بسم الله الرحمن الرحيم

King Abdulaziz University
Engineering College
Department of Production and Mechanical System Design

MENG 270 Mechanics of Materials

Final Exam
Wednesday: 22/11/1424 H
Time Allowed: Two Hours

Name:	Sec. No.:	ID No.:

Question 1		10
Question 2		10
Question 3		10
Question 4		10
Question 5		10
Question 6		10
TOTAL		60

إِن اللَّهَ يُمْسِكُ السمَاوَاتِ وَالأَرْضَ أَن تَزُولا وَلَئِن زَالَتَا إِنْ أَمْسَكَهُمَا مِنْ أَحَدٍ من بَعْدِهِ
إِنهُ كَانَ حَلِيماً غَفُورا

Instructions

1. There are totally 6 problems in this exam.
2. Show all work for partial credit.
3. Assemble your work for each problem in logical order.
4. Justify your conclusion. I cannot read minds.

بسم الله الرحمن الرحيم

Mechanics of Materials
MENG270
Final Exam

Closed-book Exam
Time 1 hrs
Wednesday: 22/11/1424 H

Student Name:		Sec. No.:	ID No.:
Q1: /10	Q2: /10	Q3: /10	

1. Are these statements **true** or **false**?

		True	False
a.	The shear strain in a rod is the deformation per unit length	☐	☐
b.	The Hook's law states that for small deformations the stress is directly proportional to the strain.	☐	☐
c.	The ratio of the lateral strain over the axial strain is called *Poisson's ratio*.	☐	☐
d.	The hoop stress of spherical thin-walled pressure vessels is twice as large as the longitudinal stress.	☐	☐
e.	Ductile materials are characterized by the fact that, when subjected to a tensile test, they fail suddenly through fracture without any prior yielding.	☐	☐
f.	The failure criterion most frequently used for brittle materials is the maximum-shear-stress criterion.	☐	☐
g.	The plane of maximum shearing stress is at 45 degree to the principal plane.	☐	☐
h.	The beam which has a fixed end at $x=0$ and is supported by a roller at $x=L$ is statically indeterminate.	☐	☐
i.	If the stress on a transverse section of a column is less than the allowable strength then you can conclude that the column has been properly designed.	☐	☐
j.	The strain energy density is equal to the area under the load-deformation diagram.	☐	☐

2. A beam is constructed by gluing three long, rectangular x-cross section piece of wood so that the resulting x-section is as shown below in Figure (1a). The loading is such that, at a particular transverse section, the internal shear force and the bending moment are as shown in Figure (1b).

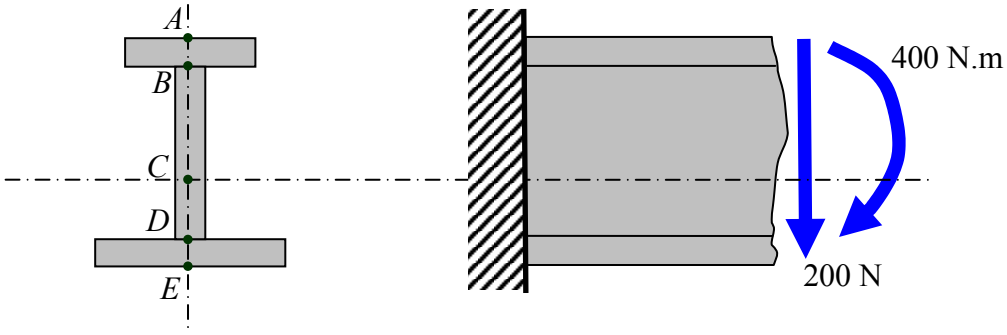

Figure (1)

Use the point labeled on Figure (1a) to complete the statement below. (There may be more than one answer for each statement):

a) Zero normal stress occurs at Point(s) _____.

b) Zero shear stress occurs at Point(s) _____.

c) Maximum compressive stress occurs at Point(s) _____.

d) Maximum shear stress occurs at Point(s) _____.

e) Maximum tensile stress occurs at Point(s) _____.

3. The beam *ABCD* is loaded by a force *W*=30 KN by the arrangement shown in the Figure (2). The cable passes over a small frictionless pulley at *B* and is attached at E to the vertical arm. Calculate the following:

a) The reaction forces at *A* and *D*.
b) The axial forces *N* at section *C*.
c) The shear force *V* at section *C*.
d) The bending moment *M* at section *C*.

