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ID **16242**

SUBJECT **MECHANIC OF MATERIAL**

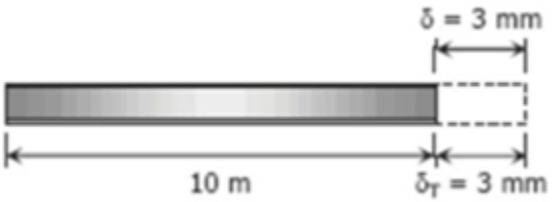
SEMESTER **02**

EXAME **FINAL TERM**

DATE **25-06-2020**

SUBIMMITTED **ENGE MARVAN RAZA**

Q1) Steel railroad reels 10 m long are laid with a clearance of 3 mm at a temperature of 25°C. At what temperature will the rails just touch? What stress would be induced in the rails at that temperature if there were no initial clearance? Assume α = 11.7 μm/(m·°C) and E = 250 GPa.



(ANS).

Q1 Temperature at which $\delta t = 3mm$

$\delta t = \alpha L (\Delta T)$

$\delta t = \alpha L (Tf - Ti)$

$3 = (11.7 \times 10^{-6})(10000)(Tf - 25)$

$Tf = 50°C$

Required stress

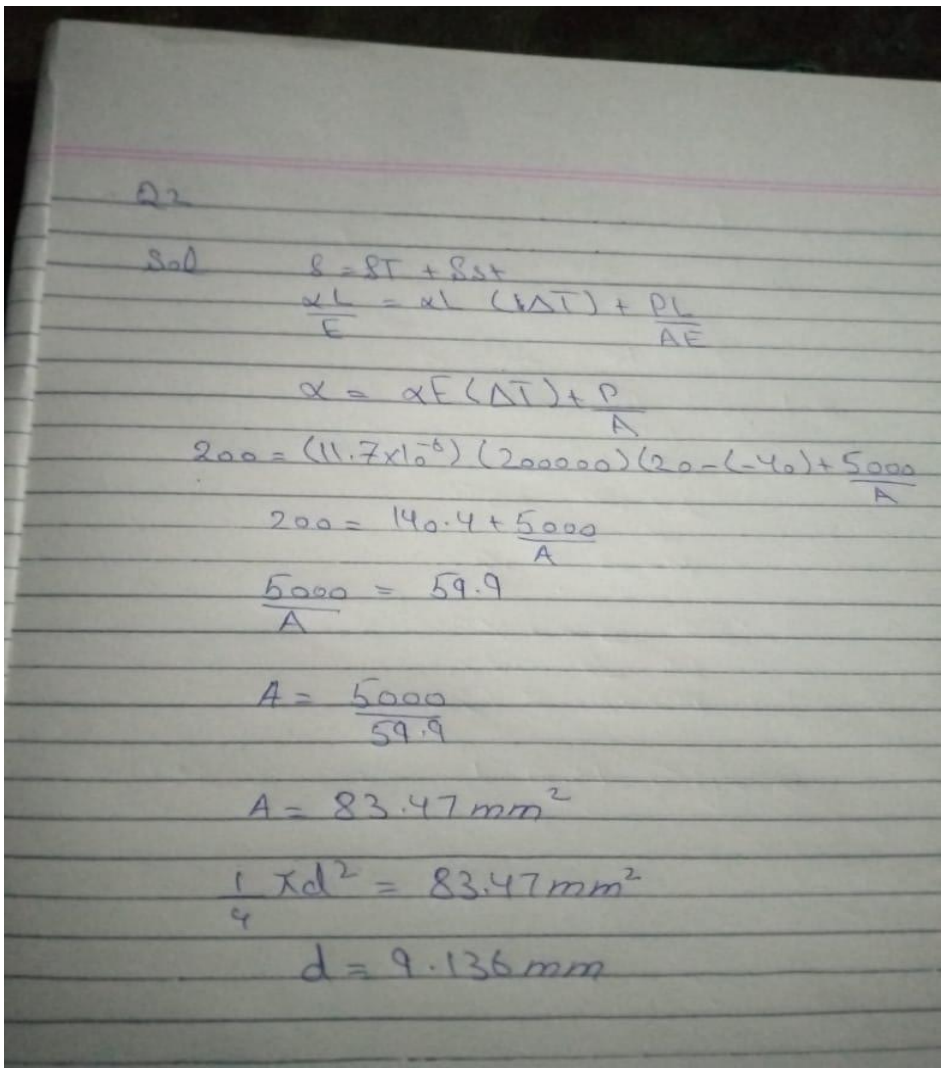
$\delta = \delta t$

$\alpha \frac{L}{E} = \alpha L (\Delta T) = \alpha E (Tf - Ti)$

$= (11.7 \times 10^{-6})(250000)(50 - 25)$

