Strength of Materials Test 2

Number of Questions 35 **Time:60 min.**

Directions for questions 1 to 35: Select the correct alternative from the given choices.

1. Circular beams of uniform strength can be made by varying diameter in such a way that
(A) $\frac{\sigma}{y}$ is constant (B) $\frac{E}{R}$ is constant
(C) $\frac{M}{R}$ is constant (D) $\frac{M}{Z}$ is constant

2. A beam of length 8 meters carries a point load 100 kN at its centre. The beam is fixed at both ends. The fixing moment (kN-m) at the ends is
(A) 200 (B) 100
(C) 400 (D) 800

3. If the two axes about which the product of inertia is found, are such that the product of inertia becomes zero, the two axes are called
(A) centroidal axes
(B) major and minor axes
(C) principal axes
(D) none of the above

4. A bolt is made to pass through a tube and both of them are tightly fitted with the help of washers and nuts. If the nut is tight ended, then
(A) bolt and tube are subjected to compressive load.
(B) bolt and tube are subjected to tensile load
(C) bolt is subjected to compressive load, while tube is subjected to tensile load.
(D) bolt is subjected to tensile load while tube is subjected to compressive load.

5. If the values of modulus of elasticity and Poisson's ratio for an alloy body 200 GPa and 0.25 respectively, the value of modulus of rigidity for the alloy (GPa) will be
(A) 160 (B) 134
(C) 320 (D) 80

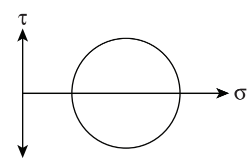
6. A solid circular shaft is subjected to pure torsion. The ratio of maximum shear stress to maximum normal stress at any point would be
(A) 1 : 2 (B) 2 : 1
(C) 1 : 1 (D) 2 : 3

7. A mass of 100 kg falls on a spring of stiffness 8 kN/m from a height of 10 m. The deflection caused in the first fall is
(A) 1.226 m (B) 1.11 m
(C) 1.49 m (D) 1.56 m

8. In case of a beam of triangular cross-section subjected to transverse loading, the maximum shear stress developed in the beam is greater than the average shear stress by
(A) 50% (B) 33%
(C) 150% (D) 25%

9. A uniformly distributed load w (kN/m) is acting over the entire length of a 8 m long simply supported beam. If the bending moment at the midpoint of simply supported beam is 16 kN-m, what is the value of *w*?
(A) 3 (B) 2
(C) 4 (D) zero

10. Consider the Mohr's circle shown below.



What is the state of stress represented by this circle?
(A) $\sigma_x \neq \sigma_y, \tau_{xy} = 0$ (B) $\sigma_x = \sigma_y = 0, \tau_{xy} \neq 0$
(C) $\sigma_x = \sigma_y, \tau_{xy} = 0$ (D) $\sigma_x \neq 0, \sigma_y = \tau_{xy} = 0$

11. A beam of length '*L*' is fixed at both the ends. A concentrated load of 12 kN is acting on it at its midspan. What is the slope (in radians) at fixed end? (*EI* = Flexural rigidity of the beam)
(A) $\frac{12L^2}{16EI}$ (B) $\frac{12L^2}{2EI}$
(C) Zero (D) $\frac{12L^2}{24EI}$

12. A bar of copper and steel form a composite system. They are heated to a temperature of 60°C. What type of stress is induced in the steel bar?
(A) Compressive
(B) Tensile
(C) Both tensile and compressive
(D) Shear

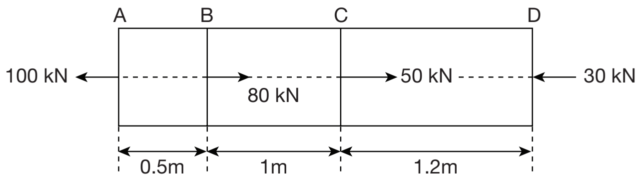
13. A point of a body is subjected to plane stress. The value of maximum and minimum principal stresses are –20 MPa and –100 MPa respectively. The design is to be done on the basis of the maximum shear stress theory. Then yielding will just begin if the designer chooses a ductile material whose yield strength (MPa) is
(A) 40 (B) 60
(C) 120 (D) 80

