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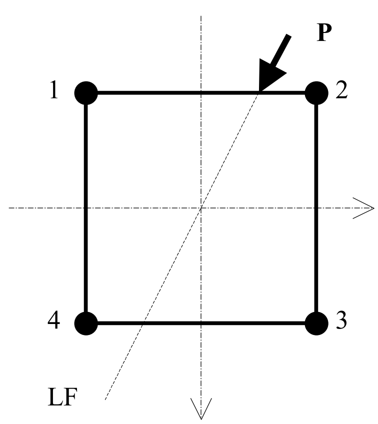
STRENGTH OF MATERIALS II

1) The following relation exists between the neutral axis and the load trace in case of skew bending:

a) the neutral axis passes through the cross–section centroid and through the other two quadrants than the load trace; a) □
b) the neutral axis passes through the cross-section centroid and through the same quadrants as the load trace; b) □
c) the neutral axis does not pass through the cross-section centroid and is perpendicular to the load trace; c) □
d) the neutral axis does not pass through the cross-section centroid and intersects the load trace under a different angle from $\pi/2$. d) □

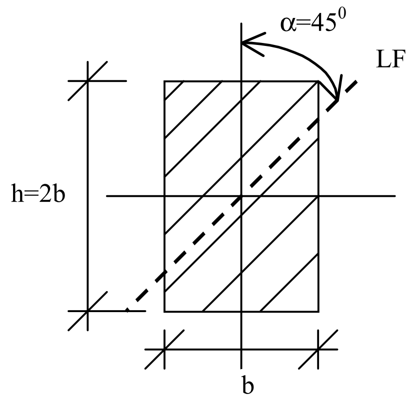
2) On the section shown in the figure, belonging to a cantilever subjected to skew bending by the force P, the maximum positive stress occurs at point:

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



a) □
b) □
c) □
d) □

3) The rectangular section shown in the following figure is subjected to skew bending. The angle between the principal centroidal axes of the section and the load trace is $\alpha = 45^{o}$. What is the maximum normal stress, when the bending moment produced by the loads at this section is M?



a) $\frac{2\sqrt{2}}{b^3}M$ a) ☐

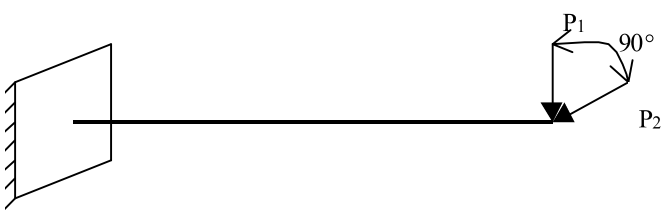
b) $\frac{4\sqrt{2}}{b^4}M$ b) ☐

c) $\frac{8\sqrt{2}}{b^3}M$ c) ☐

d) $\frac{9\sqrt{2}}{4b^3}M$ d) ☐

4) The beam presented in the figure is subjected to:

a) combined bi-axial bending, shear and torsion; a) ☐
b) bi-axial bending; b) ☐
c) combined bi-axial bending and shear; c) ☐
d) combined bi-axial bending and torsion. d) ☐



5) The eccentric compression produced by a normal force to the element cross-sectional plane, that has the point of application on one of the section principal centroidal axes is equivalent to:

a) combined bending, shear and concentric compression; a) ☐
b) combined bi-axial bending and concentric compression; b) ☐
c) combined bending and concentric compression; c) ☐
d) combined bi-axial bending, shear and concentric compression. d) ☐

6) When the eccentric compressive or tensile force point of application is located on one of the principal axes of the element cross-section, the neutral axis is:

a) perpendicular to this axis; a) □
b) parallel to this axis; b) □
c) coincident to this axis; c) □
d) inclined with respect to this axis under an angle different from $\pi/2$. d) □

7) In case of eccentric tension or compression, when the neutral axis rotates around a fixed point, the force point of application moves along a line:

a) that does not pass through the centroid of the element cross-section; a) □
b) that passes through the centroid of the element cross-section; b) □
c) that coincides to one of the cross-section principal axes; c) □
d) that is tangent to the section. d) □

8) When the eccentric compressive force acts inside the contour of the section central core, the neutral axis:

a) intersects the cross-section, but does not pass through its centroid; a) □
b) does not intersect the cross-section; b) □
c) is tangent to the cross-section boundary; c) □
d) intersects the cross-section and passes through its centroid. d) □

9) The contour of the central core for a circular cross-section, D in diameter, is a circle with the diameter:

a) $\frac{D}{2}$ a) □
b) $\frac{D}{8}$ b) □
c) $\frac{D}{16}$ c) □
d) $\frac{D}{4}$ d) □

