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لجنة الميكانيك - الإتجاه الإسلامي

Faculty of Engineering Department of Mechanical Engineering Strength of Materials / Final Exam

Name: _____

Date:.....

1	2	3	4	5	6	7	8	9	10

* Questions 1-10: (Multiple choices)

Q1: What force is required to punch a 20-mm-diameter hole in a plate that is 15 mm thick? The shear strength is 350 MN/m².

A- 0.11 MN B- 0.33 MN C- 0.22 MN D- 0.44 MN E- 0.55 MN

Q2: The rigid beam is supported by a pin at A and wires BD and CE. If the load P on the beam is displaced 40 mm downward, determine the normal strain developed in the wire CE.

A- 0.008036 B- 0.008929 C- 0.00625 D- 0.00714 E- 0.00287

Q3: In Q2, determine the normal strain developed in the wire BD.

A- 0.005 B- 0.005714 C- 0.006429 D- 0.00714 E- 0.00387

Q4: What is the minimum diameter of a solid steel shaft that will not twist through more than 3° in a 5-m length when subjected to a torque of 12 kN·m? Use G = 83 GPa.

A- 0.1089 m B- 0.0728 m C- 0.143 m D- 0.1261 m E- 0.169 m

Q5: In Q4, What is the maximum shearing stress is developed?

A- 20.8 MPa B- 30.5 MPa C- 47.3 MPa D- 158 MPa E- 17.2 MPa

* If the beam shown in the figure is subjected to a max shear of V=150 kN and a maximum bending moment of M=40 kN·m, answer the following:

Q6: The neutral axis is located from the bottom at $\bar{y} =$

A- 160mm B- 280mm C- 180mm D- 175mm E- 135mm

Q7: The area moment of inertia for the section shown at the neutral axis is

A- $0.033 \times 10^{-3} \text{ m}^4$ B- $0.218 \times 10^{-3} \text{ m}^4$ C- $0.178 \times 10^{-3} \text{ m}^4$ D- $0.055 \times 10^{-3} \text{ m}^4$

E- $0.066 \times 10^{-3} \text{ m}^4$

Q8: The shear stress at C, $\tau_c =$

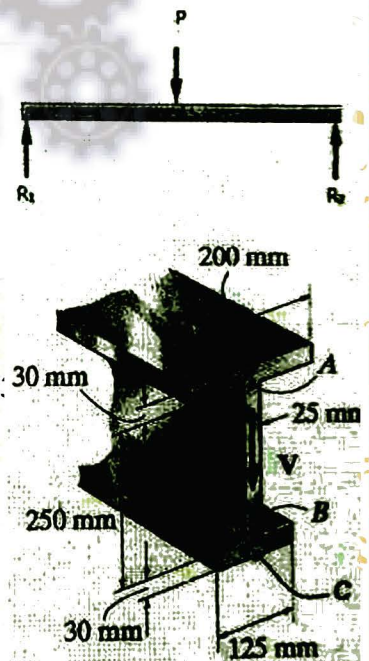
A- $3.1 \times 10^6 \text{ Pa}$ B- $18.6 \times 10^6 \text{ Pa}$ C- $24.1 \times 10^6 \text{ Pa}$ D- 0.00 Pa E- $30.5 \times 10^6 \text{ Pa}$

Q9: The max. tensile stress is

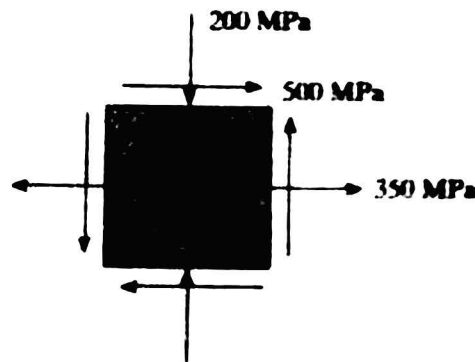
A- $36.1 \times 10^6 \text{ Pa}$ B- $40.1 \times 10^6 \text{ Pa}$ C- $28.1 \times 10^6 \text{ Pa}$ D- $32.1 \times 10^6 \text{ Pa}$ E- 0.00 Pa