14. The material of a rubber balloon has a Poisson's ratio of 0.5. If uniform pressure is applied to blow the balloon, the volumetric strain of the material will be
(A) 0.5 (B) 0.25
(C) zero (D) 0.20

15. The number of independent elastic constants for isotropic material is

(A) 2 (B) 9
(C) 21 (D) 17

16. A steel bar having cross-sectional area of 1000 mm^2 is subjected to axial forces as shown in figure

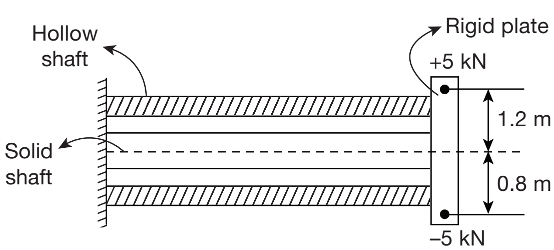


If modulus of elasticity (E) = 120 GPa, then the total elongation (mm) of the bar will be
(A) 0.883 (B) 0.583
(C) 0.283 (D) 0.383

17. A brass bar 500 mm long and 100 mm × 100 mm in cross-section is subjected to an axial pull in the direction of its length. If the increase in volume of the bar is 50 mm^3, then the magnitude of the pull (kN) will be (Take E = 100 GPa and μ = 0.25)
(A) 20 (B) 30
(C) 25 (D) 15

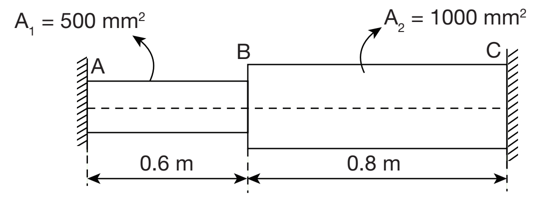
18. A thin cylinder of mean radius 100 mm thickness = 2.5 mm is subjected by 5 MPa (gauge) internal pressure along with 2 kN-m twisting moment. The magnitude of maximum shear stress (MPa) will be
(A) 12.7 (B) 51.6
(C) 100 (D) 200

19. A solid brass shaft and a hollow steel shaft are rigidly attached to a rigid plate at one end and are fixed at other end. The rigid plate can rotate and it is subjected by two force of 5 kN magnitude along the axis (⊥ to the paper). If G_{steel} = 1.2 G_{brass} (G = Modulus of rigidity), then the maximum stress (MPa) induces in the hollow shaft will be



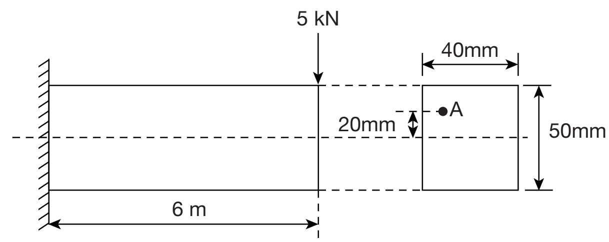
Outer radius of hollow shaft = 5 cm
Inner radius of hollow shaft = 4 cm
Radius of solid shaft = 3 cm
(A) 78.4 (B) 62.4
(C) 86.9 (D) 72.9

20. A steel rod ABC is firmly held between two rigid supports A and C as shown in the figure. If the rod is heated through 30°C then the stress developed in portion AB of the rod will be
(Take $\alpha = 12 \times 10^{-6}/°C$ and E = 200 GPa)



(A) 43.84 MPa (B) 50.4 MPa
(C) 100.8 MPa (D) 54.75 MPa

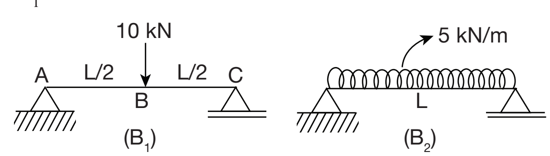
21. A cantilever beam of span 6 m is subjected to transverse shear force of 5 kN at free end. Beam is having rectangular cross-section of dimension 40 mm × 50 mm. Determine the magnitude of shear stress (kPa) on an element A lying at a distance of 20 mm from neutral axis.



