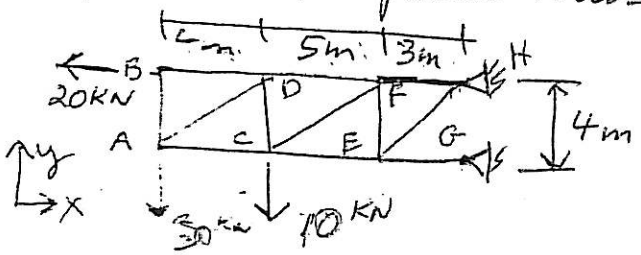
UNO ENCE 2351 Mech of Materials Practice Test 3
FOR FALL

1. Given: The plane truss shown



Steel $E = 200\ GPa$, $\nu = 0.3$
$G = 70\ GPa$

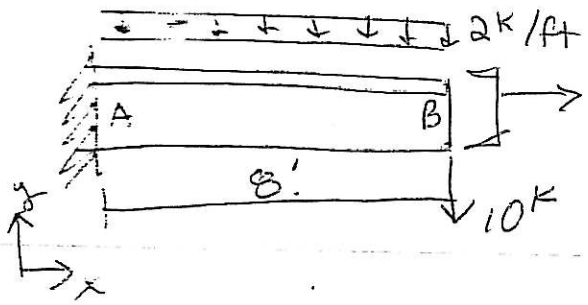
Reqd a) Reactions at G & H
b) $F_{AB}, F_{BD}, F_{AD}, F_{AC}, F_{EG}$ using method of joints
c) F_{DF}, F_{CF}, F_{CE} using the method of sections
d) For EG

Area = 6000 mm²

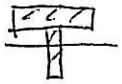
all six stresses & strains

---

2 Beam Shown

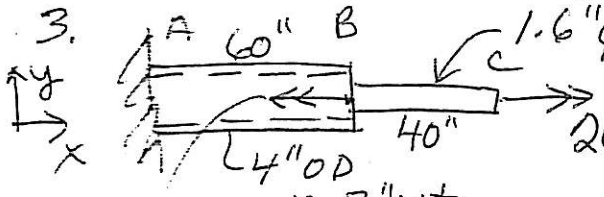


Two plates 1"x9"



Reqd
a) Reactions at A
b) Shear & moment diagrams
c) $\sigma_{xx\ max}$ tension, $\sigma_{xx\ max}$ compression
q_{max} Tell where each occurs

3.

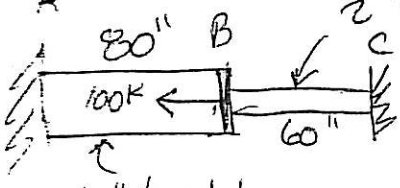


50 IN-K

$G = 3,700\ ksi$

Reqd a) τ_{max} AB & BC
b) ϕ_{AC}, degrees (C viewed from A)

4.

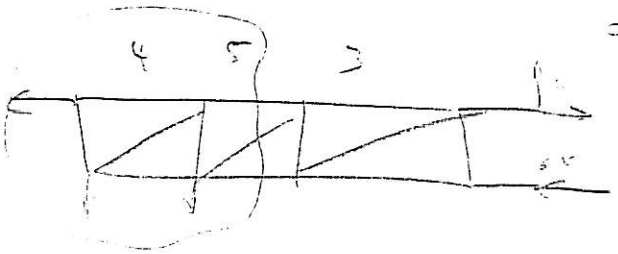


$E = 30,000\ ksi$, $\alpha = 6.5 \times 10^{-5}\ IN/IN/^\circ F$

$\Delta T = 50^\circ C$

calculate reactions at A & C

4" ϕ solid
$E = 10,000\ ksi$
$\alpha = 11.5 \times 10^{-6}\ IN/IN/^\circ F$



a) $\Sigma F_x = C_x = 0$

$\Sigma F_y = 110\,kN \uparrow$

ΣM_G from $H_x = 120\,kN$

$G_x = 110\,kN$

b) JT B

$F_{BL} = 20\,T$

$F_{BC} = 0$

JT A

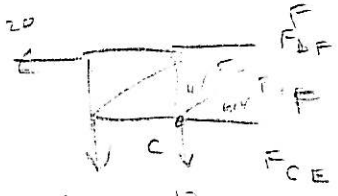
$F_{AE} = 42.4\,T$

$F_{AC} = 30\,kN\,C$

JT G

$\Sigma F_x = 110$

c)