$= \alpha\ 73\ MPa$

Q2) A steel rod is stretched between two rigid walls and carries a tensile load of 5000 N at 20°C. If the allowable stress is not to exceed 200 MPa at -40°C, what is the minimum diameter of the rod? Assume α = 11.7 μm/(m ·°C) and E = 200 GPa.



Q3) External and internal diameters of a propeller shaft are 600mm and 300mm respectively. Find maximum shear stress developed in the cross section when a twisting moment of 60 KN-m is applied. If span of shaft is 5m, also find twisting angle of shaft. Take modulus of rigidity, G = 0.8*10^3 N/mm2.

ans

Q3

Given Data

D = 600mm

d = 300mm

T = 60KN-m

L = 6m

Sol) As we know that

$T = \pi/16 \times (I) D(4) - d(4)/D$

$60 \times 1000000 = \pi/16 \times (I) \times 600(4) - 300(4)/600$

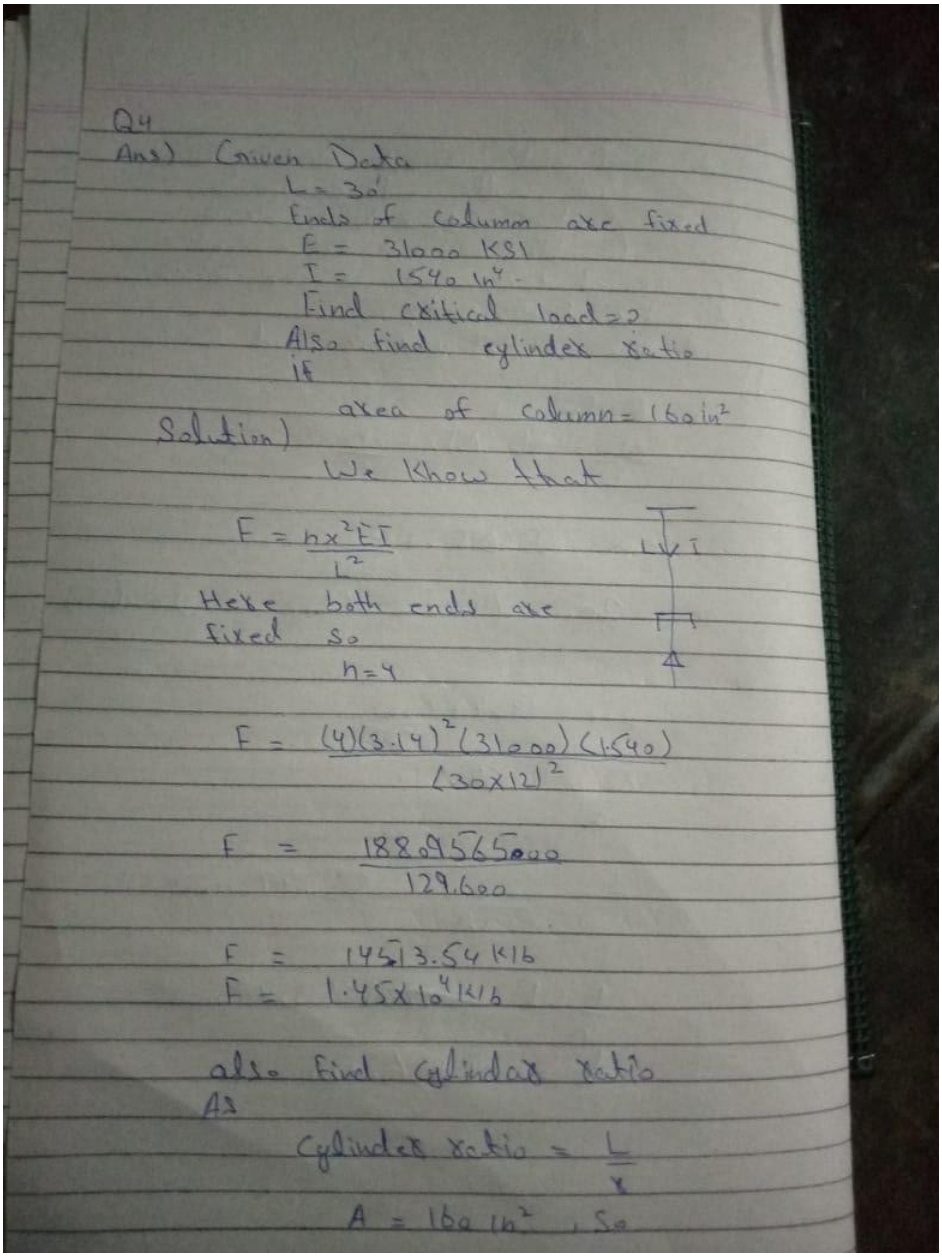
$\frac{60 \times 1000000}{39760782.02} = \frac{39760782.02\ I}{39760782.02}$

