INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2019**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**EGM1180 : Mechanics of Engineering Materials**
Date of Examination	:	August 3, 2019 (Saturday)
Time	:	2:00 pm – 4:00 pm Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

NIL

Examiner (s) : **Soo Swee Yoong**

Moderator : Mr Abdolreza Toudehdehghan

*This paper consists of **6** printed pages, including the cover page.*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGM1180: MECHANICS OF ENGINEERING MATERIALS
FINAL EXAMINATION: APRIL 2019 SESSION

Instructions: This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) A steel bar *2 m* long and *150 mm²* in cross-section is subjected to an axial pull of *15 kN* as shown in Figure Q1 (a). Find the elongation of the bar. Take $E = 200\ GPa$.
(5 marks)

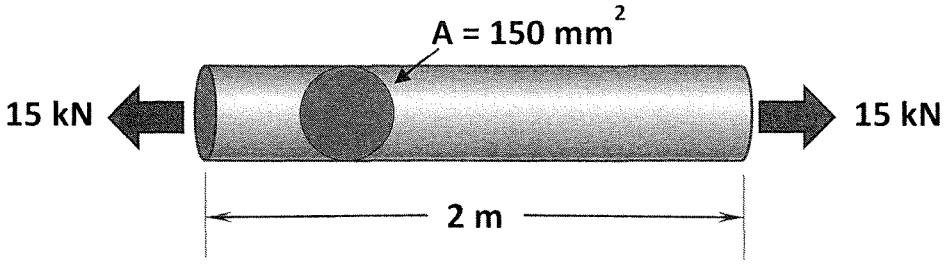


Figure Q1 (a)

(b) A compound bar ABC *2.5 m* long is made up of two parts of aluminium and steel and that cross sectional of aluminium bar is twice that of the steel bar. The rod subjected to an axial tensile load of *300 kN*. If the elongation of aluminium and steel parts are equal, applying the Principle of Superposition, find the lengths of the two parts of the compound bar as shown in Figure Q1b. Take E = *200 GPa* for steel and E for aluminium as one-fourth of E for steel. (10 marks)

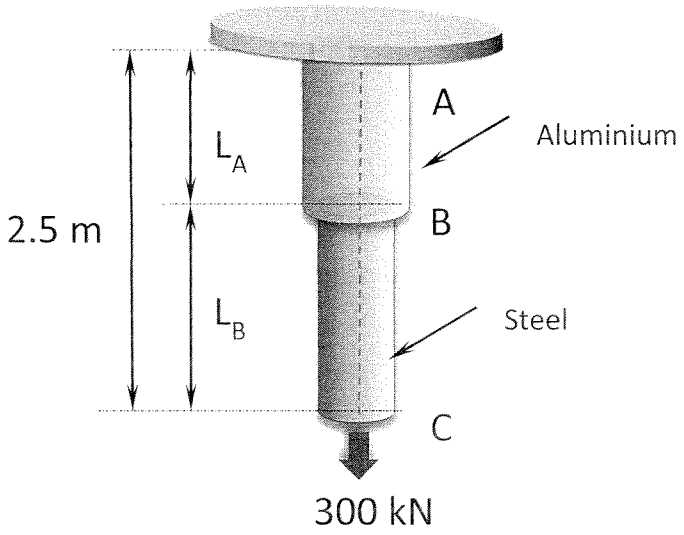


Figure Q1 (b)

(c) A steel rod ABC is firmly held between two rigid supports A and C as shown in Figure Q1 (c). Find the stresses developed in the two portions of the rod, when it is heated through *15 K*. Take $\alpha = 12 \times 10^{-6} / K$ and E = *200 GPa*.

(10 marks)

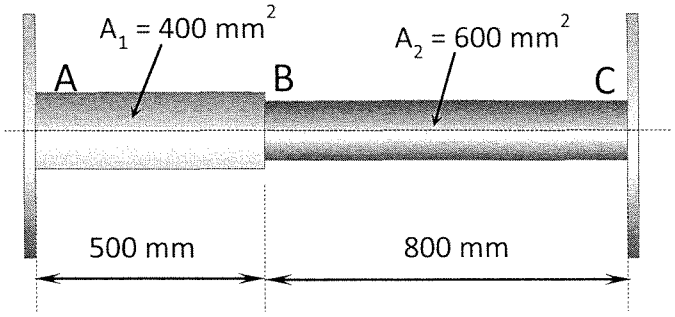


Figure Q1 (c)

Question 2

(a) In an experiment, a bar of *30 mm* diameter is subjected to a pull of *60 kN*. The measured extension on gauge length of *200 mm* is *0.09 mm* and the change in diameter is *0.0039 mm*. Calculate the Poison's ratio and the values of the three moduli (E, G and K).

(10 marks)

(b) A steel cube block of *50 mm* side is subjected to a force of *6 kN* (Tension), *8 kN* (Compression) and *4 kN* (Tension) along x, y and z directions respectively. Determine the change in volume of the block. Take E as *200 GPa* and $\upsilon = 0.3$.