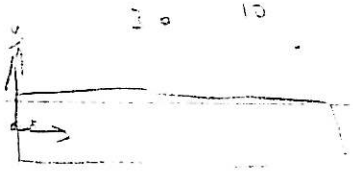


$\Sigma F_y = 0 \Rightarrow F_{EF} = \frac{6.4}{4}(10+20) = 64.8\,kN\,T$

$\Sigma M_C = 0 \Rightarrow F_{BF} = \frac{1}{4}(20(4) - 20(4)) = 50\,kN\,T$

$\Sigma M_F = 0 \Rightarrow F_{CE} = \frac{1}{4}[10(5) + 20(8)] = 80\,kNC$

D)



JT J

$\Sigma F_x = 0$

$E = 100\,kN$

$S = 70.6\,kN$

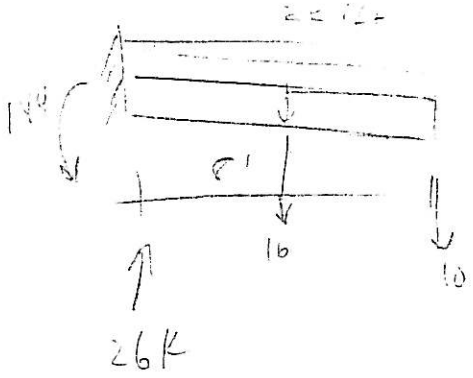
$\sigma_{xx} = \frac{F}{A} = \frac{110\,kN}{6000\,mm^2} = 18.3\,MPa$

$\sigma_{yy} = \sigma_{zz} = \tau_{xy} = \tau_{yz} = \tau_{xz} = 0$

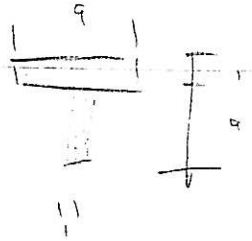
$-\varepsilon_{xx} = -\frac{.0183}{.200} = -.0000917$

$\varepsilon_{yy} = \varepsilon_{zz} = \varepsilon_{xx}\nu$

$.0000917(.3) = .0000275, \quad \gamma_{xy} = \gamma_{yz} = 0$



Tension in TOP



$$\bar{y} = \frac{9(9.5) + 9(4.5)}{18} = 7.0 \text{ in}$$

$$I = \frac{1}{12}(9)(1^3) + 9(2.5)^2 + \frac{1}{12}(1)(9^3) + 9(2.5)^2 = \boxed{174 \text{ in}^4}$$

$$\sigma_{x\,max} = \frac{My}{I} = \frac{144^{k}\left(12 \text{ in/ft}\right)(3 \text{ in})}{174 \text{ in}^4}$$

$$= 29.8 \text{ ksi}$$

$$\sigma_{5\,max\,c} \quad \frac{144(12)(7)}{174} = 69.5 \text{ ksi}$$

$$\tau_{max} = \frac{VQ}{I} = \frac{26(1)(7)(2.5)}{174} = 3.66 \text{ k/in}$$

NA @ A

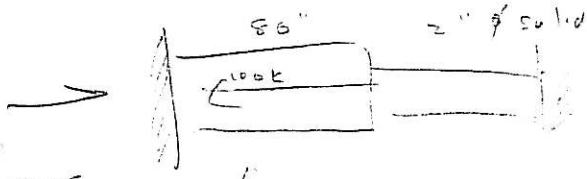
3) $J_{AB} = \frac{\pi}{2}\left(2^4 - 1.8^4\right) = 5.64\ in^4$

$J_{BC} = \frac{\pi}{2}(.8)^4 = .64\ in^4$

$\tau_{max} = \frac{Tc}{J} = 6.95\ ksi$

$\tau_{BC_{max}} = \frac{20(.8)}{.64} = 25.0\ ksi$

$\phi_{AC} = 16.1^\circ\ CW$



$\Delta T = 50^\circ C \cdot \frac{9}{5} = 90^\circ F$

39.05

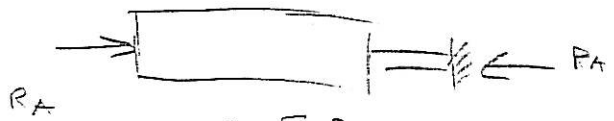
$E = 30{,}000\ ksi$

$R_A = 100 - 60.95 = 60.9$

Release A

$\Delta L = \frac{100k\,(60")}{\pi(1)(30{,}000\ ksi)} + 11.5\times10^{-6}(80)(90) + 6.5\times10^{-6}(60)(90)$

$= .0637 + .6822 + .351 = .4975"$



$R_A\left[\frac{80}{\pi(2^2)10{,}000} + \frac{60}{\pi(1)(30000}\right] = .4975$

$R_A = 39.05$