(A) 1250 (B) 2500
(C) 5000 (D) 1350

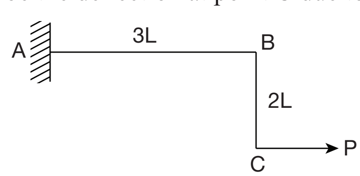
22. A motor shaft consists of a tube 50 mm external diameter and 4 mm thick. The engine develops 12 kW at 2000 rpm. If the power is transmitted through 4:1 gearing, then the maximum stress (MPa) in the tube will be
(A) 4.65 (B) 18.67
(C) 8.23 (D) 9.33

23. The diagrams show the details of two simply supported beams B_1 and B_2. EI is constant throughout the beam length and same for both the beams. The beams have the same area of cross-section and the same depth. What is the ratio of maximum bending stress in B_2 to B_1?



(A) $\frac{L}{4}$ (B) $\frac{L}{2}$
(C) L (D) $L/8$

24. What will be the deflection at point C due to load P?



(A) $\frac{42PL^3}{6EI}$ (B) $\frac{27PL^3}{2EI}$

(C) $\frac{27PL^3}{8EI}$ (D) $\frac{44PL^3}{3EI}$

25. If ε_x and ε_y are the maximum and minimum strains respectively in a point in a stressed material, then what is the expression for the minimum principal stress?

(A) $E\varepsilon_y$ (B) $E(\varepsilon_y + \mu\varepsilon_x)$

(C) $\frac{E}{(1-\mu^2)}(\varepsilon_y + \mu\varepsilon_x)$ (D) $\frac{E}{(1-\mu^2)}(\varepsilon_x + \mu\varepsilon_y)$

26. Match List-I (End conditions of columns) with List-II (equivalent length in terms of length of hinged column) and select the correct answer using codes given the lists:

	List-I		List-II
P.	Both ends fixed	1.	2L
Q.	Both ends hinged	2.	$\frac{L}{\sqrt{2}}$
R.	One end fixed and other end free.	3.	L
S.	One end fixed and other end hinged	4.	$\frac{L}{2}$

	P	Q	R	S
(A)	4	1	3	2
(B)	4	3	1	2
(C)	2	4	1	3
(D)	2	1	4	3

27. Plane stress at a point in a body is defined by principal stresses 4σ and 2σ. The ratio of the normal stress to the maximum shear stress on the plane of maximum shear stress will be

(A) 3 (B) 2

(C) 4 (D) 1

28. A closely-coiled helical spring of round steel wire 6 mm in diameter having 12 complete coils of 60 mm mean diameter is subjected to an axial load of 200 N. Determine maximum shear (MPa) in the material.

(A) 130.1 (B) 141.5

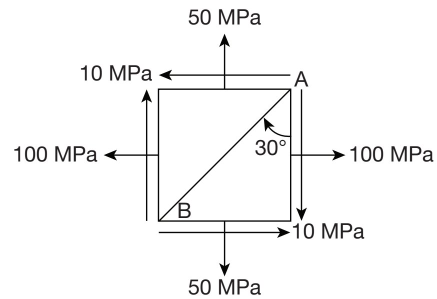
(C) 193.6 (D) 162.5

29. A steel bar of rectangular cross-section (40 mm × 50 mm) and hinge at each end subjected by axial compressive force. If the proportional limit of the material is 230 MPa and modulus of elasticity (E) = 200 GPa, then determine the minimum length for which Euler's equation of column can be applied to determine buckling load.

