CLASS TEST

S.No.: 03DLSKCE_JKL_11102025

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STRENGTH OF MATERIALS

CIVIL ENGINEERING

Date of Test : 11/10/2025

ANSWER KEY

1.	(c)	7.	(c)	13.	(b)	19.	(c)	25.	(b)
2.	(c)	8.	(d)	14.	(c)	20.	(c)	26.	(a)
3.	(a)	9.	(b)	15.	(b)	21.	(b)	27.	(d)
4.	(c)	10.	(b)	16.	(c)	22.	(a)	28.	(a)
5.	(a)	11.	(b)	17.	(c)	23.	(d)	29.	(a)
6.	(b)	12.	(c)	18.	(c)	24.	(d)	30.	(a)

DETAILED EXPLANATIONS

1. (c)

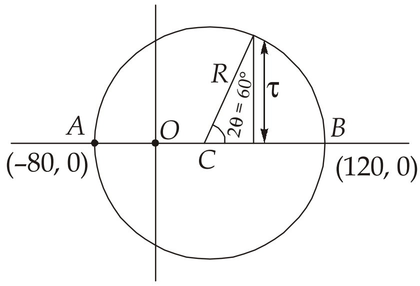
Radius, $R = \dfrac{120-(-80)}{2} = 100$

Tangential stress, $\tau = R \sin 2\theta$

$= 100 \sin 60°$

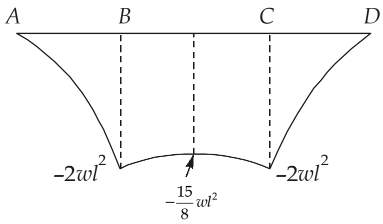
$= 100 \times \dfrac{\sqrt{3}}{2}$

$= 50\sqrt{3}$



2. (c)

The bending moment caused by load on overhang is more than by load between supports. So B.M. does not change sign throughout beam.



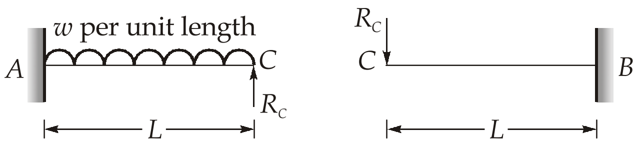
3. (a)

The value of shear stress at the top edge and bottom edge of any section will always be zero.

4. (c)

We know that at internal hinge deflection will be same at just left and right of hinge.

So,



$$(\delta_c)_{left}\downarrow = \frac{wL^4}{8EI} - \frac{R_cL^3}{3EI} \quad ...(i)$$

$$(\delta_c)_{right}\downarrow = \frac{R_cL^3}{3EI} \quad ...(ii)$$

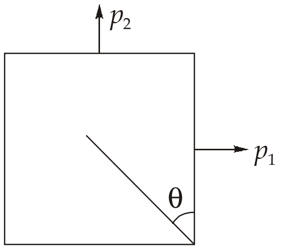
So from eq. (i) and (ii)

$$\frac{wL^4}{8EI} - \frac{R_cL^3}{3EI} = \frac{R_cL^3}{3EI}$$

$$\Rightarrow \quad \frac{2R_cL^3}{3EI} = \frac{wL^4}{8EI}$$

$$\Rightarrow \quad R_c = \frac{3}{16}wL$$

5. (a)



The maximum shear stress will occur at 45° plane from principle plane

So, $$\sigma_{@\,45} = \sigma_1 \cos^2\theta + \sigma_2 \sin^2\theta$$

$$= \frac{p_1}{2} + \frac{p_2}{2} = \frac{p_1 + p_2}{2}$$

$$\tau_{@\,45°} = \frac{p_1 - p_2}{2}$$

So, resultant stress, $$p_r = \sqrt{\sigma^2 + \tau^2} = \sqrt{\frac{p_1^2 + p_2^2 + 2p_1p_2 + p_1^2 + p_2^2 - 2p_1p_2}{4}}$$

$$= \sqrt{\frac{p_1^2 + p_2^2}{2}}$$

6. (b)

Suppose total axial load $= W$

Load carried by spring 1 $= W_A$

Load carrying by spring 2 $= W_B$

$$\delta_A = \delta_B$$

$$\Rightarrow \quad \frac{W_A}{k_A} = \frac{W_B}{k_B}$$

Also, $$W_A + W_B = W$$

$$\Rightarrow \quad W_A + \frac{k_B}{k_A} W_A = W$$

$$\Rightarrow \quad W_A\left[1 + \frac{k_B}{k_A}\right] = W$$

$$\Rightarrow \quad W_A = \frac{W}{\left[1 + \frac{k_B}{k_A}\right]}$$

Now assume equivalent stiffness as k.

