CATEDRA DE MECANICA CONSTRUCTIILOR
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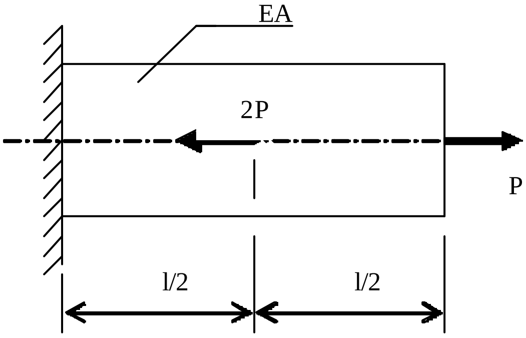
STRENGTH OF MATERIALS 1

1) The axial displacement of the section from the free end of the structural element shown in the following figure is:



a) $\frac{Pl}{2EA}$

b) $\frac{Pl}{EA}$

c) $-\frac{2Pl}{EA}$

d) 0

a)
b)
c)
d)

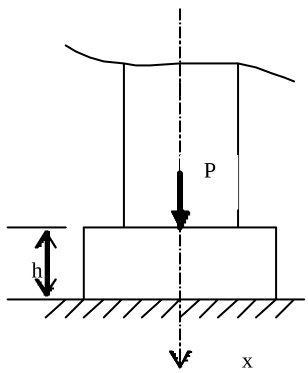
2) The cross-sectional area of the foundation block for the column shown in the following figure loaded by a force P is determined by using the relation:

a) $A_{nec} = \frac{P}{\sigma_{0teren} - \gamma_{beton}.h}$

b) $A_{nec} = \frac{P}{\sigma_{0beton} - \gamma_{beton}.h}$

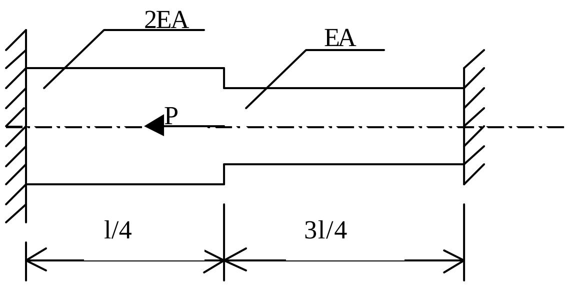
c) $A_{nec} = \frac{P + \gamma_{beton}.h}{\sigma_{0teren}}$

d) $A_{nec} = \frac{P + \gamma_{beton}.h}{\sigma_{0beton}}$



a)
b)
c)
d)

3) The maximum stress in absolute value for the following element loaded by a force P is:



a) $\frac{P}{7EA}$

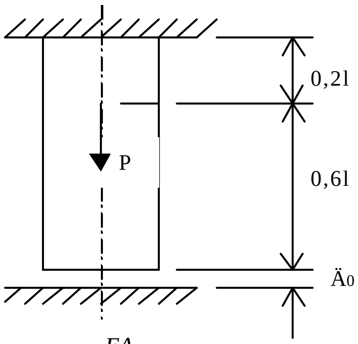
b) $\frac{6P}{14A}$

c) $\frac{P}{14A}$

d) $\frac{2P}{7EA}$

a)
b)
c)
d)

4) The maximum stress produced by the force P in the steel bar shown in the figure is given by the relation:



$P > \frac{EA}{0,2l} \cdot \Delta_0$

a) $\sigma_x = \frac{0,2P}{A} - \frac{\Delta_0 E}{l}$

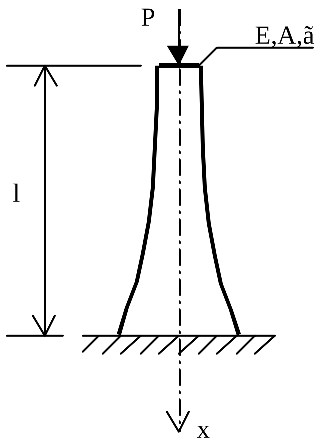
b) $\sigma_x = \frac{0,2P}{l} + \frac{\Delta_0 E}{l}$

c) $\sigma_x = \frac{0,8P}{A} + \frac{\Delta_0 E}{l}$

d) $\sigma_x = \frac{0,8P}{A} - \frac{\Delta_0 E}{l}$

a)
b)
c)
d)