(A) 1.29 m (B) 2.14 m

(C) 0.98 m (D) 1.07 m

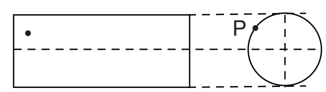
30. For the state of stress at a point as shown in figure, determine the normal stress (MPa) and shear (MPa) on the plane AB.



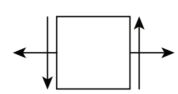
(A) 96.16 and–16.65 (B) 121.16 and 26.65

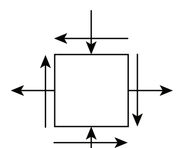
(C) 123.3 and–16.65 (D) 144.95 and–3.84

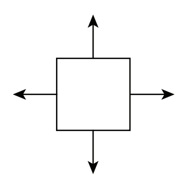
31. A thin cylinder with closed lids is subjected to internal pressure and supported at the ends as shown in the figure.

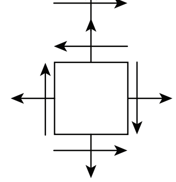


The state of stress at point P is as represented as

(A) 

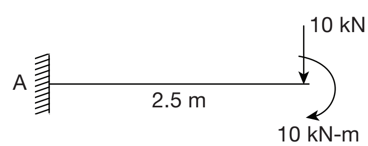
(B) 

(C) 

(D) 

Common Data Question 32 and 33:

A cantilever beam 2.5 m long is loaded with a shear force and a bending moment as shown in the figure. Flexural rigidity of the beam is 1.9×10^{12} N-mm^2.



32. The maximum slope (in radians) of the beam will be

(A) 0.0031 (B) 0.296

(C) 0.0296 (D) 0.0043

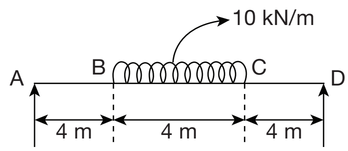
33. The maximum deflection (in m) of the beam will be

(A) 0.044 (B) 0.126

(C) 0.0056 (D) 0.44

Linked Answer Question 34 and 35:

A massless beam has a loading pattern as shown in the figure. The beam is of rectangular cross-section with a width of 50 mm and height of 120 mm.



34. The maximum bending moment occurs at

(A) 5.6 m from *D* (B) 4.8 m from *D*
(C) 3 m from *A* (D) 4.4 m from *A*

35. The maximum magnitude of bending stress (in MPa) is given by

(A) 512 (B) 640
(C) 596 (D) 674

Answer Keys

1. D	**2.** B	**3.** C	**4.** D	**5.** D	**6.** C	**7.** D	**8.** A	**9.** B	**10.** A
11. C	**12.** B	**13.** D	**14.** C	**15.** A	**16.** C	**17.** A	**18.** B	**19.** D	**20.** C
21. D	**22.** B	**23.** A	**24.** D	**25.** C	**26.** B	**27.** A	**28.** B	**29.** D	**30.** A
31. C	**32.** C	**33.** A	**34.** D	**35.** B					

Hints and Explanations

1. For same strength of beam to bear an applied bending moment, *M*/*Z* should be constant. Choice (D)

2. $M = \frac{WL}{8} = \frac{100 \times 8}{8} = 100$ kN-m Choice (B)

3. Choice (C)

4. Choice (D)

5. $E = 2G(1 + \mu)$

$\Rightarrow \frac{200}{2 \times (1 + 0.25)} = G \Rightarrow G = 80$ GPa Choice (D)

6. For pure torsion

$\tau_{max} = \tau$

$\sigma_{1,2} = \pm\tau$

$\therefore \quad \tau_{max} : \sigma_{max} = \tau : \tau = 1:1$ Choice (C)

7. Equation of conservation of energy

$mgh = \frac{1}{2}kx^2$

$\Rightarrow \quad 100 \times 9.81 \times 10 = \frac{1}{2} \times 8000 \times x^2$

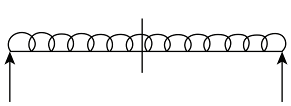
$\Rightarrow \quad x = 1.566$ m Choice (D)

8. $\tau_{max} = 1.5\ \tau_{avg}$

$\tau_{max} = \tau_{avg} + 0.5\ \tau_{avg}$

or $\tau_{max} = \tau_{avg} + 50\%\ \tau_{avg}$ Choice (A)

9.