Q10: The shear stress at a layer 20 mm from the top of the cross-section is

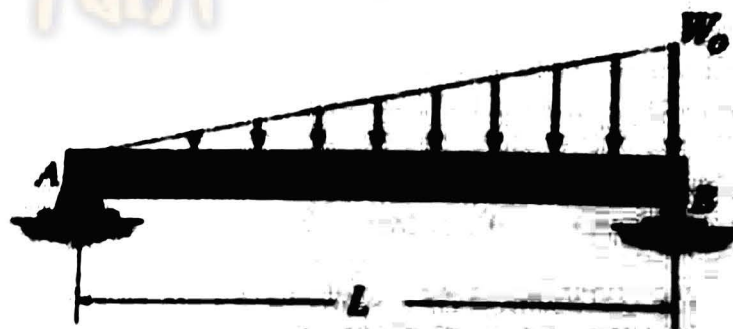
A- $1.15 \times 10^6 \text{ Pa}$ B- $1.72 \times 10^6 \text{ Pa}$ C- $2.29 \times 10^6 \text{ Pa}$ D- $2.87 \times 10^6 \text{ Pa}$ E- None



Q11: For the element shown, draw Mohr's circle in details. By using Mohr's circle, determine the principal stresses and the maximum in-plane shear stress, and specify the orientation of the element in each case.



Q12: Determine the equation of the deflection curve for the shown beam. Then, find the maximum deflection in the beam.



لجنة الميكانيك - الإتجاه الإسلامي

بسم الله الرحمن الرحيم

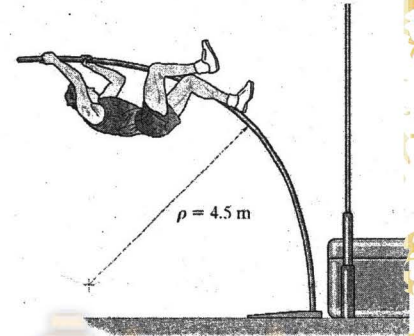


Al-Balqa Applied University
Mechanical Engineering Department
Course: Mechanics of Materials
Date: Wednesday, 11-1-2012

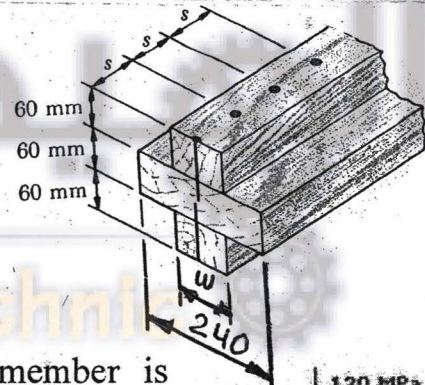
Faculty of Engineering Technology
Final Exam
Time: 120 Mins.
Lecturer: Dr. Mohammad Al-Hasan

Q₂ [4×8]

A) A picture is taken of a man performing a pole vault. Minimum radius of curvature of the pole is estimated by measurement to be 4.5 meters. If the pole is made of a glass-reinforced plastic for which $E = 131 \text{ GPa}$ and the maximum bending stress is 580 MPa, determine the diameter of the pole.

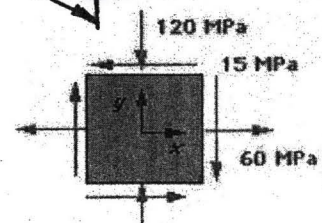


B) Three boards are nailed together to form the beam shown, which is subjected to a vertical shear of 740 N. Knowing that the spacing between the nails is 75 mm and that the allowable shearing stress in nails is 4 MPa, determine the nail diameter when $\omega = 120 \text{ mm}$

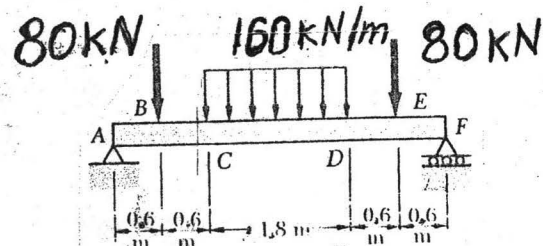


C) The state of stress at a point in structural member is determined to be as shown in figure bellow. Using Mohr's circles **only**, determine:

1) the principle stresses, 2) the principle angles 3) the maximum shearing stress



D) For the beam and loading shown, design the cross section of the beam, knowing that for the grade of timber used $\sigma_{all} = 160 \text{ MPa}$ $\tau_{all} = 100 \text{ MPa}$



With my best wishes



لجنة الميكانيك - الإتجاه الإسلامي

Al-Balqa Applied University
Mechanical Engineering Department
Course: Mechanics of Materials

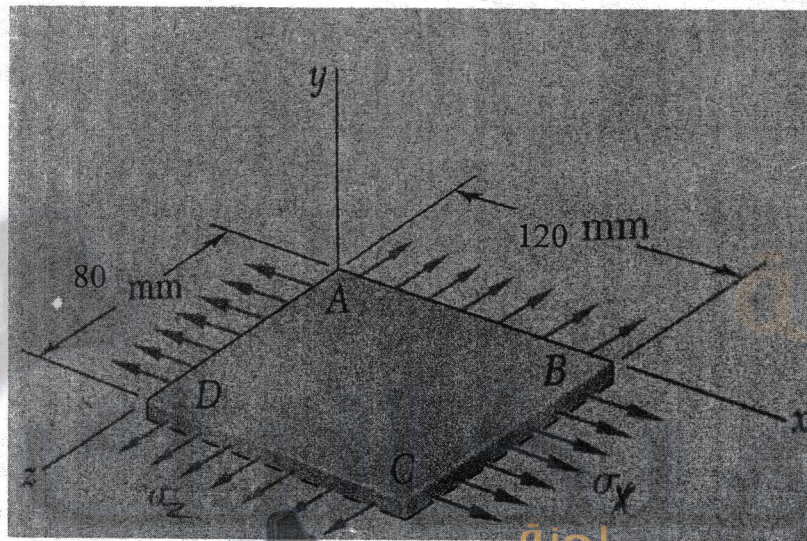


Faculty of Engineering Technology
Final Exam (٩٥٢ -
Time: 100 Mins.
Date: Saturday, 26- 5 -2012

Problem #1

10 pt

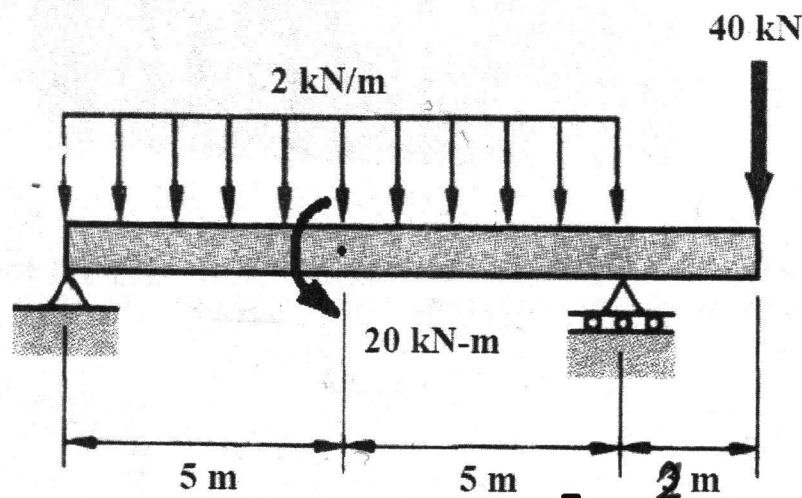
A fabric structure is subjected to a biaxial normal stresses $\sigma_x = 100$ MPa, and $\sigma_z = 150$ MPa, Knowing that the properties of fabric are: $E = 80$ GPa, and $\nu = 0.3$, determine the change in length of (a) side AB (b) side BC and (c) diagonal AC.



