



**POSTAL
BOOK PACKAGE**

2025

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**MECHANICAL
ENGINEERING**

Objective Practice Sets

Strength of Materials

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Properties of Materials

MCQ and NAT Questions

- Q.1** In a tensile test, near the elastic limit zone
- tensile stress increases at a faster rate
 - tensile stress decreases at a faster rate
 - tensile stress increases in linear proportion to the strain
 - tensile stress decreases in linear proportion to the strain

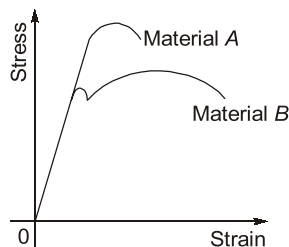
- Q.2** Consider the following statements:
- Mild steel is more elastic than rubber.
 - Young's modulus of a material is used to represent the elasticity of the material.
 - Greater the Young's modulus, greater the elasticity.

Which of the above statement(s) is/are correct?

- Only 2
- 1 and 3
- 2 and 3
- 1, 2 and 3

- Q.3** Which of the following properties is more sensitive to increase in strain rate?
- Yield strength
 - Elastic limit
 - Proportional limit
 - Tensile strength

- Q.4** The stress-strain diagram for two materials A and B is shown below:



The following statements are made based on this diagram:

- Material A is more brittle than material B.
- The ultimate strength of material B is more than that of A.

With reference to the above statements, which of the following applies?

- Both the statements are false
- Both the statements are true
- I is true but II is false
- I is false but II is true

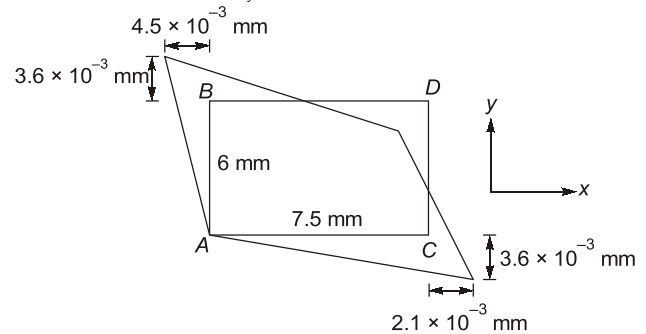
- Q.5** As soon as the external forces causing deformation in a perfectly elastic body, are withdrawn, the elastic deformation disappears
- only partially
 - completely over a prolonged period of time
 - completely and instantaneously
 - completely after an initial period of rest

- Q.6** Consider the following statements:
- Strain-softening region in stress strain curve is also known as post ultimate stress.
 - Logarithmic strain given as $\bar{\epsilon} = \ln\left(\frac{L_f}{L_0}\right)$ is same as true strain.
 - Value of elastic modulus is a definite property of a material.

Which of the above statements is(are) INCORRECT?

- 1 and 3
- 2 only
- 1 only
- None of these

- Q.7** An initially rectangular element of a material is deformed as shown in figure. The shear strain for the element (γ_{xy}), will be



- 1370×10^{-6}
- 1500×10^{-6}
- 1230×10^{-6}
- 900×10^{-6}

Select the correct answer using the codes given below.

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

Q.24 The following observation refer to two metal specimens 'A' and 'B' of the same size subjected to uni-axial tension test upto failure.

- The elastic strain energy of A is more than that of B.
- Area under stress strain curve of A is less than that of B.
- The yield strength of A is more than that of B.
- The percentage elongation of A and B at elastic limit are equal.

Which of the following statements is true in this regard?

- (a) Specimen A is more ductile than specimen B.
(b) Specimen B is more ductile than specimen A.
(c) The ductility of two specimens are equal.
(d) The data is insufficient to compare the ductilities of the two specimens.

Q.25 A steel bar of length 3 m has yield stress 250 MPa and the slope of linear part of stress-strain curve is 190 GPa. The bar is loaded axially until it elongates 6 mm and then the load is removed. What is the residual strain in bar?

- (a) 0.002 (b) 0.00131
(c) 0.00069 (d) None of these

Q.26 The initial diameter of a cylindrical test specimen is 30 mm. During plastic deformation stage, it shows a diameter of 27 mm. Assuming the specimen is ductile material. The true longitudinal strain is _____ (Answer up to two decimal place)

Q.27 Consider the following statements regarding tension test of a specimen:

- Gauge length for specimen is $5.65\sqrt{A}$, where A is cross-sectional area of specimen.
- True rupture stress is much more than nominal rupture stress in specimen.
- For steel specimen, proportionality limit is more than elastic limit.
- Steel specimen breaks at ultimate stress.