Bending moment at midpoint $= \frac{wL^2}{8}$

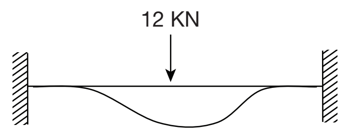
$\Rightarrow 16 = \frac{w \times 8^2}{8}$

$\Rightarrow \quad w = 2$ kN/m Choice (B)

10. $\sigma_x = \sigma_1$; $\sigma_y = \sigma_2$ and $\sigma_x \neq \sigma_y$

$\tau_{xy} = 0$ Choice (A)

11.



Slope at the fixed ends is zero. Choice (C)

12. Co-efficient of thermal expansion (α) of copper is more than that of steel. While heating the copper bar extends more than that of steel. Hence for no strain, copper bar is subjected to compressive stress and steel bar is subjected to tensile stress.

$\alpha_{copper} > \alpha_{steel}$ Choice (B)

13. Maximum shear stress theory

$\tau_{max} = \frac{\sigma_x - \sigma_y}{2} = \frac{\sigma_{yield\ point}}{2}$

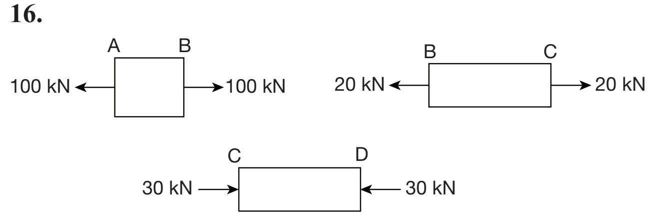
$\Rightarrow \sigma_{yield\ point} = \frac{-20 + 100}{1} = 80$ Choice (D)

14. Volumetric strain, $\in_v = \frac{\delta V}{V} = \frac{(1 - 2\mu)}{E}(\sigma_x + \sigma_y + \sigma_z)$

$\Rightarrow \quad \in_v = 0\ (\mu = 0.5)$ Choice (C)

15. Choice (A)

16.



$\delta L = \frac{1}{AE}\left[P_1L_1 + P_2L_2 + P_3L_3\right]$

$\delta L = \frac{1}{(1000 \times 120)}\left[(100 \times 0.5) + (20 \times 1) - (30 \times 1.2)\right] \times 1000$

$\Rightarrow \quad \delta L = 0.283$ mm Choice (C)

17. Volumetric strain, $\in_v = \frac{\delta V}{V} = \frac{(1-2\mu)}{E}\sigma_x$

V = Volume = (500 × 100 × 100)

$V = 5 \times 10^6$ mm^3

$\delta V = 50$ mm^3

$\mu = 0.25$

$$\frac{50}{(5\times10^6)} = \frac{(1-2\times0.25)}{100\times10^3}\times\frac{P}{(100\times100)}$$

P = 20 kN Choice (A)

18. $\sigma_h = \sigma_x = \frac{PD}{2t} = \frac{5\times10^6\times0.2}{2\times2.5\times10^{-3}}$

⇒ $\sigma_h = \sigma_x = 200$ MPa

$\sigma_L = \sigma_y = \frac{PD}{4t} = 100$ MPa

$$\tau_{xy} = \frac{T}{2\pi r^2 t} = \frac{2000}{2\times\pi\times0.1^2\times0.0025}$$

⇒ $\tau_{xy} = 12.74$ MPa

$$\tau_{max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\tau_{max} = \sqrt{\left(\frac{200-100}{2}\right)^2 + 12.74^2} = 51.6 \text{ MPa}$$

Choice (B)