Problem #2

10 pts

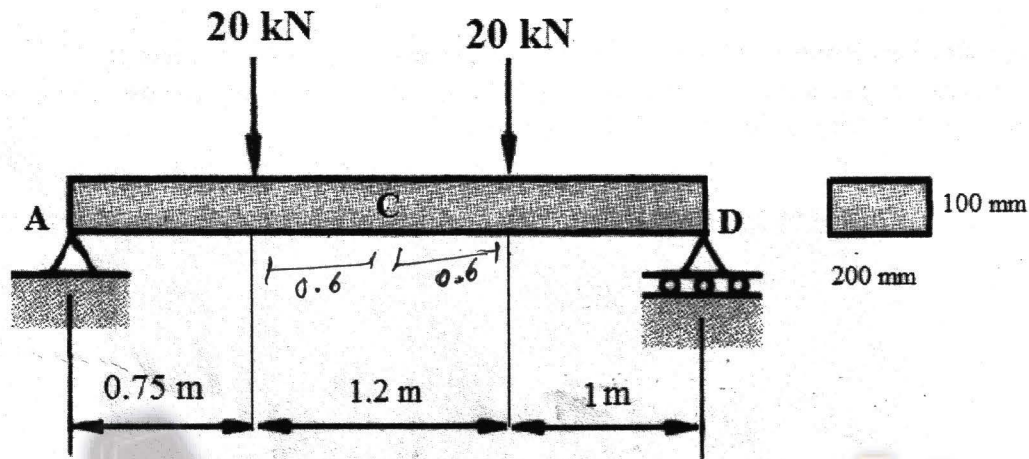
Plot the shear force and bending moment diagrams for the beam subjected to the loading shown, also, find the maximum normal stress in the beam. The beam has a square cross-section of 50 mm x 50 mm.



Problem #3

10 pts

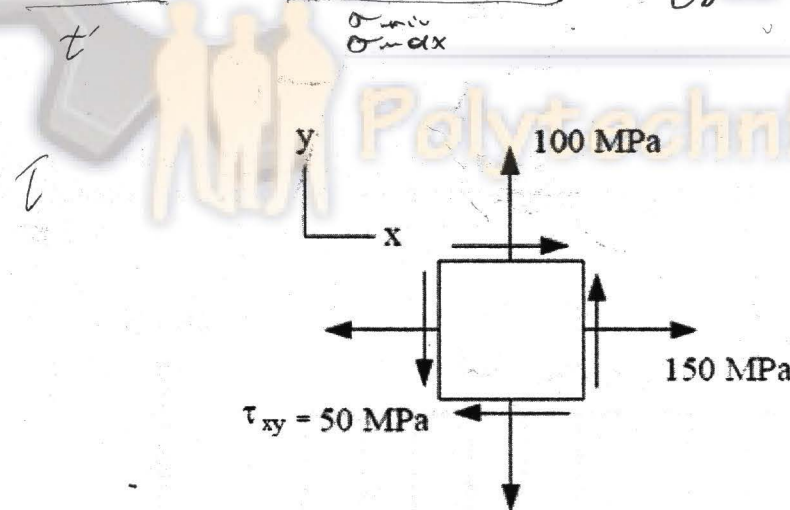
For a beam with the loading shown, determine the deflection at the center C of the beam. Knowing that the beam is made of steel for which $E = 200$ GPa, and it has a rectangular cross-section of (200 mm. x 100 mm).



Problem #4

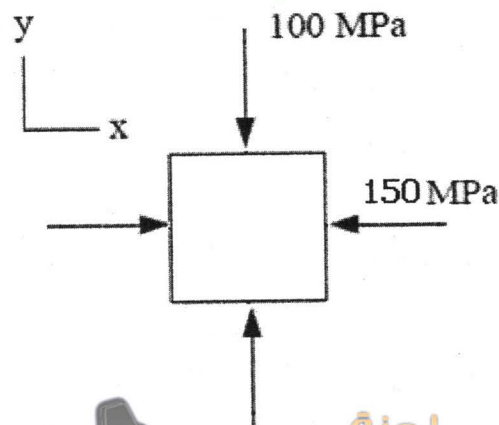
15 pts

(a) For the state of plane stress given on the element below, construct a Mohr's Circle. Use the circle to determine (1) the principal stresses, (2) the principal stress directions, (3) the maximum in-plane shear stress and corresponding normal stress.



(b) For a state of biaxial compression stresses (i.e. $\sigma_x = -150$, $\sigma_y = -100$ MPa), construct the Mohr's Circle(s) and calculate the absolute maximum shear stress.

