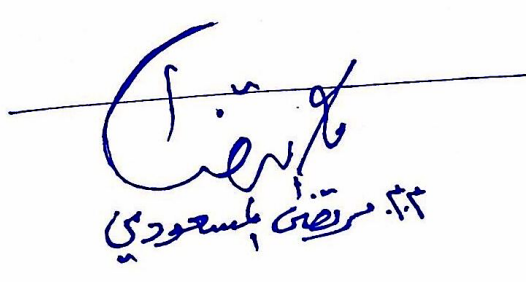
Class: 2nd
Subject: Strength of Materials
Lecturer: M.Sc Murtadha Mohsen Al-Masoudy
E-mail: Murtadha_Almasoody@mustaqbal-college.edu.iq

Al-Mustaqbal University College
Air Conditioning and Refrigeration Techniques Engineering Department

Strength of Materials

Second Stage

M.Sc Murtadha Mohsen Al-Masoudy



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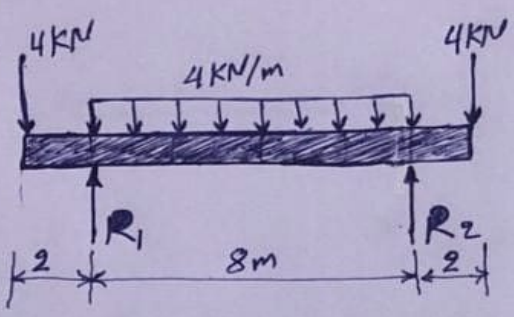
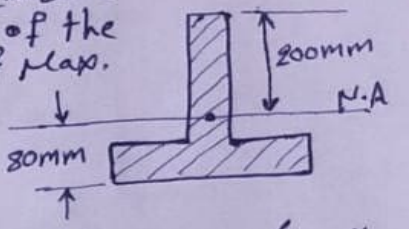
Unsymmetrical sections (Economic sections)

Ex.1 - Find the magnitude and Location of the Max. tensile & Max. Compressive bending stress?

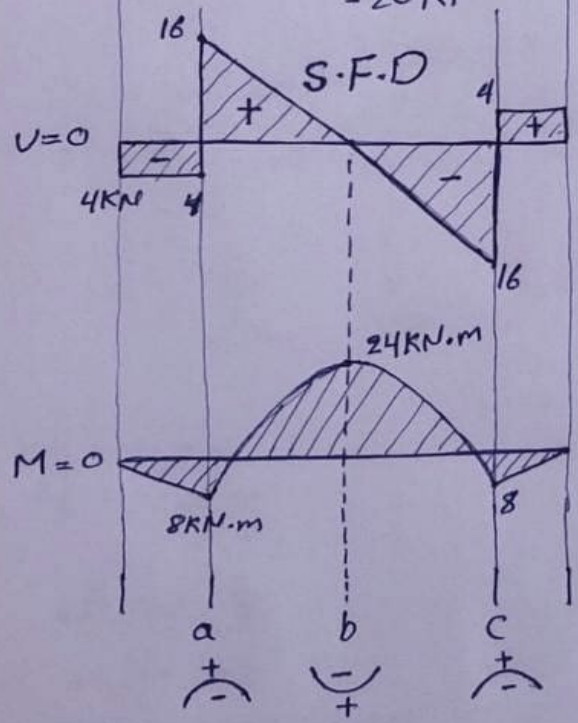




$I_{N.A} = 60*10^{6}\ mm^4$

Solution:

$$R_1 = R_2 = \frac{(4*8)+(4*2)}{2} = 20KN$$



$$\max.\ \sigma_b = \frac{M.y}{I_{N.A}}$$

For sec. a & c; at the top.

$$\max.\ \sigma_b = \frac{(8*10^3)(0.2)}{60*10^6*10^{-12}} = 26.6\ MPa\ (Ten.)$$

- at the bottom

$$\max.\ \sigma_b = \frac{(8*10^3)(0.08)}{60*10^6*10^{-12}} = 10.7\ MPa\ (Comp.)$$