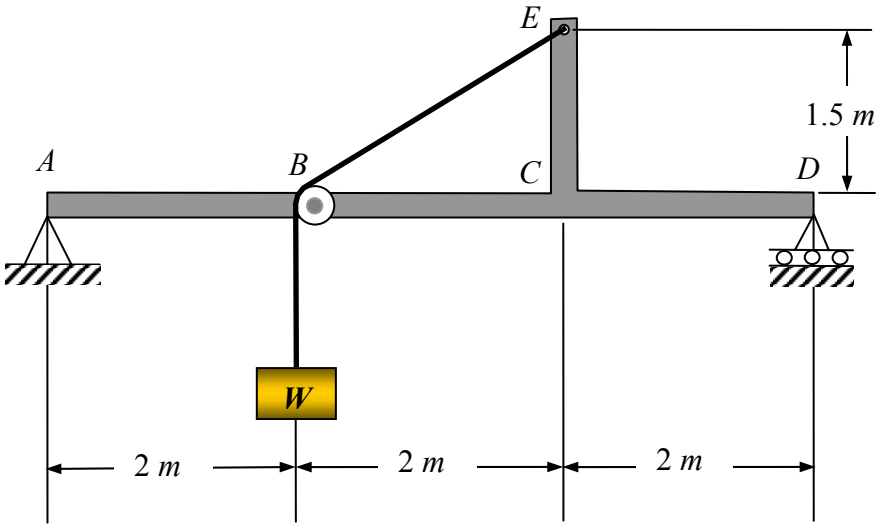

Figure (2)

بسم الله الرحمن الرحيم

Mechanics of Materials
MENG270
Final Exam

Open-book Exam
Time 1 hrs
Wednesday: 23/10/1424 H

Student Name:		Sec. No.:	ID No.:
Q4: /10	Q5: /10	Q6: /10	

4. Each member of the truss shown in Figure (3) is made of aluminum (E= 72 GPa). If the cross section area of the member BC is 2000 mm^2 and of the member CD is 2500 mm^2. Determine the strain energy of the truss.

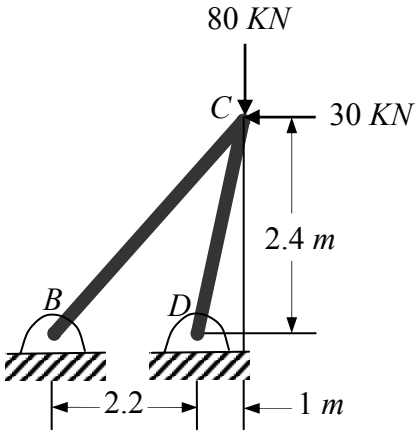

Figure (3)

5. Beam *CE* rests on beam *AB* as shown in Figure (4). Knowing that a W250x49.1 rolled steel shape is used for each beam (E = 200 GPa), determine the following:

a) The deflection at point *D* due to point load on beam *CE*.
b) Forces acting on beam *AB*.
c) Deflection at point *C* on beam *AB*.
d) Total deflection at point *D*.

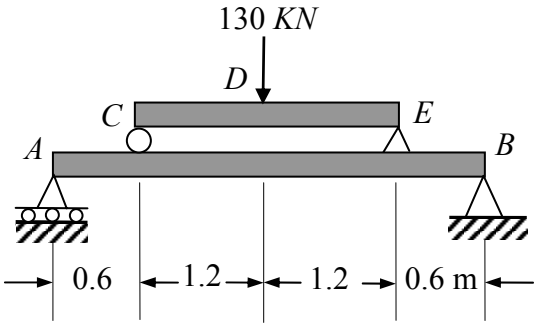

Figure (4)

6. Knowing that the couple M_x shown in Figure (5) acts in the vertical plane of a cantilever beam, determine the stress at point A and at point B.

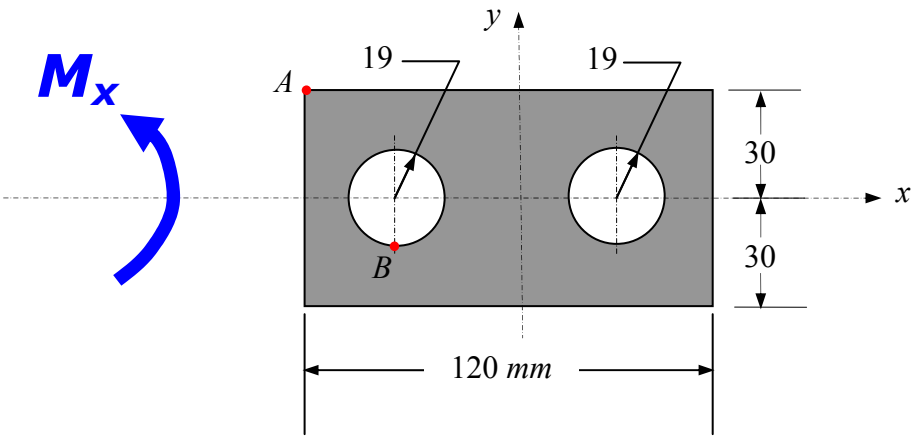

Figure (5)

مع دعواتنا لكم بالتوفيق والنجاح

د. سعيد عسيري
د. عبدالحميد مؤمن

You can check your answers online right after the exam.
Just go to the course website at:
http://www.asiri.net.