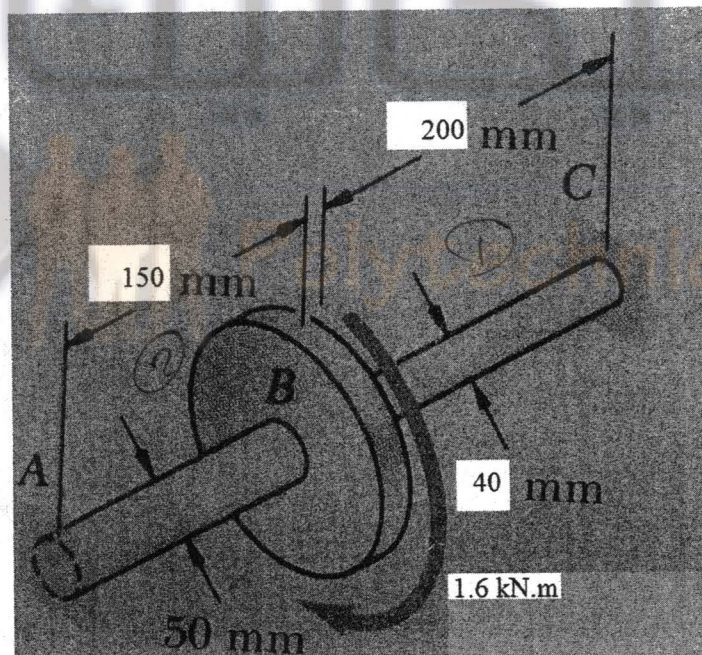
Handwritten calculations for part (b):
 $\sigma_1 = 25$
 $\sigma_2 = -25$
 $\tau_{max} = 25$
 (Circled '2.5')



Problem #5

5 pts

Two solid steel shafts ($G=77$ GPa) are connected to a coupling disk B and to a fixed supports at A and C. for the loading shown, determine (a) the reaction at each support and (b) maximum shear stress in shaft AB.



Good Luck



لجنة الميكانيك - الإتجاه الإسلامي

AL-BALQA' APPLIED UNIVERSITY



FACULTY OF ENGINEERING TECHNOLOGY

Time: 12-2

Structure : Dr. Nasir Al-Kloub

Final Exam

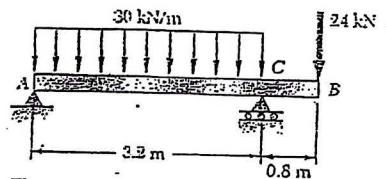
Strength of Materials

Date: 19/1/2010

Student Name: _____

Question (1):

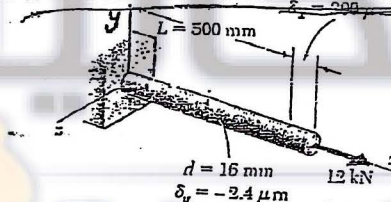
Draw the shear and bending-moment diagrams for the beam and loading shown, and determine the maximum absolute value (a) of the shear (b) of the bending moment.



Question (2):

A 500-mm-long, 16-mm-diameter rod made of homogenous, isotropic material is observed to increase in length by 300 μm and to decrease in diameter by 2.4 μm when subjected to an axial 12-kN load. Determine the modulus of elasticity and Poisson's ratio of the material.

$$\epsilon_x = \frac{1}{E} (\sigma_x - \nu \sigma_y)$$



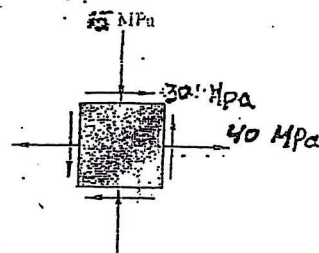
$$\delta = \frac{PL}{AE}$$

$$PL = \sigma AE$$

$$\epsilon = \frac{PL}{EA}$$

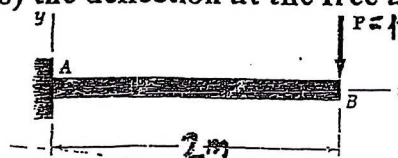
Question (3):

For the state plane stress shown determine (a) the principal planes, (b) the principal stresses, (c) the maximum shearing stress and the corresponding normal stress, and shearing stresses after the element has been rotated through (d) 25° clockwise and Draw Mohr circle.