For sec. b

at the top.

$$\max.\ \sigma_b = \frac{(24*10^3)*0.2}{60*10^6*10^{-12}} = 80\ MPa\ (Comp.)$$

at the bottom

$$\max.\ \sigma_b = \frac{(24*10^3)(0.08)}{60*10^6*10^{-12}} = 32\ MPa\ (Ten.)$$

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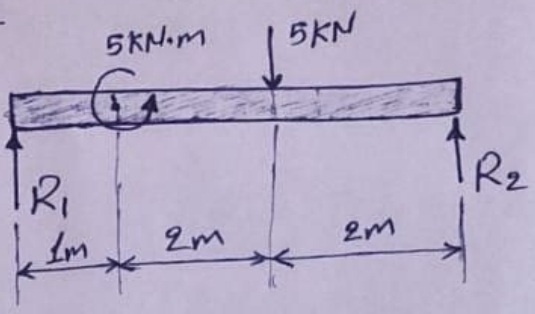
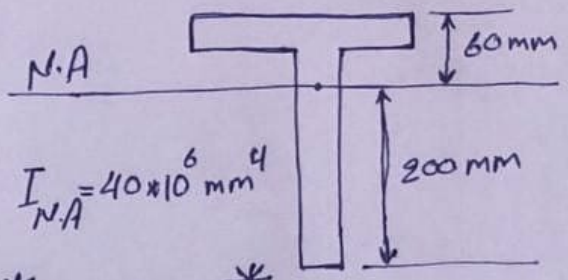
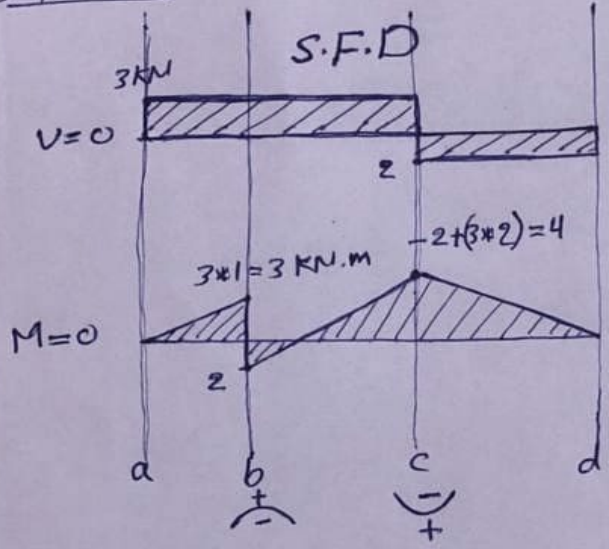
Ex.2

Find the Magnitude and location of the Max. σ_b in Ten. and Comp.





solution:-



Determination of R_1 & R_2

$\curvearrowleft + \Sigma M_{R_2} = Zero$

$5*2+5-5R_1 = Zero$

$\therefore \boxed{R_1 = 3\ KN}$

$\Sigma F_y = Zero$

$3+R_2 = 5 \Rightarrow \boxed{R_2 = 2\ KN}$

$\sigma_b = \frac{M.y}{I_{N.A}}$

at sec. b

at the top

$max.\ \sigma_b = \frac{(2\times10^3)(0.06)}{40\times10^6\times10^{-12}} = \boxed{3\ MPa}$ Ten.

at the bottom

$max.\ \sigma_b = \frac{(2\times10^3)(0.02)}{40\times10^6\times10^{-12}} = \boxed{10\ MPa}$ Comp.

at sec. C

at the top.

$max.\ \sigma_b = \frac{(4\times10^3)(0.06)}{40\times10^6\times10^{-12}} = \boxed{6\ MPa}$ Comp.

at the bottom.

$max.\ \sigma_b = \frac{(4\times10^3)(0.02)}{40\times10^6\times10^{-12}} = \boxed{20\ MPa}$ Ten.