So deflection, $$\delta = \frac{W}{k}$$

So, $\delta_A = \delta$

$$\Rightarrow \quad \frac{W_A}{k_A} = \frac{W}{k}$$

$$\Rightarrow \quad k = \frac{W}{W_A} k_A$$

$$\Rightarrow \quad k = \left(1+\frac{k_B}{k_A}\right)k_A$$

$$\Rightarrow \quad k = k_A + k_B$$

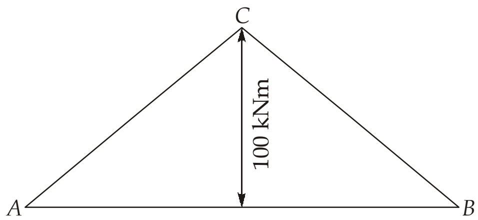
Alternatively:

The two springs are in parallel.

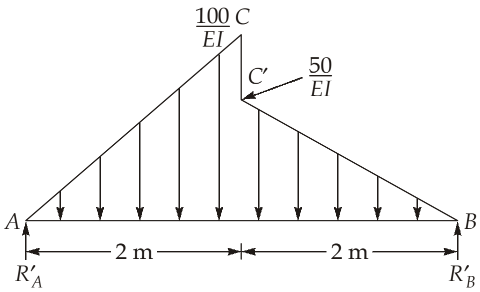
$$\therefore \quad k = k_A + k_B$$

7. (c)

BM diagram of given beam



Conjugate beam



Taking moments about B

$$R'_A \times 4 = \frac{1}{2}\times 2\times\frac{100}{EI}\left(2+\frac{2}{3}\right) + \frac{1}{2}\times 2\times\frac{50}{EI}\times 2\times\frac{2}{3}$$

$$\Rightarrow \quad R'_A = \frac{250}{3EI}$$

8. (d)

Shear span is zone of constant shear force.

9. (b)

$$\sigma_1 = 100\ \text{N/mm}^2$$

$$\sigma_2 = \sigma_3 = 0$$

Maximum shear strain energy

$$U = \frac{\mu+1}{6E}[(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2]$$

$$\therefore \quad E = 2G(1+\mu)$$

$$\therefore \qquad U = \frac{1}{12G}[(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2]$$

$$\Rightarrow \qquad U = \frac{1}{12G}(100^2+100^2)$$

$$U = \frac{5000}{3G}$$

10. (b)

$$\text{Resilience} = \frac{1}{2}\times 70\times 0.005\times 10^6 = 17.5\times 10^4 \text{ Nm/m}^3$$

$$\text{Toughness} = 17.5\times 10^4 + \left\{\frac{(70+110)}{2}\right\}\times 0.01\times 10^6$$

$$= 107.5\times 10^4 \text{ Nm/m}^3$$

11. (b)

$$\text{Total load} = 2\left[\frac{1}{2}\left(\frac{L}{2}\right)\times w_0\right] = \frac{w_0 L}{2}$$

By symmetry, $\quad R_1 = R_2 = \frac{1}{2}\times\text{Total load}$

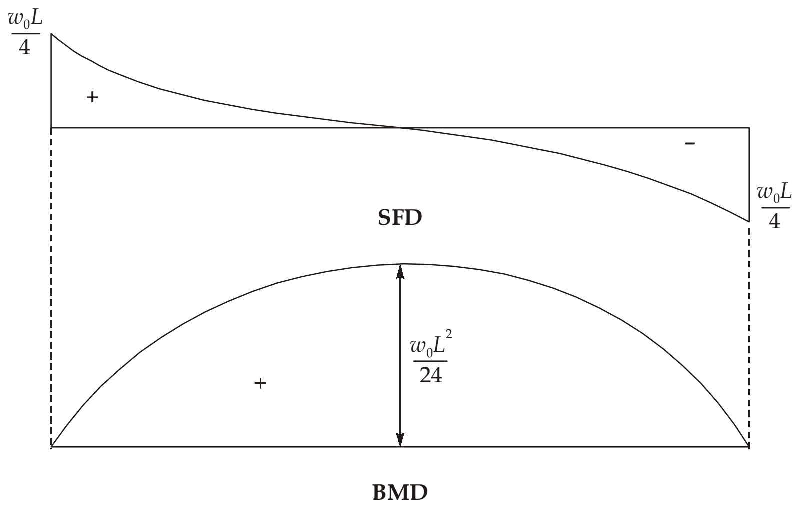
$$\Rightarrow \qquad R_1 = R_2 = \frac{w_0 L}{4}$$