Which of the above statements are CORRECT?

- (a) 1 and 2 (b) 1 and 3
(c) 2, 3 and 4 (d) 3 and 4

Multiple Select Questions (MSQ)

Q.28 Consider the following statements with reference to ductile materials and choose the correct statement(s) :

- (a) Large deformation is possible before absolute failure by rupture takes place.
(b) In ductile material, elastic deformation is more predominant than plastic one.
(c) Drawn permanently with great changes of shape without rupture.
(d) It can be beaten or rolled into plates.

Q.29 Which of the following statements is(are) correct?

- (a) The greatest strain energy stored in a body is called proof resilience.
(b) The quantity of strain energy stored in a body when strained upto elastic limit is called proof resilience.
(c) The least energy stored in a body is called proof resilience.
(d) Ability to absorb mechanical energy upto failure is called toughness.



Answers Properties of Materials

1. (c) 2. (d) 3. (b) 4. (c) 5. (c) 6. (c) 7. (c) 8. (d) 9. (c) 10. (b)
11. (d) 12. (c) 13. (0.85) 14. (d) 15. (a) 16. (d) 17. (b) 18. (b) 19. (c) 20. (b)
21. (a) 22. (b) 23. (b) 24. (b) 25. (c) 26. 0.21 27. (a) 28. (a, c) 29. (a, b, d)

Shear Centre

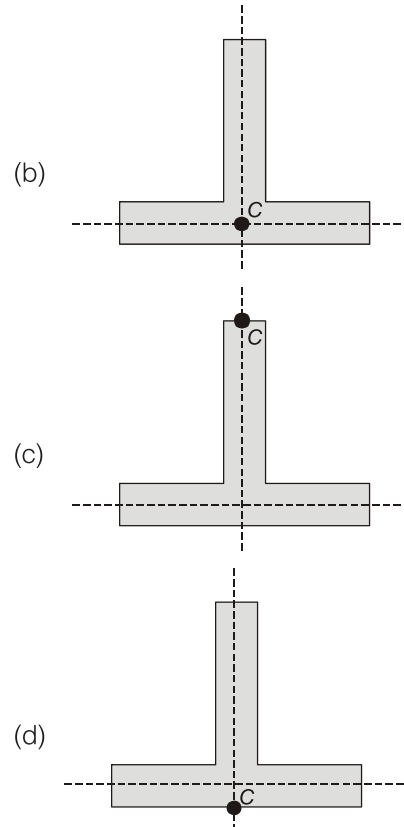
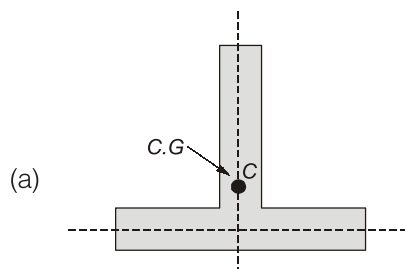
MCQ and NAT Questions

- Q.1** The shear centre may be defined as
- the point through which the resultant of the shear stresses pass
 - the point through which the moment of the shear flow is zero
 - the point through which the resultant of the shear flow passes
 - the centre of gravity of the section
- Q.2** Which one of the following statements specifies shear flow?
- Flow of shear force along the beam
 - It is the product of the shear stress at any level and the corresponding width b (of the section)
 - Unbalanced force on any side of given section divided by area of section
 - The deformation at any level due to sudden variation in shear stress
- Q.3** Consider the following statements:
- If a beam has two axes of symmetry even then shear centre does not coincide with the centroid.
 - For a section having one axis of symmetry, the shear centre does not coincide with the centroid but lies on the axis of symmetry.
 - If a load passes through the shear centre, then there will be only bending in the cross-section and no twisting.

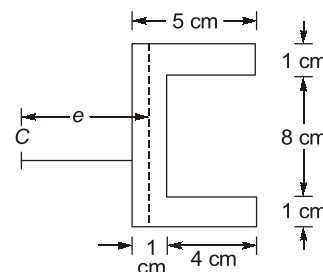
Which of these statements are correct?