5) The normal stress, σ_x and axial displacement, u diagrams along a constant stress beam, when the own weight is considered are:



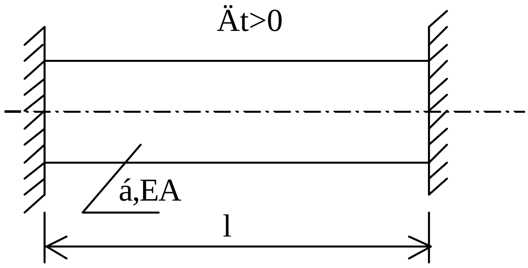
a) constant for σ_x linear for u — a)

b) linear for σ_x constant for u — b)

c) linear for σ_x parabolic for u — c)

d) constant for σ_x parabolic for u — d)

6) The normal stress in a bar of constant cross-section, subjected to an uniform temperature change $\Delta t > 0$ is:



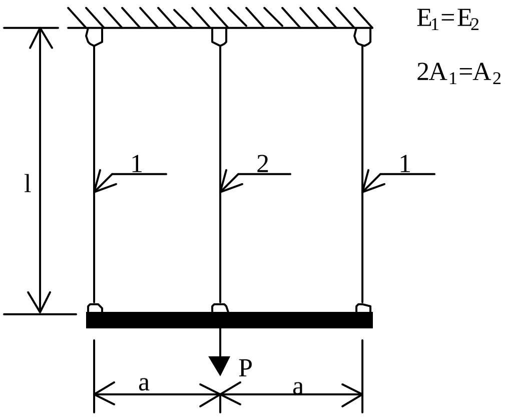
a) $- EA\alpha\Delta t$ — a)

b) $El\ \alpha\Delta t$ — b)

c) $- E\alpha\Delta t$ — c)

d) $l\alpha\Delta t$ — d)

7) The axial force in the bar 2 of the system shown in the figure is:



a) $N_2 = \frac{P}{3}$

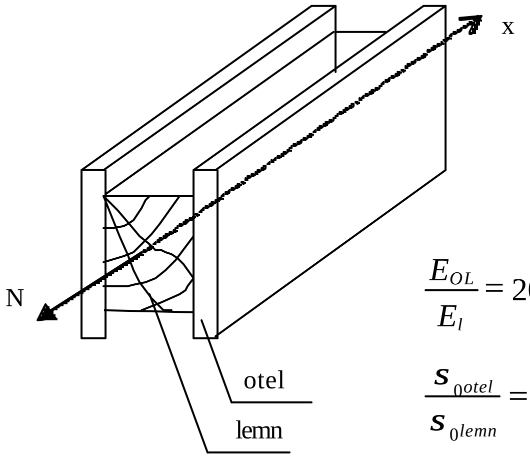
b) $N_2 = \frac{P}{2}$

c) $N_2 = \frac{2P}{3}$

d) $N_2 = \frac{P}{4}$

a)
b)
c)
d)

8) The carrying capacity of the non-homogeneous element shown in the following figure is:



$\frac{E_{OL}}{E_l} = 20$

$\frac{\sigma_{0otel}}{\sigma_{0lemn}} = 16$

a) $N_{cap} = A_{lemn}\sigma_{0lemn} + A_{otel}\cdot\sigma_{o\ otel}$

b) $N_{cap} = A_{otel}\sigma_{o\ otel} + A_{lemn}\frac{\sigma_{ootel}}{20}$

c) $N_{cap} = A_{lemn}\sigma_{olemn} + A_{otel}\,20\sigma_{olemn}$

d) $N_{cap} = A_{otel}\sigma_{olemn} + A_{lemn}16\sigma_{olemn}$

a)
b)
c)
d)

9) The magnitude of the maximum principal stress, σ_1 and its direction α_1 in case of pure shear are:

a) $\sigma_1 = \tau$
$\alpha_1 = 0$

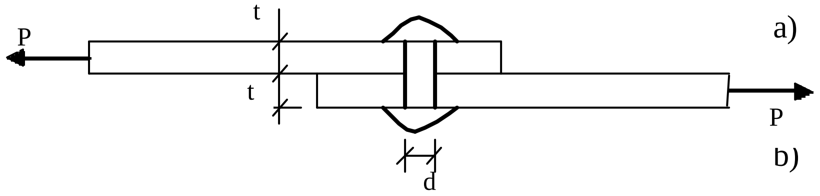
b) $\sigma_1 = \tau$
$\alpha_1 = 45^0$

c) $\sigma_1 = \frac{\tau}{2}$
$\alpha_1 = 45^0$

d) $\sigma_1 = 2\tau$
$\alpha_1 = 90^0$

a)
b)
c)
d)