Bending moment at B,

$$(M_B) = R_1\times\frac{L}{2}-\frac{1}{2}w_0\times\frac{L}{2}\times\frac{2}{3}\left(\frac{L}{2}\right)$$

$$= \frac{w_0 L}{4}\times\frac{L}{2}-\frac{w_0}{2}\times\frac{L}{2}\times\frac{2}{3}\left(\frac{L}{2}\right)$$

$$= \frac{w_0 L^2}{8}-\frac{w_0 L^2}{12} = \frac{w_0 L^2}{24}$$



12. (c)

$$\text{Force on central bar} = 200 \text{ kN}$$

$$\text{Stress in central bar} = \frac{200\times10^3}{A_2}$$

$$= \frac{200\times10^3}{\frac{\pi}{4}d^2} = \frac{254648}{d^2}$$

But this stress should not exceed, 150 N/mm^2

$$150 = \frac{254648}{d^2}$$

$$\Rightarrow \quad d = 41.2 \text{ mm}$$

$$\therefore \quad A_2 = \frac{\pi}{4}(41.2)^2 = 1333.2\,\text{mm}^2$$

$$A_1 = \frac{\pi}{4}(50)^2 = 1963.5\,\text{mm}^2$$

Let the length of middle portion be 'L_2' mm.
Hence total length of the two end portions = $2L_1$ = $(500 - L_2)$ mm

$$\therefore \quad \Delta = 0.3 = \frac{P}{E}\left[\frac{2L_1}{A_1} + \frac{L_2}{A_2}\right]$$

$$\Rightarrow \quad 0.3 = \frac{200\times10^3}{200\times10^3}\left[\frac{500-L_2}{1963.5} + \frac{L_2}{1333.2}\right]$$

$$\Rightarrow \quad 2.407L_2 \times 10^{-4} = 0.0454$$

$$\Rightarrow \quad L_2 = 188.62 \text{ mm}$$

$$\therefore \quad L_1 = \frac{1}{2}(500 - 188.62) = 155.69 \text{ mm}$$

$$\therefore \quad L_1 + L_2 = 188.62 + 155.69$$

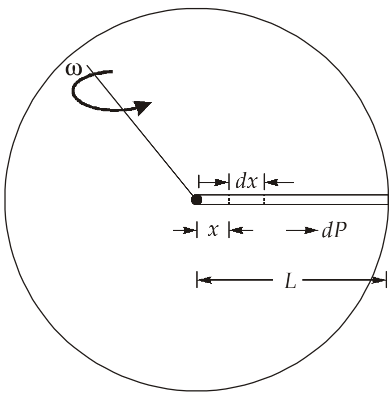
$$= 344.31 \text{ mm}$$

13. (b)

$$\delta = \frac{PL}{AE}$$

From the figure,

$$d\delta = \frac{dPx}{AE}$$



Centrifugal force on differential mass dM,

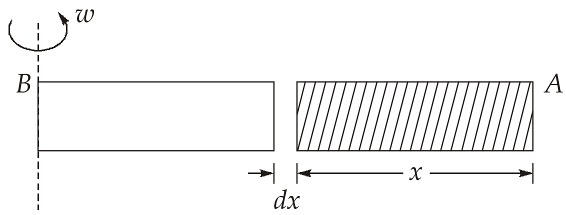
$$dP = dM\cdot \omega^2 x = (\rho A dx)\omega^2 x$$

$$\therefore \quad d\delta = \frac{\left(\rho A\omega^2 x dx\right)x}{AE}$$

$$\therefore \quad \delta = \frac{\rho\omega^2}{E}\int_0^L x^2 . dx = \frac{\rho\omega^2}{E}\left[\frac{x^3}{3}\right]_0^L$$

$$\Rightarrow \qquad \delta = \frac{\rho\omega^2}{3E}\left[L^3 - 0^3\right] = \frac{\rho\omega^2 L^3}{3E}$$

Alternate Solution:



$$m_x = \rho A x$$

Distance between the C.G. of mass to the centre of rotation,

$$r = L - \frac{x}{2}$$

Centrifugal force,
$$F = m_x w^2 r = \rho A x\left(w^2\right)\left(L - \frac{x}{2}\right)$$

Element elongation,
$$d\delta = \frac{Fdx}{AE} = \frac{Ax\rho\left(L - \frac{x}{2}\right)w^2 dx}{AE}$$

$$d\delta = \frac{\rho w^2\left(L - \frac{x}{2}\right)}{E}x.dx$$

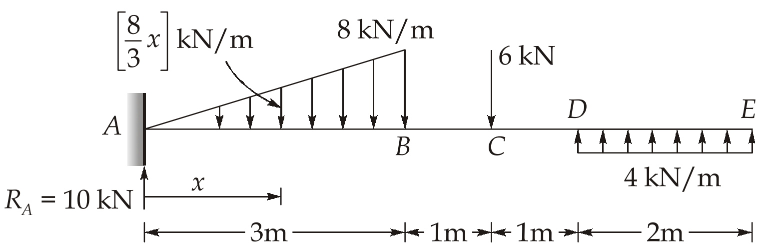
Total elongation,
$$\delta = \int_0^L \frac{\rho w^2}{E}\left(L - \frac{x}{2}\right)xdx$$

$$= \frac{\rho w^2}{E}\left[L\left(\frac{L^2}{2}\right) - \left(\frac{x^3}{6}\right)\right]_0^L$$

$$= \frac{\rho w^2}{E}\left[\frac{L^2}{2} - \frac{L^3}{6}\right]$$

$$\delta = \frac{\rho w^2 L^2}{3E}$$

14. (c)