19. Parallel arrangement

$\theta_s = \theta_h$

$$\left(\frac{T_s \times L}{GJ}\right)_s = \left(\frac{T_h L}{GJ}\right)_h$$

$$\frac{T_s \times L_s \times 32}{G_s \times \pi \times 0.06^4} = \frac{T_h \times L_h \times 32}{G_h \times \pi \times (0.1^4 - 0.08^4)}$$

∴ $L_s = L_h$ and $G_s = 1.2G_b$

∴ $T_s = 0.183\ T_h$

Now $T_s + T_h = 5(1.2 + 0.8) = 10$ kN-m

∴ $T_s = 1.547$ kN-m

$T_h = 8.453$ kN-m

$$\therefore (\tau_{max})_{hollow} = \frac{16\times8.543}{\pi\times0.1^3\times\left\{1-\frac{0.08^4}{0.10^4}\right\}}$$

= 72.91 MPa Choice (D)

20. $(\text{Thermal Load})_{AB} = (\text{Thermal Load})_{BC}$

∴ $(\sigma_t A_1)_{AB} = (\sigma_t A_2)_{BC}$

⇒ $(\sigma)_{AB} \times 5 \times 10^{-4} = (\sigma_t)_{BC} \times 1 \times 10^{-3}$

⇒ $(\sigma)_{AB} = 2(\sigma_t)_{Bc}$ ------------- (1)

Free expansion, $\delta L_{AB} = L_1 \times \alpha \times \Delta t = 0.6 \times 12 \times 10^{-6} \times 30$

⇒ $\delta L_{AB} = 2.16 \times 10^{-4}$ m

$\delta L_{BC} = L_2 \times \alpha \times \Delta t = 0.8 \times 12 \times 10^{-6} \times 30$

⇒ $\delta L_{BC} = 2.88 \times 10^{-4}$ m

$\delta L_{total} = \delta L_{AB} + \delta L_{BC}$

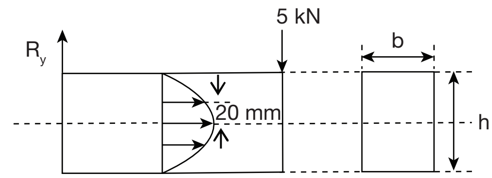
⇒ $(2.16 + 2.88) \times 10^{-4} = \left(\frac{\sigma_t L}{E}\right)_{AB} + \left(\frac{\sigma_t L}{E}\right)_{BC}$

⇒ $0.6(\sigma_t)_{AB} + 0.8(\sigma_t)_{BC} = 1008 \times 10$ (2)

From equation (1) and (2)

$(\sigma_t)_{AB} = 100.8$ MPa and $(\sigma_t)_{BC} = 50.4$ MPa Choice (C)

21\. Shear stress $= \frac{R_y}{2I}\left[\frac{h^2}{4} - y^2\right]$



$R_y = 5$ kN; $h = 50$ mm; b = 40 mm

$$I = \frac{bh^3}{12} = \frac{0.04 \times 0.05^3}{12} = 4.167\times10^{-7} \text{ m}^4$$

$$�(\tau)_{y=20mm} = \frac{5000}{(2\times4.167\times10^{-7})}\times\left[\frac{0.05^2}{0.4} - 0.02^2\right]$$

= 1350 kPa Choice (D)

22. 4:1 gearing

$N = 2000/4 = 500$ rpm

Power, $P = \frac{2\pi NT}{60} \Rightarrow 12 = \frac{2\pi\times500\times T}{60}$

⇒ T = 0.23 kN-m

Torque transmitted by the shaft (T)

$$T = \frac{\pi}{16}\tau\left[\frac{D^4 - d^4}{D}\right]$$

$$0.23 \times 10^3 = \frac{\pi}{16} \times \tau \times \left[\frac{0.05^4 - 0.042^4}{0.05}\right]$$

$\tau = 18.67$ MPa Choice (B)