- 1, 2 and 3
- 1 and 2
- 2 and 3
- 1 and 3

- Q.4** In a thin-wall T-section, the shear centre C is located at the point shown in



- Q.5** The following figure refers to a channel section of uniform thickness of 1 cm used as a beam with the cross-sectional dimensions shown in cm units. Moment of inertia of channel I_{xx} be equal to 246 cm^4 and C be the shear centre, then the value of e in cm is equal to



- 1.4
- 2.5
- 2.25
- 1.67

11. (a)

Laminated springs are loaded at the end and supported at the centre. These are commonly used in trucks, trolleys & others goods carrying vehicles.

12. (6)

Maximum shear stress induced in spring wire of a helical compression spring is given by,

$$\tau_{\max} = \frac{8WD}{\pi d^3} k_W \quad \text{or} \quad \frac{8WC}{\pi d^2} k_W$$

$$\tau_{\max} \propto \frac{1}{d^2}$$

$$[\because W_1 = W_2 = W; C_1 = C_2 \text{ (i.e., } C = \frac{D}{d}) \\ (k_W)_1 = (k_W)_2 = k_W]$$

$$\frac{\tau_2}{\tau_1} = \left(\frac{d_1}{d_2}\right)^2$$

$$\frac{\tau_2}{24} = \left(\frac{d}{2d}\right)^2$$

$$\Rightarrow \tau_2 = 6 \text{ MPa}$$

13. (8.243)

$$\text{Stiffness of helical spring, } K = \frac{Gd^4}{64R^3n}$$

d = spring wire diameter

R = mean coil radius

n = number of turns

$$\therefore K \propto d^4$$

$$\frac{K'}{K} = \left(\frac{d'}{d}\right)^4$$

$$K' = \left(\frac{1.02d}{d}\right)^4 K = 1.08243 K$$

$$\% \text{ increase in stiffness} = \frac{K' - K}{K} \times 100\%$$

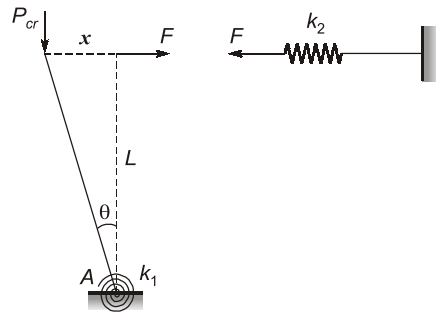
$$= \left(\frac{1.08243K - K}{K}\right) \times 100\% = 8.243\%$$

14. (b)

$$f_s = \frac{16wR}{\pi d^3}$$

$$\therefore w_{\max} = \frac{\pi d^3}{16R} (f_s)_{\max} = \frac{\pi \times (10)^3}{16 \times 50} \times 80 = 100 \pi \text{ N}$$

15. (c)



From geometry $x = L\theta$

Taking moment about A,

$$\Sigma M_A = 0$$

$$P_{cr} \times x = k_1\theta + FL$$

$$P_{cr} \times x = k_1\left(\frac{x}{L}\right) + k_2xL$$

$$P_{cr} = \frac{k_1}{L} + k_2L$$

16. (c)

$$\tau = \frac{16T}{\pi d^3}$$

{ \therefore Shear stress in closed coiled helical spring is mainly due to torsional effect}

$$\tau = \frac{16PR}{\pi d^3} = \frac{16 \times 200\pi \times 25}{\pi \times (10)^3} \\ = 80 \text{ N/mm}^2$$

17. (c)

Let mean coil diameter = D

Wire diameter = d

$$\text{Given, } \frac{D}{d} = 10$$

To find $(D - d) = ?$

$$\tau = \frac{16PR}{\pi d^3} \leq 80$$

$$\frac{16 \times (160\pi) \times \frac{D}{2}}{\pi \left(\frac{D}{10}\right)^3} \leq 80$$

$$\frac{128 \times 10^4}{80} \leq D^2$$

$$D \geq 126.49 \text{ mm}$$

$$\therefore D = 126.5 \text{ mm}$$

$$d = 12.65 \text{ mm}$$

$$\therefore D - d = 113.85$$

$$= 11.38 \text{ cm} \approx 11.4 \text{ cm}$$