Let at a distance 'x' from A, shear force is zero

$$\therefore \qquad SF_x = R_A - \frac{1}{2}(x)\frac{8}{3}x = 0$$

$$\Rightarrow \quad 10 = \frac{4x^2}{3}$$

$$\Rightarrow \quad x = 2.7386 \text{ m}$$

$\therefore$ Beam at distance 'x' (BM_x)

$$= 10x - \frac{1}{2}x\left(\frac{8}{3}x\right)\frac{x}{3} = 10(2.7386) - \frac{4}{9}(2.7386)^3 = 18.26 \text{ kNm}$$

15. **(b)**

Change in temperature (fall) = 400 – 300 = 100°C

Area of cross-section of rod = $\frac{\pi}{4}(20)^2 = 314.16 \text{ mm}^2$

$\because$ Wall yield by 5 mm

$$\therefore \quad \frac{p_t L}{E} = \Delta = (L\alpha t - a), \qquad \text{where } a = 5 \text{ mm}$$

$$\Rightarrow \quad p_t = \frac{E}{L}(L\alpha t - 5) = E\alpha t - \frac{5E}{L}$$

$$= \left(2\times10^5 \times 12\times10^{-6} \times 100\right) - \frac{5\times2\times10^5}{8000} = 240 - 125 = 115 \text{ N/mm}^2$$

$\therefore$ Pull, $P = pA = 115 \times 314.16$

$= 36128 \text{ N} = 36.128 \text{ kN}$

16. **(c)**

Area of tube, $A = \frac{\pi}{4}\left[40^2 - 25^2\right] = 765.8 \text{ mm}^2$

$$I = \frac{\pi}{64}\left[D^4 - d^4\right] = \frac{\pi}{64}\left[40^4 - 25^4\right] = 106488.9 \text{ mm}^4$$

We also know strain in alloy tube is,

$$\varepsilon = \frac{\delta l}{l} = \frac{4.8}{4\times10^3} = 0.0012$$

Modulus of elasticity for the alloy

$$E = \frac{\text{Load}}{\text{Area} \times \text{Strain}} = \frac{60\times10^3}{765.8\times0.0012}$$

$$= 65291.2 \text{ N/mm}^2$$

Since, column is pinned at its both ends, therefore equivalent length of the column

$$L_e = l = 4 \times 10^3 \text{ mm}$$

Euler's buckling load, $P_E = \frac{\pi^2 EI}{l_e^2} = \frac{\pi^2\times65291.2\times106488.9}{(4\times10^3)^2}\text{N}$

$= 4.29 \text{ kN}$

17. (c)

(i) Force on shaded area $= \dfrac{f_{max}}{y_{max}} Ay$

where, A is area of shaded portion, y is distance of centroid of shaded area from NA

$$Ay = 5 \times 5 \times (5 + 2.5) = 187.5 \text{ cm}^3$$

So, $$\text{Force} = \frac{80}{10} \times 187.5 = 1500 \text{ kg}$$

(ii) Moment of this force about the neutral axis

$$M = \frac{f_{max}}{y_{max}} I_o$$

(I_o = Moment of inertia of shaded area about neutral axis)

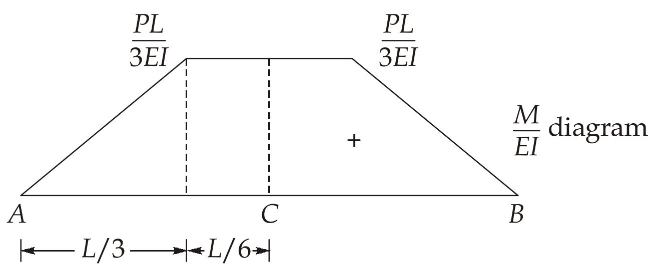
$$I_o = \frac{5 \times 5^3}{12} + 5 \times 5 \times (7.5)^2 = \frac{4375}{3} \text{ cm}^4$$

So, $$M = \frac{80}{10} \times \frac{4375}{3} = 11666.67 \text{ kg cm}$$

18. (c)

For rotation at A, we will solve it by moment area method.

So $\dfrac{M}{EI}$ diagram of given beam AB is as shown below.