23. Bending stress, $\sigma_b = \frac{M_{y_{max}}}{I}$

∴ $A_1 = A_2$, $h_1 = h_2$

∴ $\sigma_b \propto M$

Now $\frac{(\sigma_{b2})_{max}}{(\sigma_{b1})_{max}} = \frac{(M_{max})_1}{(M_{max})_2}$

$(M_{max})_1 = 5L/2$; $(M_{max})_2 = \frac{5L^2}{8}$

$$\therefore \frac{(\sigma_{b2})_{max}}{(\sigma_{b1})_{max}} = \frac{5L^2}{8}\times\frac{2}{5L} = \frac{L}{4}$$

Choice (A)

24. Total strain energy $= \frac{1}{2}P \times \delta$

$$(S.E)_{BC} = \int_0^{2L}\frac{M^2\,dx}{2EI} = \int_0^{2L}\frac{(Px)^2}{2EI}dx$$

$$\Rightarrow (S.E)_{BC} = \frac{P^2 L^3}{6EI}$$

$$(S.E)_{AB} = \int_0^{3L} \frac{M^2\,dx}{2\,EI} = \int_0^{3L} \frac{(2PL)^2}{2\,EI}dx$$

$$(S.E)_{AB} = \frac{4P^2 L^2}{2\,EI}(3L) = \frac{12\,P^2 L^3}{2\,EI}$$

$$\text{Total } S.E = \frac{8P^2 L^3}{6EI} + \frac{12\,P^2 L^3}{2\,EI} = \frac{22}{3}\frac{P^2 L^3}{EI}$$

$$\Rightarrow \frac{22\,P^2 L^3}{3\;\;EI} = \frac{1}{2}P\times\delta$$

$$\therefore \delta = \frac{44\,P\,L^3}{3\,EI}$$ Choice (D)

25. $\varepsilon_x = \frac{1}{E}[\sigma_x - \mu\sigma_y]$ and $\varepsilon_y = \frac{1}{E}[\sigma_y - \mu\sigma_x]$

$\Rightarrow$ $E\varepsilon_x = \varepsilon_x - \mu\sigma_y$ (1)

and $E\varepsilon_y = \sigma_y - \mu\,\sigma_x$ (2)

$\sigma_x = E\varepsilon_x + \mu\,\sigma_y$ {From equation (1)} (3)

$\sigma_y = E\varepsilon_y + \mu\,\sigma_x$ {From equation (2)} (4)

Putting σ_x from equation (3) to equation (4)

$\sigma_y = E\varepsilon_y + \mu[E\varepsilon_x + \mu\,\sigma_y]$

$\Rightarrow$ $\sigma_y = E\varepsilon_y + \mu E\,\varepsilon_x + \mu^2\,\sigma_y$

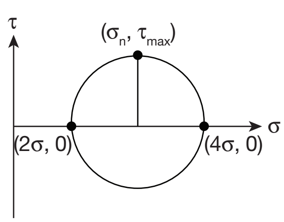
$\Rightarrow$ $\sigma_y(1 - \mu^2) = E[\varepsilon_y + \mu\,\varepsilon_y]$

$$\Rightarrow \sigma_y = \frac{E}{\left(1-\mu^2\right)}\left[\varepsilon_y + \mu\varepsilon_x\right]$$ Choice (C)

26. Choice (B)

27. $$\tau_{\max} = \frac{\sigma_1 - \sigma_2}{2} = \frac{4\sigma - 2\sigma}{2} = \sigma$$

$$\sigma_n = 2\sigma + \frac{2\sigma}{2} = 3\sigma$$



$$\frac{\sigma_n}{\tau_{\max}} = \frac{3\sigma}{\sigma} = 3$$ Choice (A)

28. $$PR = \frac{\pi}{16}\times\tau\times d^3$$

$$200\times 0.03 = \frac{\pi}{16}\times\tau\times(0.006)^3$$

$\Rightarrow$ $\tau = 141.47$ MPa Choice (B)