10) The maximum stress in the element presented in the following figure is obtained by using the relation:



$A_{br} = b \cdot t$

a) $\sigma_{x\ max} = \dfrac{P}{A_{br} - \dfrac{pd^2}{4}}$

b) $\sigma_{x\ max} = \dfrac{P}{A_{br} - 2dt}$

c) $\sigma_{x\ max} = \dfrac{P}{A_{br} - dt}$

d) $\sigma_{x\ max} = \dfrac{P}{A_{br} - db}$

a)
b)
c)
d)

11) The carrying capacity of a rivet in the connection shown in the following figure is:

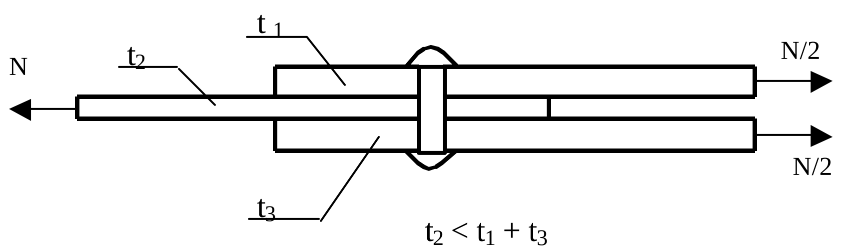
a) $N_{1\ nit} = \min\left[\dfrac{pd^2}{4}\boldsymbol{t}_{0nit},\ d(t_1 + t_2)\boldsymbol{s}_{0g}\right]$

b) $N_{1\ nit} = \min\left[\dfrac{pd^2}{4}\boldsymbol{t}_{0nit},\ d(t_1 + t_3)\boldsymbol{s}_{0g}\right]$

c) $N_{1\ nit} = \min\left[\dfrac{pd^2}{4}\boldsymbol{t}_{0s},\ dt_1\boldsymbol{t}_{0nit}\right]$

d) $N_{1\ nit} = \min\left[\dfrac{pd^2}{2}\boldsymbol{t}_{0nit},\ dt_2\boldsymbol{s}_{0g}\right]$

a)
b)
c)
d)



$t_2 < t_1 + t_3$

12) The density of strain energy in case of pure shear is:

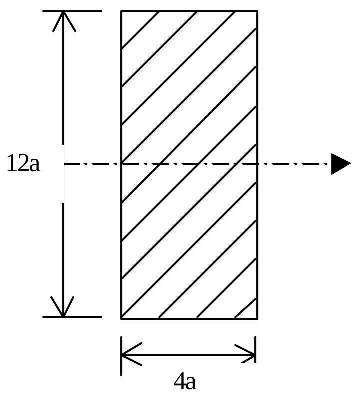
a) $U_{ds} = \dfrac{1}{2}\dfrac{T^2}{GA^2}$ a)

b) $U_{ds} = \dfrac{1}{2}\dfrac{T^2}{EA}$ b)

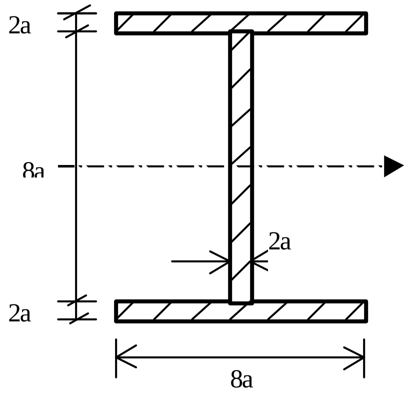
c) $U_{ds} = \dfrac{T^2}{GA}$ c)

d) $U_{ds} = \dfrac{T^2}{EI}$ d)

13) What is the most effective section in bending?