Question (4):

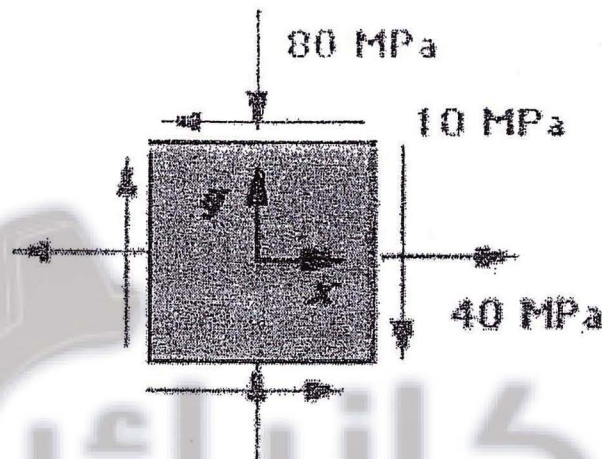
For the loading shown, determine (a) the equation of the elastic curve for the cantilever beam AB, (b) the deflection at the free end, and (c) the slope at the free end.



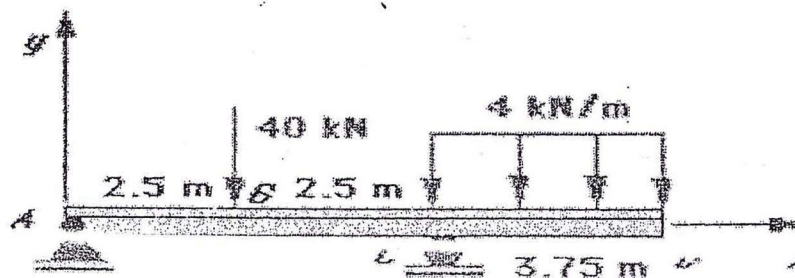
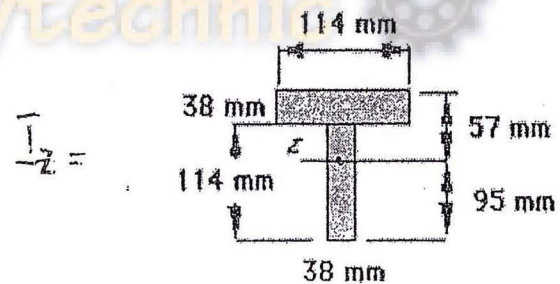
Good luck



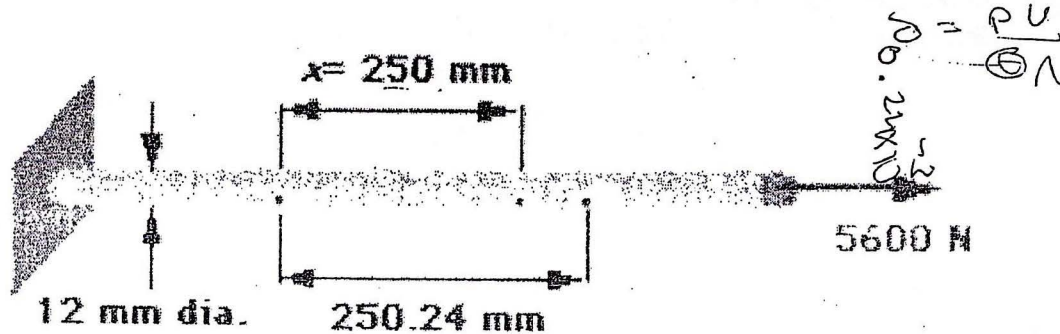
Q1:- The state of stress at a point in a structural member is determined to be as shown. Using Mohr circle, determine the principal stresses and principle angle associated with this state of stress.