So, $$\theta_{CA} = \theta_C - \theta_A = -\theta_A = \text{Area of } \frac{M}{EI} \text{ diagram between } A \text{ and } C$$

$$-\theta_A = \frac{1}{2} \times \frac{PL}{3EI} \times \frac{L}{3} + \frac{L}{6} \times \frac{PL}{3EI}$$

$$-\theta_A = \frac{PL^2}{18EI} + \frac{PL^2}{18EI} = \frac{PL^2}{9EI}$$

$\Rightarrow$ $$\theta_A = \frac{PL^2}{9EI} (\text{CW})$$

19. (c)

Torque at distance x from free end

$$T_x = \int_0^x \tau_x dx = \int_0^x \frac{kx^2}{2L^2}dx = \frac{kx^3}{6L^2}$$

Now take small element at x i.e., dx

So, $$d\theta_x = \frac{T_x dx}{GJ}$$

On integrating, $$\theta_{AB} = \int d\theta_x = \int_0^L \frac{kx^3}{6L^2}\frac{dx}{GJ} = \left[\frac{kx^4}{24L^2GJ}\right]_0^L$$

$\Rightarrow$ $$\theta_{AB} = \frac{kL^2}{24GJ}$$

20. (c)

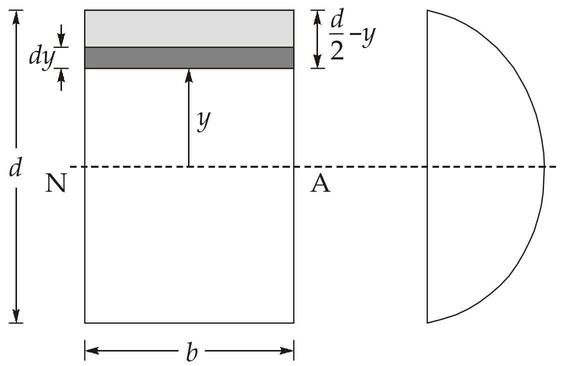
Shear centre for channel section,

$$e = \frac{3b^2}{6b+h} = \frac{b}{2+\frac{h}{3b}}$$

Now, $$\frac{h}{3b} = \frac{150}{3\times 50} = 1$$

$\therefore$ $$e = \frac{50}{2+1} = \frac{50}{3} = 16.67 \text{ mm}$$

21. (b)



Shear stress at 'y' distance from neutral axis.

$$\tau = \frac{VQ}{It}$$

Where $$Q = A\bar{y} = \left(\frac{d}{2}-y\right)b\times\left(y+\frac{\frac{d}{2}-y}{2}\right)$$

$\Rightarrow$ $$Q = \left(\frac{d}{2}-y\right)b\left(\frac{\frac{d}{2}+y}{2}\right)$$

$$\Rightarrow \qquad Q = \left(\frac{d^2}{4} - y^2\right)\frac{b}{2}$$

$$I = \frac{bd^3}{12}$$

So,
$$\tau = \frac{V\left(\frac{d^2}{4} - y^2\right)\frac{b}{2}}{\frac{bd^3}{12} \times b} = \frac{6V}{d^3 b}\left(\frac{d^2}{4} - y^2\right)$$

Now shear force carried by elementary portion

$$dF = \tau dA$$
$$= \tau b dy$$
$$dF = \frac{6V}{d^3}\left(\frac{d^2}{4} - y^2\right)dy$$

So, shear force carried by upper $1/3^{rd}$ portion:

$$F = \int_{d/6}^{d/2} \frac{6V}{d^3}\left(\frac{d^2}{4} - y^2\right)dy$$

$$= \frac{6V}{d^3}\left[\frac{d^2}{4}y - \frac{y^3}{3}\right]_{d/6}^{d/2}$$

$$= \frac{6V}{d^3}\left[\frac{d^2}{4}\frac{d}{2} - \frac{d^3}{24} - \frac{d^2}{4}\frac{d}{6} + \frac{d^3}{216 \times 3}\right]$$

$$= \frac{6V}{d^3} \times \frac{7d^3}{162}$$

$$\therefore \qquad F = \frac{7V}{27}$$

22. (a)

Direct longitudinal stress, $\sigma_x = \frac{90 \times 10^3}{30 \times 30} = 100 \text{ MPa}$

$$\varepsilon_x = \frac{1}{E}\left[-\sigma_x + \mu\left(\sigma_y + \sigma_z\right)\right] \quad \ldots(i)$$

$$\varepsilon_y = \varepsilon_z = \frac{1}{E}\left[-\sigma_y + \mu\left(\sigma_x + \sigma_z\right)\right] = 0 \quad \ldots(ii)$$

As we know, $\sigma_y = \sigma_z$

Also on solving eq. (ii)

$$\sigma_y = \frac{\mu}{1-\mu}\sigma_x = \frac{0.25}{1-0.25}\sigma_x = \frac{\sigma_x}{3}$$