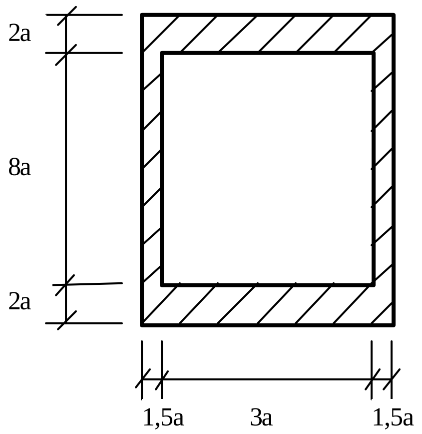


a)

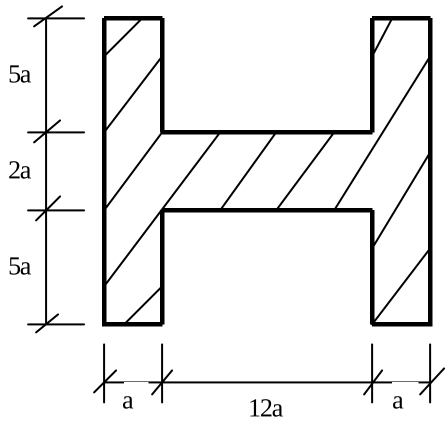


b)

a)
b)
c)
d)



c)



d)

14) The maximum shear stress on a rectangular section subjected to combined shear and bending is:

a) $\frac{3}{2}\frac{T}{A}$

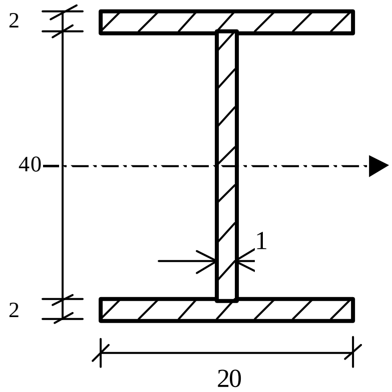
b) $\frac{2}{3}\frac{T}{A}$

c) $\frac{4}{3}\frac{T}{A}$

d) $\frac{3}{4}\frac{T}{A}$

a)
b)
c)
d)

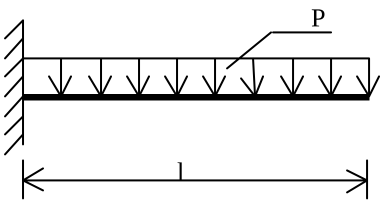
15) The arm of the internal resisting moment for the section shown in the following figure subjected to bending is:



a) 18cm b) 24cm c) 39cm d) 52cm

a)
b)
c)
d)

16) The maximum defection for the beam shown in the figure is:



a) $\dfrac{pl^4}{4EI}$

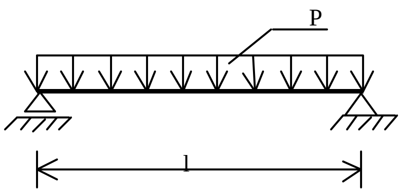
b) $\dfrac{pl^4}{2EI}$

c) $\dfrac{pl^4}{16EI}$

d) $\dfrac{pl^4}{8EI}$

a)
b)
c)
d)

17) The rotation of the support sections for the beam shown in the following figure is:



a) $\dfrac{pl^3}{24EI}$

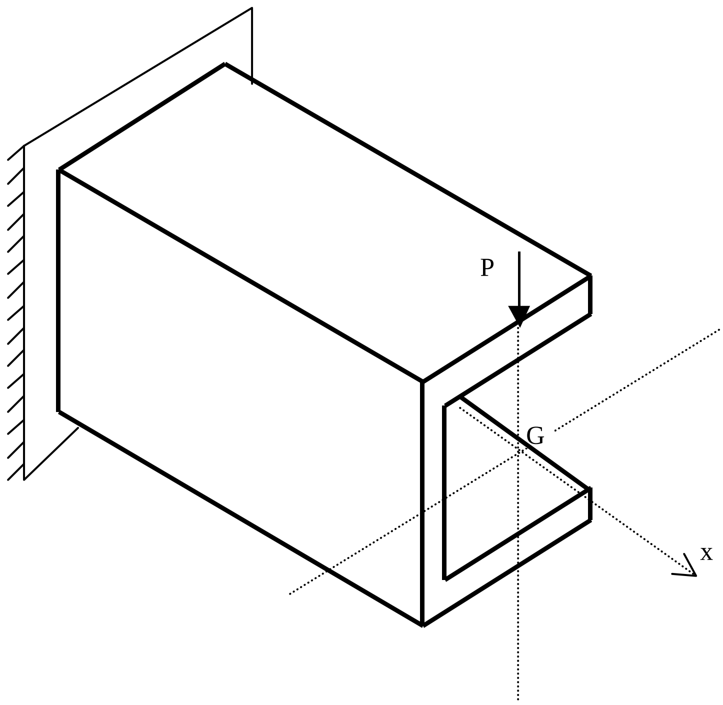
b) $\dfrac{pl^3}{48EI}$

c) $\dfrac{pl^4}{48EI}$

d) $\dfrac{pl^3}{12EI}$

a)
b)
c)
d)

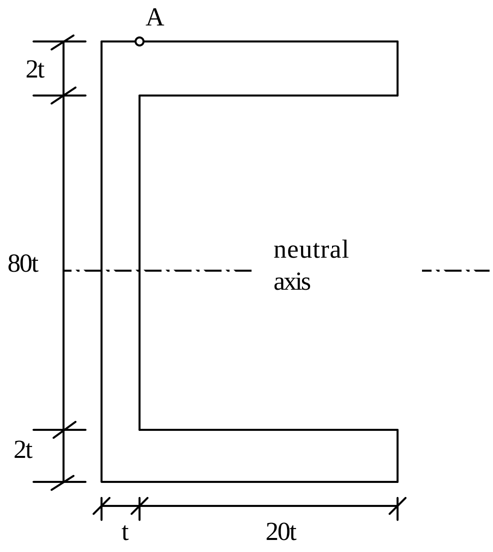
18) The state of loading for the beam shown in the figure is:



a) combined shear and bending
b) pure bending;
c) combined shear, bending and torsion;
d) pure shear;

a)
b)
c)
d)

19) The shear stress at point A belonging to the section shown in the following figure, subjected to bending is:



a) $\dfrac{V}{164t^2}$

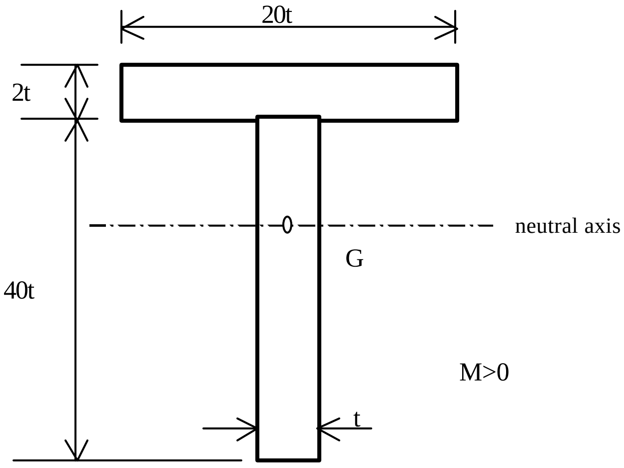
b) $\dfrac{V}{224t^2}$

c) $\dfrac{V}{1640t^3}$

d) $\dfrac{V}{328t^2}$

a)
b)
c)
d)

20) The maximum normal stress on the following section subjected to bending is:



a) $\frac{M}{464t^3}$

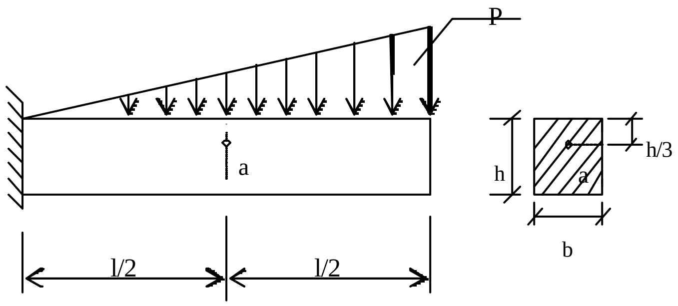
b) $\frac{M}{1260t^3}$

c) $\frac{M}{842t^2}$

d) $\frac{M}{1654t^2}$

a)
b)
c)
d)