(15 marks)

Question 3

(a) For the *60 mm* diameter solid cylinder and the loading shown in Figure Q3 (a), determine the maximum shearing stress and determine the inner diameter of the hollow cylinder, of *80 mm* outer diameter, for which the maximum shear stress is the same as the *60 mm* diameter solid shaft.

(10 marks)

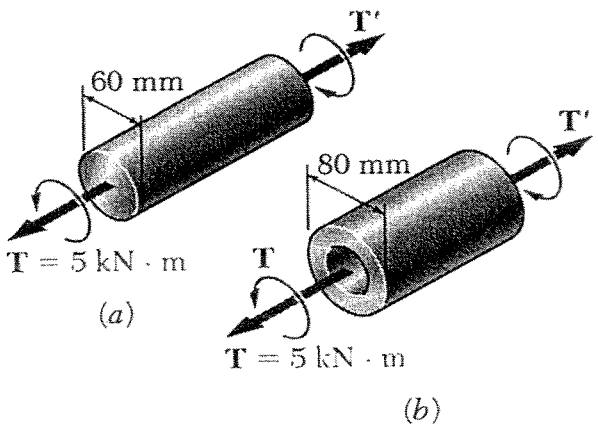


Figure 3 (a)

(b) Knowing that a *10 mm* diameter hole has been drilled through each of the shafts AB, BC, and CD, as shown in Figure Q3 (b), determine (i) the shaft in which the maximum shearing stress occurs, (ii) the magnitude of that stress.

(15 marks)

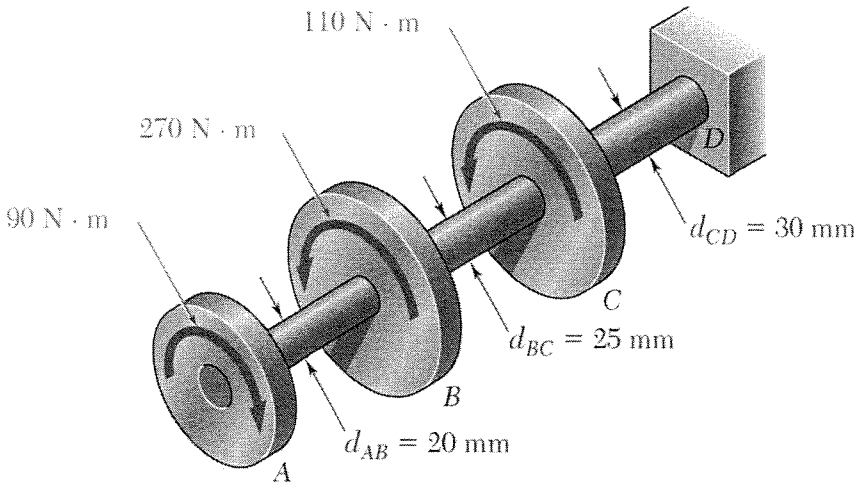
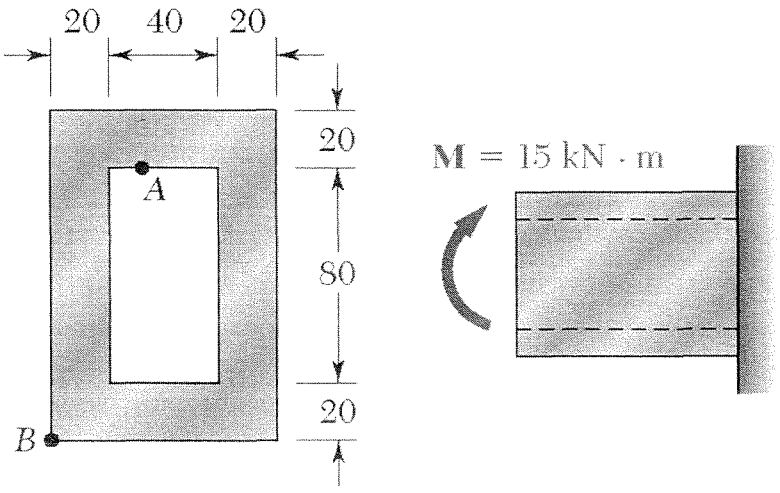


Figure Q3 (b)

Question 4

(a) Knowing that the couple shown in Figure Q4 (a) acts in a vertical plane, determine the stress at (i) point A, (ii) point B.

(10 marks)



Dimensions in mm

Figure Q4 (a)

(b) Two vertical forces are applied to a beam of the cross section shown in Figure Q4 (b). Determine the maximum tensile and compressive stresses in portion BC of the beam.

