{1}{6}+\frac{1}{12} = \frac{3}{12}$$

(because spring are is series)

$$k_{eq} = 4 \text{ unit}$$

5. (c)

$$c = \xi c_{cr} = \xi \times 2\sqrt{km}$$

$$= 0.08 \times 2 \times \sqrt{20\times 10^3 \times 25}$$

$$= 113.14 \text{ Ns/m}$$

6. (a)

F_T(transmitted force)

$= F_0 \times T_r$

$= 1000 \times 0.25$

$= 250\ N$

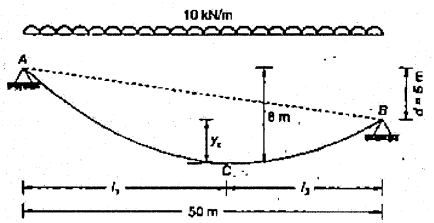
8. (d)

$$y = \frac{4y_c}{l^2}x(l-x)$$

$$= \frac{4\times 5}{30^2}\times x\times(30-x)$$

$$= \frac{x}{45}(30-x)$$

9. (a)



$$\frac{l_1}{l_2} = \left(\frac{y_c + d}{y_c}\right)^{1/1} = \left(\frac{8}{3}\right)^{1/2}$$

$$l_1 = 1.633\, l_2$$

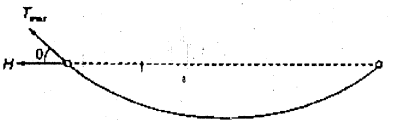
But, $l_1 + l_2 = 50$ m

$\Rightarrow$ $l_1 = 31.01$ m $\simeq 31$ m

10. (b)

$$T_1 = \sqrt{30^2 + 40^2} = 50\ kN$$

12. (b)



$T_{max} = 5$ kN

$H = 4$ kN

$H = T_{max}\cos\theta$

$$\theta = \cos^{-1}\left(\frac{4}{5}\right)$$

$\theta = 36.87° \simeq 37°$