So, $$\varepsilon_x = \frac{1}{E}\left[-\sigma_x + \mu\left(\sigma_y + \sigma_z\right)\right]$$

$$= \frac{1}{E}\left[-\sigma_x + \mu \times 2\sigma_y\right]$$

$$= \frac{1}{E}\left[-\sigma_x + 0.25 \times 2 \times \frac{\sigma_x}{3}\right]$$

$$= \frac{1}{E}\left[-\sigma_x + \frac{0.5}{3}\sigma_x\right]$$

$$= \frac{1}{100 \times 10^3}\left[-100 + 0.5 \times \frac{100}{3}\right]$$

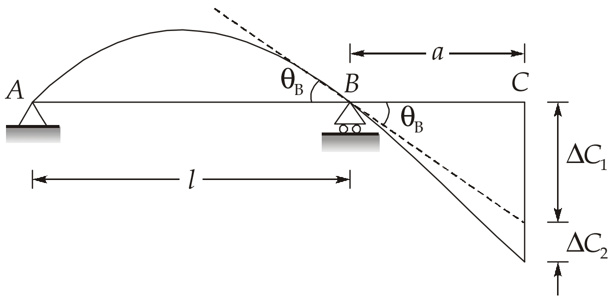
$\therefore$ $$\varepsilon_x = \frac{1}{100 \times 10^3}\left[-\frac{250}{3}\right]$$

$\therefore$ $$\delta l = l\varepsilon_x = \frac{1}{100 \times 10^3}\left[-\frac{250}{3}\right] \times 100$$

$$= -0.083 \text{ mm}$$

23. (d)

The deformation of the beam will be as shown below.



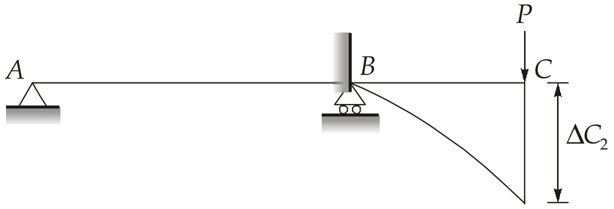
Now ΔC_1 is produced due to deflection of C as caused due to deformation of AB,

$$\Delta C_1 = \theta_B (BC) = \theta_B a$$

$$\theta_B = \frac{M_{BA} l}{3EI} = \frac{Pal}{3EI}$$

$\therefore$ $$\Delta C_1 = \frac{Pala}{3EI} = \frac{Pa^2 l}{3EI}$$

ΔC_2 is produced due to deformation of BC



$$\Delta C_2 = \frac{Pa^3}{3EI}$$

So total deflection at $C, \Delta C = \Delta C_1 + \Delta C_2$

$$= \frac{Pa^2 l}{3EI} + \frac{Pa^3}{3EI}$$

24. (d)

Stress developed in the bar,

$$\sigma = \frac{P}{A}\left[1+\sqrt{1+\frac{2AEh}{Pl}}\right]$$

$$= \frac{15\times10^3}{2500}\left[1+\sqrt{1+\frac{2\times2500\times200\times10^3\times10}{15\times10^3\times3\times10^3}}\right]$$

$$= 6[1+14.9] = 95.4\ \text{N/mm}^2$$

We know that volume of bar,

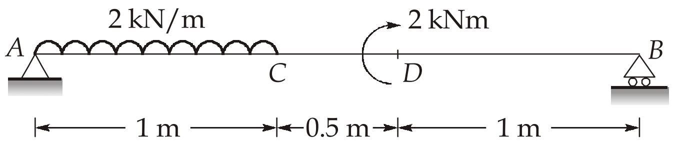
$$V = l.A$$
$$= 3\times10^3\times2500$$
$$= 7.5\times10^6\ \text{mm}^3$$

$\therefore$ Strain energy stored in the bar,

$$U = \frac{\sigma^2}{2E}V = \frac{(95.4)^2}{2\times200\times10^3}\times7.5\times10^6\ \text{Nmm}$$

$$= 170.6\ \text{Nm}$$

25. (b)



$$\Sigma M_A = 0$$

$\Rightarrow$ $R_B\times2.5 = 2\times1\times0.5+2 = 3$

$\Rightarrow$ $R_B = 1.2\ \text{kN}$

$\therefore$ $R_A = 2\times1-1.2 = 0.8\ \text{kN}$

So, $M_A = 0$

$M_C = 0.8\times1-2\times1\times0.5 = -0.2\ \text{kNm}$

$M_{D\,@\,\text{left}} = 0.8\times1.5-2\times1 = -0.8\ \text{kNm}$

$M_{D\,@\,\text{right}} = -0.8+2 = 1.2\ \text{kNm}$

$M_B = 0$

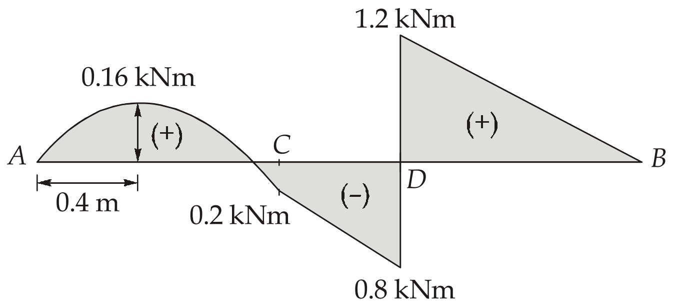
In AC, let S.F. is zero at as distance 'x' from A.