(15 marks)

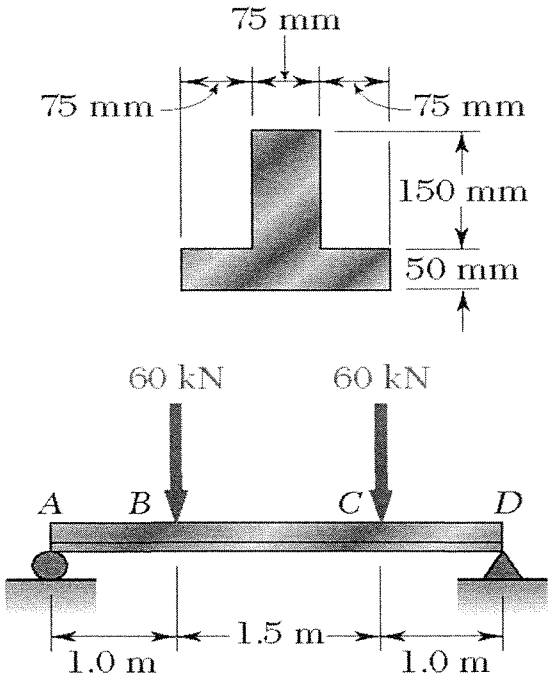


Figure Q4 (b)

Question 5

For the beam and loading shown in Figure Q5, determine (a) the equation of the elastic curve for portion BC of the beam, (b) the deflection at mid-span, (c) the slope at B. Express all the above in terms of E, I, L and ω.

(25 marks)

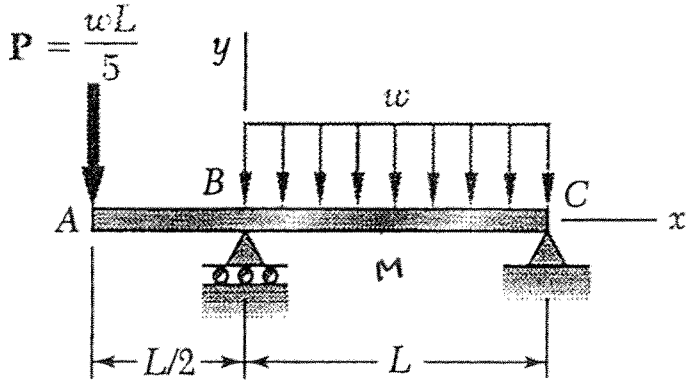


Figure Q5

Question 6

For the stressed element shown in Figure Q6, find the principal stresses and the maximum shear stress. On a diagram, show the position of the principal planes, and the planes of maximum shear stress.

(25 marks)

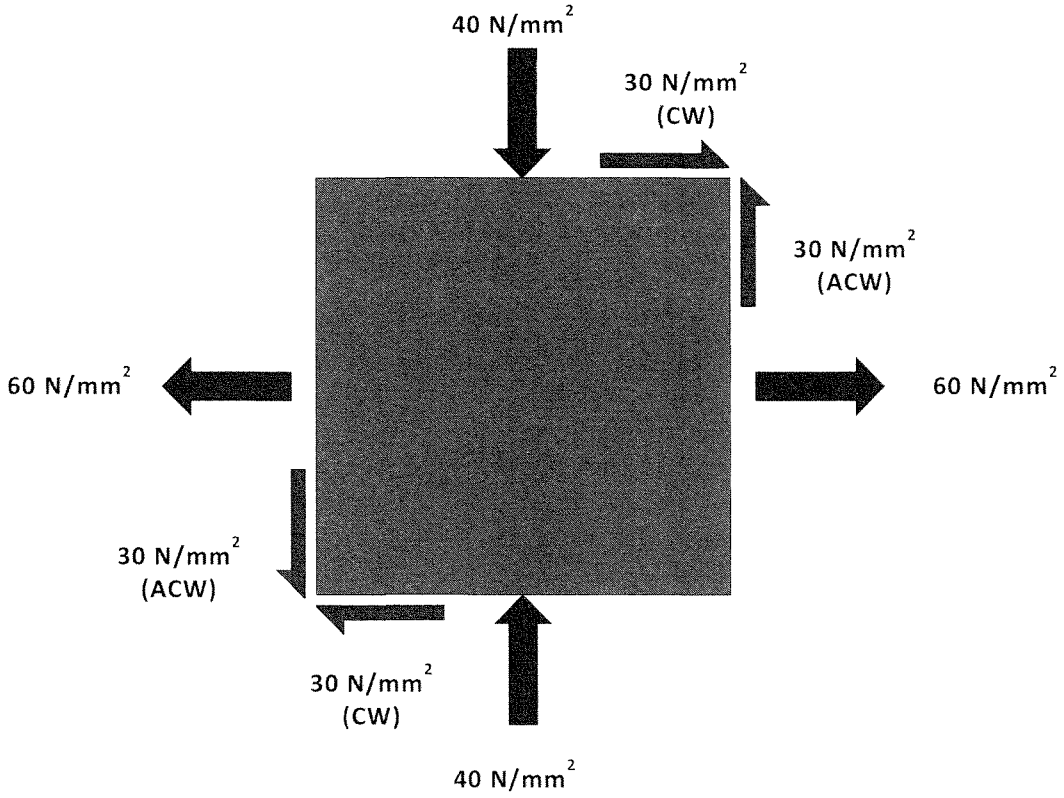


Figure Q6

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