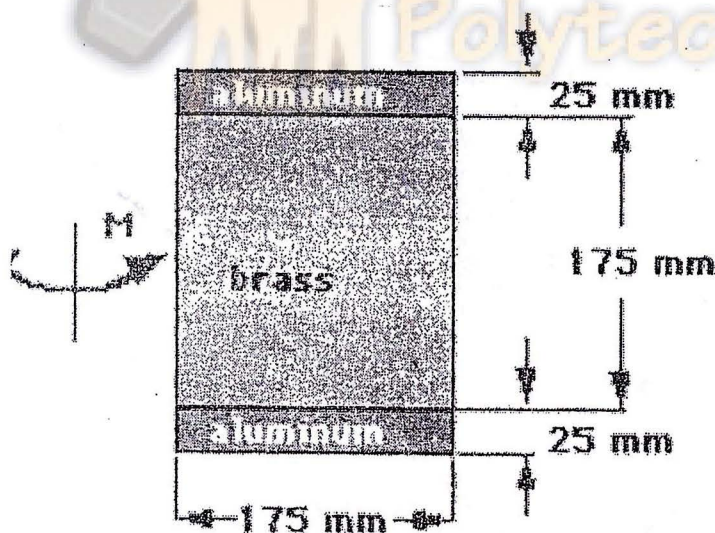
Q2:- Beam ABCD is located and supported as shown. Find the maximum tensile and compressive stresses due to bending that occur along the span of the beam. The beam dimensions and area moment of Inertia are as shown.



Q3:- Two marks placed exactly 250 mm apart on a 12-mm-diameter rod. When an axial load of 5600 N is applied to the rod, the distance between the marks becomes 250.24 mm. Determine the modulus of elasticity of the rod.



Q4:- A composite beam is constructed by bonding brass and aluminium together as shown. The maximum allowable normal stresses in the aluminium and brass are 103 MPa and 140 MPa, respectively. Determine the maximum allowable bending moment that can be applied to the beam and corresponding stress in the brass knowing that $E_{al} = 70 \text{ GPa}$ and $E_{br} = 105 \text{ GPa}$.



Good Luck

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AL-BALQA' APPLIED UNIVERSITY

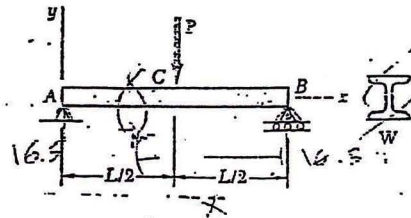


FACULTY OF ENGINEERING TECHNOLOGY

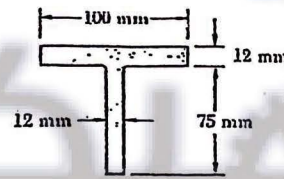
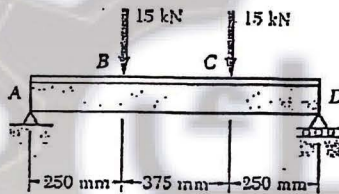
Time: 12-2	Final Exam	Date: 31-5-2009
Structure : Dr. Nasir Al-Kloub	Strength of Materials	Student Name:

1. knowing that beam AB is a $W 150 \times 13.5$ rolled-steel shape and that $p = 33 \text{ kN}$, $L = 105 \text{ m}$, and $E = 200 \text{ GPa}$ ($I = 6.83 \times 10^6 \text{ mm}^4$) determine (a) the slope at A, (b) the deflection at C.

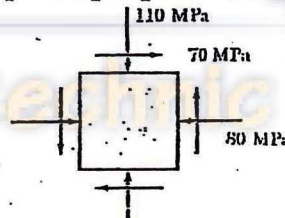
$$I = 6.83 \times 10^6 \text{ mm}^4$$



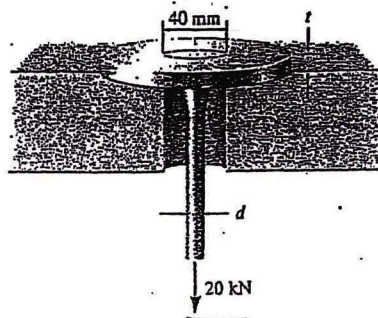
2. Two vertical forces are applied to a beam of the cross section shown. determine the maximum tensile and compressive Stresses in portion BC of the beam.



3. For the given state of stress, determine (a) the principal planes, (b) the principal stresses. (c) Draw Mohr circle.



4. The suspender rod is supported at its end by affixed-connected circular disk as shown. If the rod passes through a 40-mm-diameter hole, determine the minimum required diameter of the rod and the minimum thickness of the disk needed to support the 20-kN load. The allowable normal stress for the rod is $\sigma_{\text{allow}} = 60 \text{ MPa}$, and the allowable shear stress for the disk is $\tau_{\text{allow}} = 35 \text{ MPa}$.