$\therefore$ $0.8-2x = 0$

$\Rightarrow$ $x = 0.4\ \text{m}$

So $$M_{\text{at } x=0.4\text{ m}} = 0.8\times0.4-2\times0.4\times\frac{0.4}{2}$$

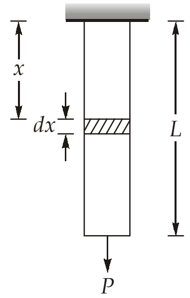
$$= +0.16\ \text{kNm}$$



BMD

So value of maximum bending moment in the beam = 1.2 kNm.

26. (a)



The axial load P_x acting on the element shown shaded in the figure is

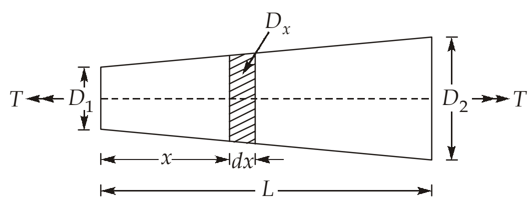
$$P_x = \gamma A(L - x) + P$$

$$U = \int_0^L \frac{P_x^2 dx}{2EA}$$

$$\Rightarrow \quad U = \int_0^L \frac{[\gamma A(L-x)+P]^2 dx}{2EA}$$

$$\Rightarrow \quad U = \frac{\gamma^2 AL^3}{6E} + \frac{\gamma PL^2}{2E} + \frac{P^2 L}{2EA}$$

27. (d)



Consider an element of length dx at distance x from the smaller diameter end.

The diameter of the elemental slice is

$$D_x = D_1 + \left(\frac{D_2 - D_1}{L}\right)x = D_1 + kx$$

where, $$k = \frac{D_2 - D_1}{L}$$

Corresponding polar moment of inertia of the shaft at the section under consideration

$$J_x = \frac{\pi D_x^4}{32} = \frac{\pi(D_1 + kx)^4}{32}$$

The angle of twist over the length dx can be obtained from the relation

$$\frac{T}{J_x} = \frac{G d\theta_x}{dx}$$

$$d\theta_x = \frac{T dx}{G J_x}$$

Therefore,
$$d\theta_x = \frac{T}{G}\left[\frac{32}{\pi(D_1 + kx)^4}\right]dx$$

The total angle of twist over the entire length is

$$\theta = \frac{32T}{\pi G}\int_0^L \frac{dx}{(D_1 + kx)^4} = \frac{32T}{\pi G}\int_0^L (D_1 + kx)^{-4}\,dx$$

$$= \frac{32T}{\pi G}\left[-\frac{(D_1 + kx)^{-3}}{3k}\right]_0^L = \frac{32T}{3\pi Gk}\left[-\frac{1}{(D_1 + kx)^3}\right]_0^L$$

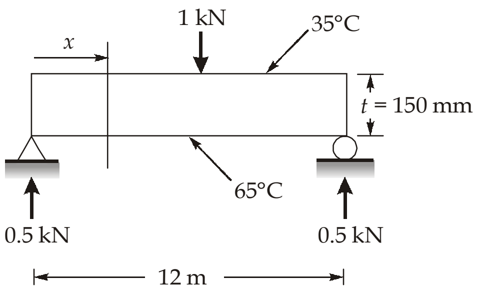
$$= \frac{32T}{3\pi Gk}\left[-\frac{1}{(D_1 + kL)^3} + \frac{1}{D_1^3}\right]$$

$$= \frac{32TL}{3\pi G(D_2 - D_1)} \times \left(\frac{D_2^3 - D_1^3}{D_1^3 D_2^3}\right)$$

$$= \frac{32TL}{3\pi G} \times \left(\frac{D_2^2 + D_1^2 + D_1 D_2}{D_1^3 D_2^3}\right) \quad \text{(Standard result, remember)}$$

28. (a)