21) The maximum principal stress σ_1 at point “a” belonging to the beam shown in the following figure is:



l=10h

a) $\sigma_1 = 12\ \frac{p}{b}$

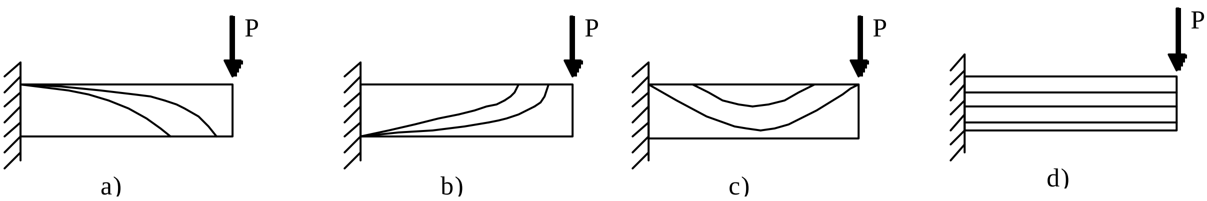
b) $\sigma_1 = 22\ \frac{p}{b}$

c) $\sigma_1 = 12\ \frac{p}{b^2}$

d) ó$_1$ = 220 $\frac{p}{b}$

a)
b)
c)
d)

22) The stress trajectories of first kind (trajectories of principal stress σ_1) for the beam shown in the following figure have the shape:



a) b) c) d)

23) The strain energy stored by a structural element subjected to combined shear and bending is:

a) $U_d = \iiint_v \left(\frac{M^2}{EI} + \frac{K_T V^2}{GA} \right) dV$

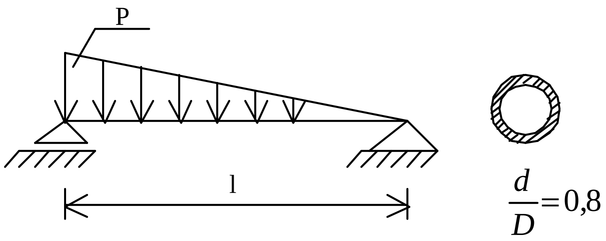
b) $U_d = \iiint_v \left(\frac{M^2}{GA} + \frac{K_T V^2}{EI} \right) dV$

c) $U_d = \iiint_v \left(\frac{M^2}{2EI} + \frac{K_T V^2}{2GA} \right) dV$

d) $U_d = \iiint_v \left(\frac{M}{2EI} + \frac{K_T V}{2GA} \right)^2 dV$

a)
b)
c)
d)

24) The maximum normal stresses in the following beam are:



a) $\sigma_{x\,max} = 2{,}08 \frac{pl^2}{D^2}$

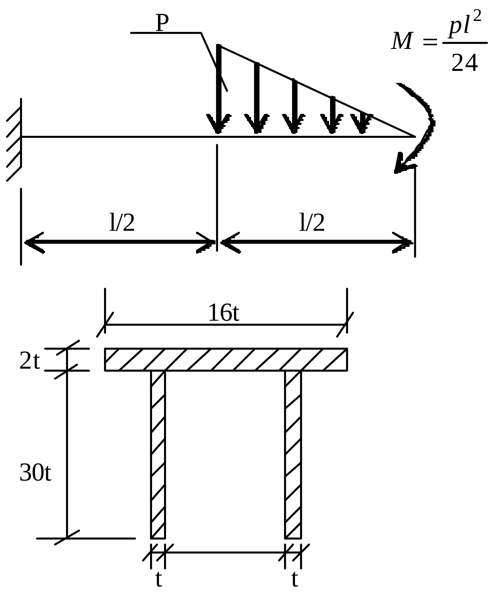
b) $\sigma_{x\,max} = 1{,}107 \frac{pl^2}{D^3}$

c) $\sigma_{x\,max} = \frac{pl^2}{D^3}$

d) $\sigma_{x\,max} = \frac{pl^2}{225 D^2}$

a)
b)
c)
d)