29. $\sigma_w = 230$ MPa, $E = 200$ GPa

$$P_{cr} = \frac{\pi^2\,E\,I_{\min}}{L^2} = \sigma_{cr}\times A$$

$\sigma_{cr} < \sigma_w$

$$\therefore \frac{\pi^2\times 200\times 10^9\times 0.05\times 0.04^3}{12\times L^2\times 0.04\times 0.05} < 230\times 10^6$$

$\therefore$ $L > 1.07$ m Choice (D)

30. $$\sigma_n = \frac{1}{2}\left(\sigma_x + \sigma_y\right) + \frac{1}{2}\left(\sigma_x - \sigma_y\right)\text{Cos}\,2\theta + \tau_{xy}\,\text{Sin}\,2\theta$$

$$\Rightarrow \sigma_n = \frac{1}{2}(100+50) + \frac{(100-50)}{2}\text{Cos}\,60^o + 10\,\text{Sin}\,60^o$$

$\Rightarrow$ $\sigma_n = 96.16$ MPa

$$\tau_s = -\frac{1}{2}\left(\sigma_x - \sigma_y\right)\text{Sin}\,2\theta + \tau_{xy}\cos 2\theta$$

$$\Rightarrow \tau_s = -\frac{1}{2}(100-50)\sin 60^o + 10\times\cos 60^o$$

$\Rightarrow$ $\tau_s = -16.65$ Choice (A)

31. Point P is subjected to longitudinal stress and hoop stress only which are tensile in nature due to pressure. Therefore there is no shear stress. Choice (C)

32. Maximum slope at $B(\theta_B)$ = slope due to bending moment + slope due to shear force.

$$\therefore \theta_B = \frac{WL^2}{2EI} + \frac{ML}{EI}$$

$$\Rightarrow \theta_B = \frac{10\times 10^3\times 2.5^2}{2\times 1.9\times 10^{12}\times 10^{-6}} + \frac{10\times 10^3\times 2.5}{1.9\times 10^{12}\times 10^{-6}}$$

$\Rightarrow$ $\theta_B = 0.0296$ radian Choice (C)

33. Maximum deflection at B = Deflection due to bending moment + Deflection due to shear force.

$$\therefore Y_B = \frac{WL^3}{3\,EI} + \frac{ML^2}{2\,EI}$$

$$\Rightarrow Y_B = \frac{WL^2}{EI}\left[\frac{L}{3} + \frac{1}{2}\right]\{\because W = M\}$$

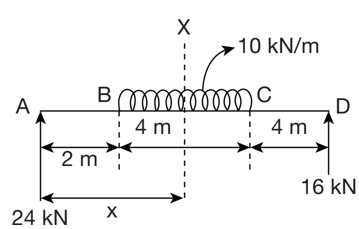
$$\Rightarrow Y_B = \frac{10\times 10^3\times 2.5^2}{1.9\times 10^6}\left[\frac{2.5}{3} + \frac{1}{2}\right]$$

$\Rightarrow$ $Y_B = 0.044$ m Choice (A)

34. Reactions at A and C

$$R_A = \frac{40\times 6}{10} = 24\,\text{kN}$$

$$R_D = \frac{40\times 4}{10} = 16\,\text{kN}$$



Taking any section $x - x$ at a distance of x from A.

Shear force = 24 – 10(x – 2)
Maximum bending moment occurs where shear force = 0

$\therefore$ 24 – 10(x – 2) = 0
24 = 10x – 20
x = 4.4 m

$\therefore$ Maximum $B.M$ occurs at 4.4 m from A.

Choice (D)

35. Maximum Bending moment

$$(\text{B.M})_{\max} = 24x \times \frac{10(x-2)^2}{2} \quad \text{at } x = 4.4$$

$= (24 \times 4.4) - 5[4.4 - 2]^2$

$(B.M)_{\max} = 76.8$ kN-m

Bending stress, $\sigma_b = \frac{M}{Z} = \frac{76.8 \times 6}{0.05 \times 0.12^2}$

$\Rightarrow \quad \sigma_b = 640$ MPa

Choice (B)