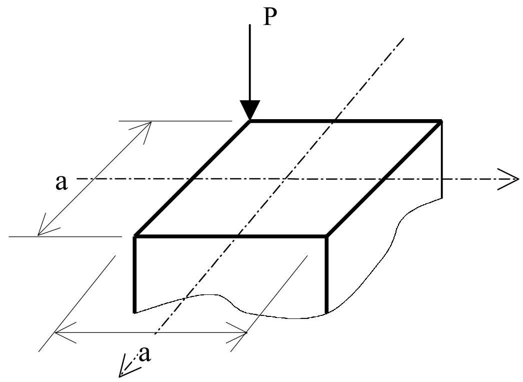
10) On the following section the maximum stress (absolute value) is:

a) $\frac{4P}{a^2}$ a) ☐

b) $\frac{5P}{2a^2}$ b) ☐

c) $\frac{7P}{a^2}$ c) ☐

d) $\frac{8P}{a^2}$ d) ☐



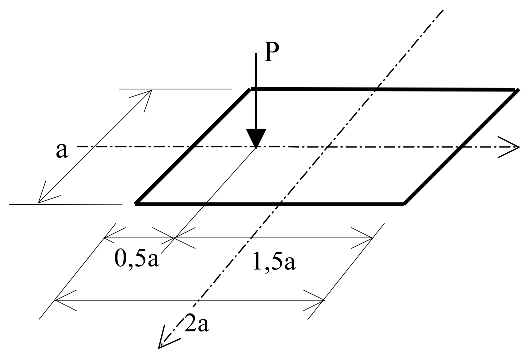
11) The section presented in the figure is made of a material that cannot resist tension. What is the maximum stress (absolute value) on the section?

a) $\frac{2P}{3a^2}$ a) ☐

b) $\frac{4P}{3a^2}$ b) ☐

c) $\frac{3P}{2a^2}$ c) ☐

d) $\frac{2P}{a^2}$ d) ☐



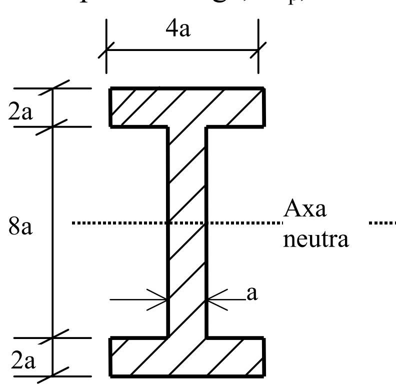
12) The modulus of section for bending in the plastic range, W_p, of the following section is:

a) $96a^3$ a) ☐

b) $108a^3$ b) ☐

c) $48a^3$ c) ☐

d) $64a^3$ d) ☐



13) At the moment when a section subjected to bending is entirely plasticized, the neutral axis divides the section in two parts characterized by:

a) equal areas; a) □
b) equal first moments of area with respect to the neutral axis; b) □
c) equal moments of inertia with respect to the neutral axis; c) □
d) equal heights. d) □

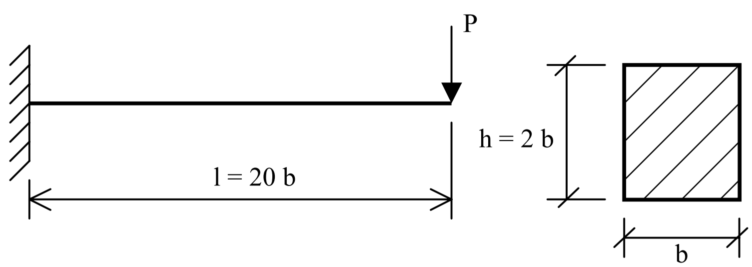
14) The elastic load, P_e, for the beam presented in the figure, is:

a) $\dfrac{b^2\sigma_c}{15}$ a) □

b) $\dfrac{b^2\sigma_c}{120}$ b) □

c) $\dfrac{b^2\sigma_c}{30}$ c) □

d) $\dfrac{2b^2\sigma_c}{15}$ d) □

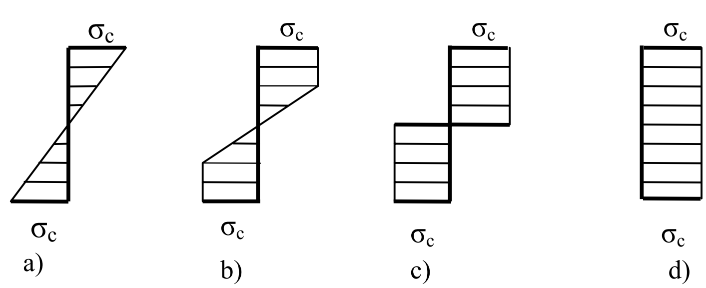


15) The ultimate load, P_u, for the beam shown in the figure, is:

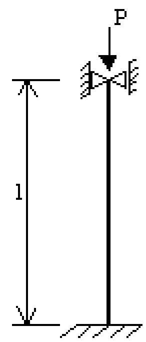
a) $150t^2\ \sigma_c$ a) □
b) $20{,}5t^2\ \sigma_c$ b) □
c) $50t^2\ \sigma_c$ c) □
d) $9{,}04t^2\ \sigma_c$ d) □

16) The stress distribution adopted in the plastic design of beams subjected to bending, at a section where a plastic hinge occurs, has the following shape:

a) □
b) □
c) □
d) □



17) The effective length for a bar subjected to concentric compression is:



a) 0,7l
b) 0,5l
c) l
d) 2l

a) □
b) □
c) □
d) □

18) The buckling of a member subjected to concentric compression occurs when:

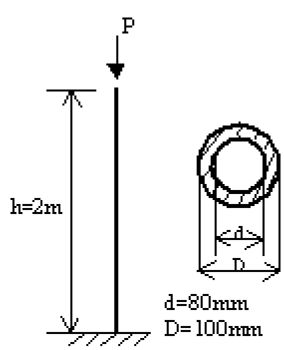
a) $\lambda < \lambda_e = \pi\sqrt{\dfrac{E}{\sigma_e}}$ a) □

b) $\lambda > \lambda_e = \pi\sqrt{\dfrac{E}{\sigma_e}}$ b) □

c) $\lambda < \lambda_e = \pi\sqrt{\dfrac{\sigma_e}{E}}$ c) □

d) $\lambda > \lambda_e = \pi\sqrt{\dfrac{\sigma_e}{E}}$ d) □

19) The slender coefficient, λ, for the member with circular hollow section, shown in the figure, is approximately equal to:



a) 84
b) 56
c) 125
d) 197

a) □
b) □
c) □
d) □

20) The buckling coefficient, φ, is:

a) lower than unity and increases with element slenderness increasing; a) ☐
b) greater than unity and increases with element slenderness increasing; b) ☐
c) lower than unity and increases with element effective length increasing; c) ☐
d) lower than unity and decreases with element slenderness increasing. d) ☐

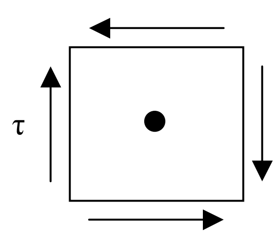
21) The allowable buckling load for a member subjected to concentric compression is:

a) $P_{af} = \varphi\, \sigma_{ac} \cdot A$ a)
b) $P_{af} = \sigma_{ac} \cdot A$ b)
c) $P_{af} = \sigma_c \cdot A$ c)
d) $P_{af} = \varphi\, \sigma_c\, A$ d)

22) According to the maximum distorsional strain energy theory, the equivalent stress, σ_{eq} at a point of a beam subjected to combined bending and shear is:

a) $\sigma_{eq} = \sqrt{\sigma^2 + 3\tau^2}$ a)
b) $\sigma_{eq} = \frac{1}{2}\sqrt{\sigma^2 + 4\tau^2}$ b)
c) $\sigma_{eq} = \frac{\sigma}{2} + \frac{1}{2}\sqrt{\sigma^2 + 4\tau^2}$ c)
d) $\sigma_{eq} = \frac{\sigma}{2} - \frac{1}{2}\sqrt{\sigma^2 + 4\tau^2}$ d)

23) According to the maximum normal stress theory, the equivalent stress, σ_{eq} at a point of an element subjected to torsion is:



a) 2τ a)
b) $\tau(1+\nu)$ b)
c) $\tau\sqrt{3}$ c)
d) τ d)

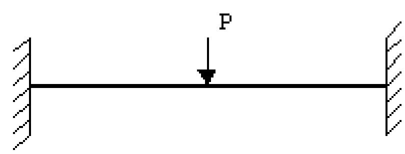
24) The stress state at a point is defined by the following stress tensor: $T_\sigma = \begin{bmatrix} \sigma_0 & 0 \\ 0 & 2\sigma_0 \end{bmatrix}$

What is the equivalent stress, σ_{eq} at the point, according to the maximum distorsional strain energy theory?

a) $\sigma_0\sqrt{2}$ a) □
b) $\sigma_0\sqrt{3}$ b) □
c) σ_0 c) □
d) $\frac{\sigma_0}{2}$ d) □

25) What is the number of plastic hinges that determine the occurrence of the collapse mechanism for the beam shown in the figure?

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



26) The critical load for the column presented in the figure is:

a) $P_{cr} = \frac{\pi^2 EI_z}{l^2}$ a) □

b) $P_{cr} = \frac{\pi^2 EI_z}{4l^2}$ b) □

c) $P_{cr} = \frac{\pi^2 EI_y}{l^2}$ c) □

d) $P_{cr} = \frac{\pi^2 EI_y}{4l^2}$ d) □