25) The maximum shear stresses in the following beam are:



a) $\tau_{max} = 0{,}5 \frac{pl}{t^3}$

b) $\tau_{max} = 0{,}5 \frac{pl}{t^2}$

c) $\tau_{max} = 20 \frac{pl}{t^2}$

d) $\tau_{max} = 0{,}005 \frac{pl}{t^2}$

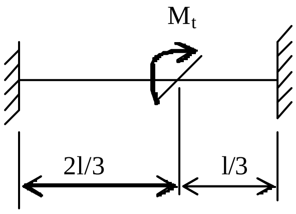
a)
b)
c)
d)

26) The shear stress distribution on a section subjected to torsion is:

a) parabolic, with maximum values at the section centroid and zero on the section boundaries;
b) linear, with maximum values on the section boundaries and zero at the section centroid;
c) uniform;
d) linear, with maximum values at the section centroid and zero on the section boundaries.

a)
b)
c)
d)

27) The maximum twisting moment along the element shown in the following figure is:



a) $\frac{2M_t}{3}$

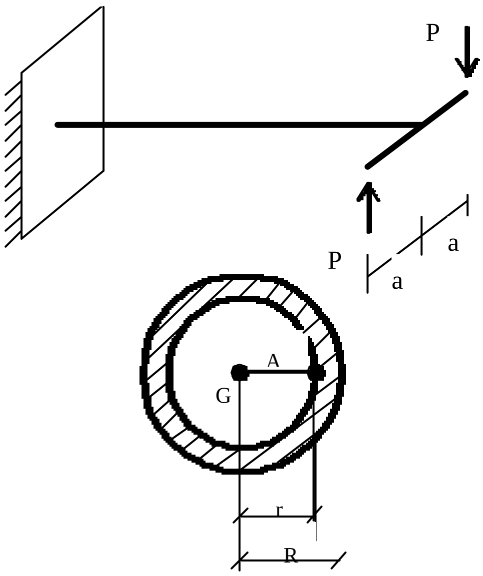
b) $\frac{M_t}{3}$

c) $\frac{3M_t}{2}$

d) M_t

a)
b)
c)
d)

28) The shear stress at point A of the following bar is determined by using the relation:



a) $\tau = \frac{2Pa}{\frac{pR^4}{4}\left(1-a^4\right)} r$

b) $\tau = \frac{Pa}{\frac{pR^4}{4}\left(1-a^4\right)} r$

c) $\tau = \frac{2Pa}{\frac{pR^3}{4}\left(1-a^4\right)}$

d) $\tau = \frac{2Pa}{\frac{pR^4}{4}\left(1-a^2\right)} r$

a)
b)
c)
d)

29) The shear stress distribution on a thin-walled closed section is:

a) linear over the thickness of the section wall;

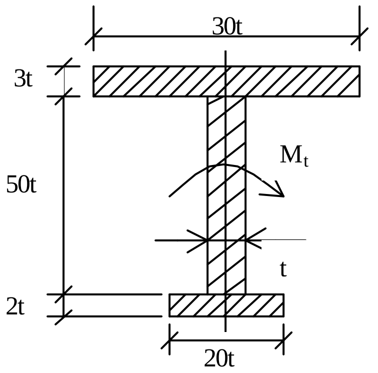
b) constant, $\boldsymbol{t} = \frac{M_t}{I_t} t$

c) parabolic over the section height;

d) constant, $\boldsymbol{t} = \frac{M_t}{2\Omega t}$

a)
b)
c)
d)

30) The maximum shear stress on the following section subjected to torsion by a twisting moment M_t is:



a) $\tau_{max} = \frac{3M_t}{340t^3}$;

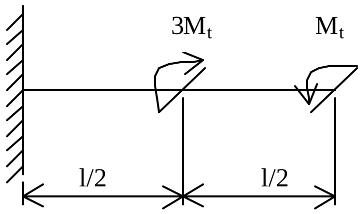
b) $\tau_{max} = \frac{M_t}{340t^3}$;

c) $\tau_{max} = \frac{M_t}{170t^3}$;

d) $\tau_{max} = \frac{3M_t}{170t^3}$;

a)
b)
c)
d)

31) The twisting angle between the ends of the following bar, subjected to torsion is:



a) $\frac{2M_t \cdot l}{G \cdot I_t}$;

b) $\frac{M_t \cdot l}{2G \cdot I_t}$;

c) $\frac{M_t \cdot l}{G \cdot I_t}$;

d) $\frac{2M_t \cdot l}{3G \cdot I_t}$;

a)
b)
c)
d)