Apply unit load at mid span



Moment due to unit load, $m = \frac{1}{2}x \qquad \text{for } 0 \le x \le 6$

As bottom temperature is more, hence

$$d\theta = \frac{dx\,\alpha T}{t} = \frac{dx \times 0.75 \times 10^{-7} \times (65 - 35)}{0.150}$$

$$d\theta = 1.5 \times 10^{-5}\,dx$$

Using unit load method,

$$1 \cdot \Delta = m \cdot d\theta$$

$$1.\ \Delta = 2\int_0^6 \frac{x}{2} \times 1.5 \times 10^{-5} dx$$

$$\Delta = 2.7 \times 10^{-4} \text{ m}$$

$$= 0.27 \text{ mm}$$

29. (a)

$$A = 50 \times 150 = 7500 \text{ mm}^2$$

$$\bar{y} = 25 \text{ mm from } NA$$

$$P = \frac{\sigma_{max}}{y_{max}} A\bar{y}$$

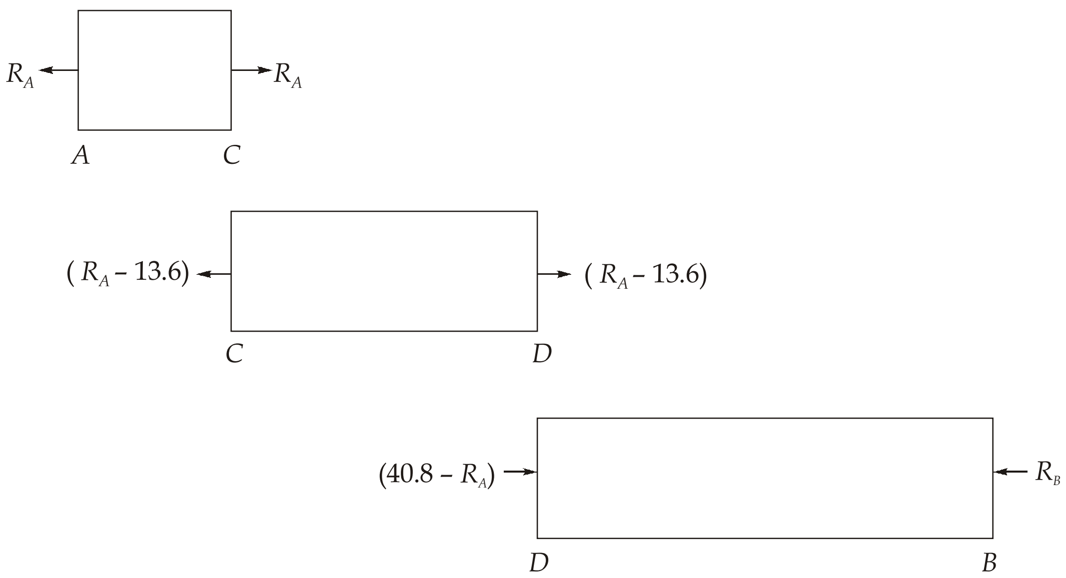
$$= \frac{8}{100} \times 7500 \times 25$$

$$= 15000 \text{ N}$$

$$= 15 \text{ kN}$$

30. (a)

Free body diagram is shown below,



$$R_A + R_B = 40.8 \qquad \text{...(i)}$$

$$\text{Total change in length} = 0$$

So, $\delta_{AC} + \delta_{CD} + \delta_{DB} = 0$

$$\frac{R_A \times 100}{AE} + \frac{(R_A - 13.6) \times 200}{AE} - \frac{(-R_A + 40.8) \times 300}{AE} = 0$$

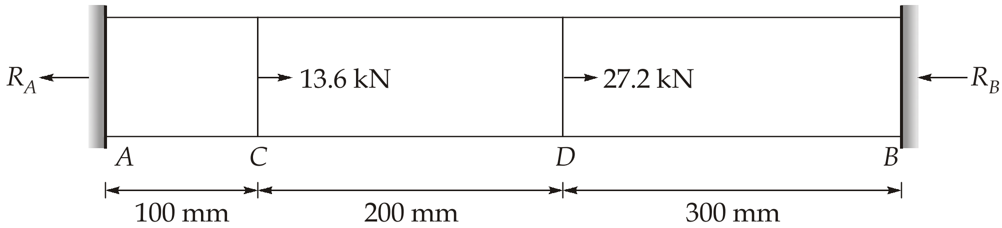
$\Rightarrow$ $R_A + 2R_A - 27.2 + 3R_A - 122..4 = 0$

$\Rightarrow$ $R_A = 24.93 \text{ kN}$

$$R_B = (40.8 - R_A) = -15.87 \text{ kN}$$

So ratio of magnitude of reactions i.e., $\dfrac{R_A}{R_B} = \dfrac{24.93}{15.87} = 1.57$

Alternatively:



$$R_A = \frac{13.6\times500}{600} + \frac{27.2\times300}{600} = 24.93\text{kN}$$

$$R_B = \frac{27.2\times300}{600} + \frac{13.6\times100}{600} = 15.87\text{kN}$$

$\therefore$ Ratio of $\left(\dfrac{R_A}{R_B}\right) = \dfrac{24.93}{15.87} = 1.57$

■■■■