Good luck



لجنة الميكانيك - الإتجاه الإسلامي

Faculty of Engineering Technology

Time : 12 - 2

Final Exam

Date : 26 / 5 / 2009

Structure : Dr. Nasir Al- Kloub

Strength of Materials

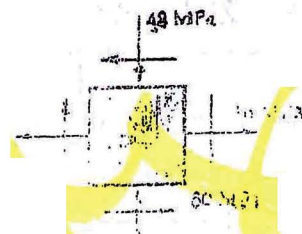
Student Name :

Final

Q.1. For the given state of stress,

Determine: a) The principal planes. b) The principal stresses. c) Draw Mohr circle.

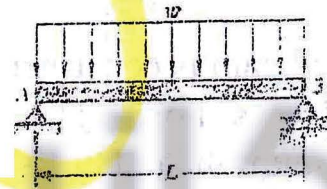
(14 Marks)



Q.2. The simply supported prismatic beam ABC carries a uniformly distributed load w per unit length.

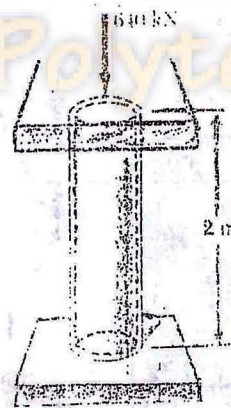
Determine the equation of the elastic curve and the maximum deflection of the beam.

(12 Marks)



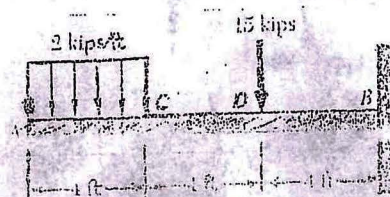
Q.3. A 2-m length of an aluminum pipe of 240-mm outer diameter and 10-mm wall thickness is used as a short column and carries a centric axial load of 640 kN. Knowing that $E = 73 \text{ GPa}$ and $\nu = 0.33$, determine : (a) the change in length of the pipe, (b) the change in its outer diameter (c) the change in its wall thickness

(12 Marks)



Q.4. Draw the shear and bending-moment diagrams for the beam and loading shown, and determine the maximum absolute value (a) of the shear, (b) of the bending moment.

(12 Marks)



Good Luck

لجنة الميكانيك - الإتجاه الإسلامي

AL-BALQA' APPLIED UNIVERSITY



FACULTY OF ENGINEERING TECHNOLOGY

Time: 9-11

Structure : Dr. Nasir Al-Kloub

Final Exam

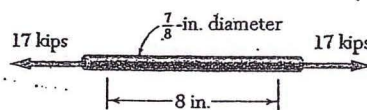
Strength of Materials

Date: 12/1/2009

Student Name:

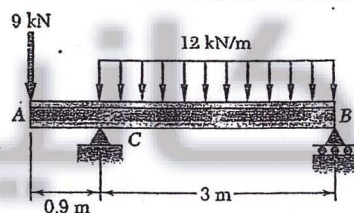
Question (1):

In a standard tensile test a steel rod of $\frac{7}{8}$ - in. diameter is subjected to a tension force of 17 kips .Knowing that $\nu = 0.3$ and $E = 29 \times 10^6$ Psi , determine (a) the elongation of the rod in an 8-in .gage length , (b) the change in diameter of the rod .



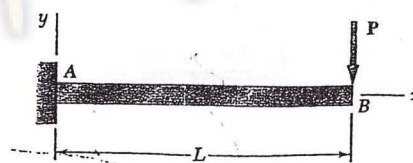
Question (2):

Draw the shear and bending- moment diagrams for the beam and loading shown and determine the maximum normal stress due to bending.



Question (3):

For the loading shown, determine (a) the equation of the elastic curve for the cantilever beam AB, (b) the deflection at the free end, (c) the slope at the free end.



Question (4):

For the given state of stress, determine (a) the principal planes, (b) the principal stresses. (c) Draw Mohr circle.