$I = 1.509\ KN/mm$

$\frac{I}{R} - \frac{G\theta}{L} \ldots R - D/2 = 600/2 = 300mm$

$= 0.0176$ radians.

Q4) A column is used to support an axial compressive load. The length is 30 feet. The column is shown in the figure. The ends of column are fixed. Find the critical buckling load. Take E = 31000ksi and I = 1540 in4. Also find the slenderness ratio if the area of the column is equal to 160 in2. (ANS).



Q4

Ans) Given Data

$L = 30'$

Ends of column are fixed

$E = 31000$ KSI

$I = 1540\ in^4$

Find critical load = ?

Also find cylinder ratio if

area of column $= 160\ in^2$

Solution)

We know that

$$F = \frac{n x^2 E I}{L^2}$$

Here both ends are fixed so

$n = 4$

$$F = \frac{(4)(3.14)^2(31000)(1540)}{(30 \times 12)^2}$$

$$F = \frac{1888956500}{129600}$$

$F = 14573.54$ kip

$F = 1.45 \times 10^4$ kip

also find cylinder ratio

Ans

Cylinder ratio $= \frac{L}{r}$

$A = 160\ in^2$, so

$A = \pi r^2$

$160 = 3.14 \times (r)^2$

$\frac{160}{3.14} = r^2$

$\sqrt{r^2} = \sqrt{50.96}$

$r = 7.138 \text{ in}$

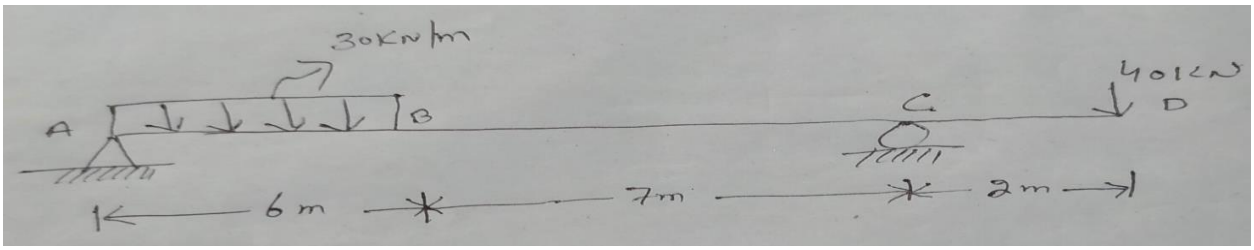
Now

Cyelindrical ratio $= \frac{L}{r}$

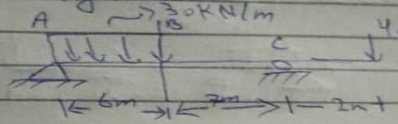
$= \frac{30 \times 12}{7.138}$

Cylindrical ratio $= 50.434$

(Q5)Find Shear force and bending moment diagram of given beam.
(ANS).



25) Draw Shear force and bending moment digram.



Find reaction at A and B
Taking moment at A ~~and B~~

$$3 \times 180 = RC \times 13$$

$$RC = \frac{180 \times 3}{13}$$

$$RC = 42\,KN$$

Now

$$RA + RC = 180$$

$$RA = 180 - 42$$

$$RA = 138\,KN$$

Now SF and B.M Digram

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