FINAL

ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**EGM1180 : Mechanics of Engineering Materials**
Date of Examination	:	August 3, 2020 (Monday)
Time	:	8:00 am – 10:15 am Reading Time : Nil
Duration	:	2 hours 15 mins

Special Instructions :

Answer **ALL FOUR (4)** questions.

Material permitted : Non-Programmable Calculator

Materials provided : Nil

Examiner(s)	:	**Soo Swee Yoong** & Dr Aaron Edward Teo
Chief Moderator	:	Mr Tham Chan Seng

*This paper consists of **5** printed pages, including the cover page*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGM1180: MECHANICS OF ENGINEERING MATERIALS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instruction: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Determine the average normal stress in each of the 20-mm diameter bars (AB, BC and AC) of the truss. Set P = 40 kN. Please use the method of joints.

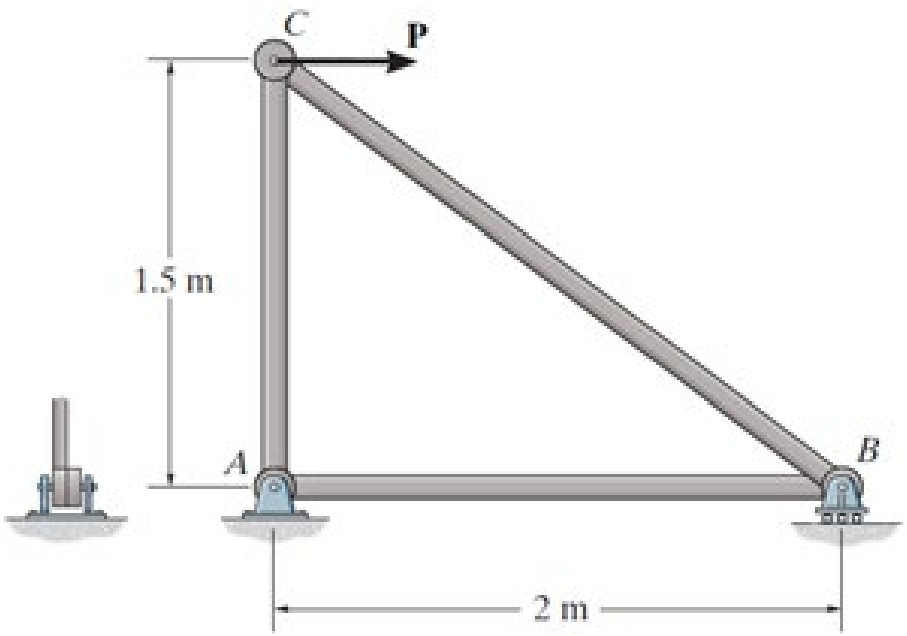

Figure 1(a)

(15 marks)

(b) A 4-m-long steel rod must not stretch more than 3 mm and the normal stress must not exceed 150 MPa when the rod is subjected to a 10-kN axial load. Given that E = 200 GPa, determine the required diameter of the rod in mm.

(10 marks)

Question 2

(a) The solid compound shaft in Figure 2(a), made of three different materials, carries the two torques.

(i) Calculate the maximum shear stress in each material.
(ii) Find the angle of twist of the free end of the shaft.

Given the shear moduli are 28 GPa for aluminium, 83 GPa for steel, and 35 GPa for bronze.

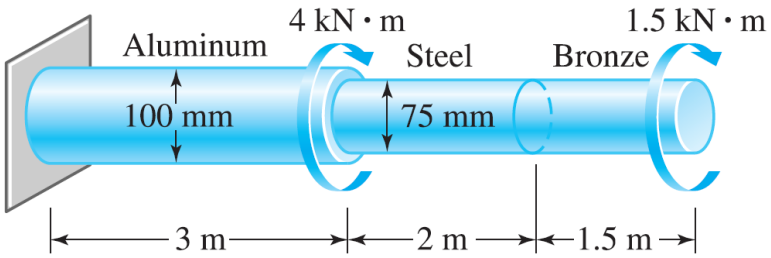

Figure 2 (a) Connecting rod

(15 marks)

(b) Figure 2(b) show a point in a strained material is subjected to the stresses

(i) Determine the equivalent state of stress on an element at the same point oriented 60° clockwise with respect to the element shown.

(ii) Sketch the results on the element.

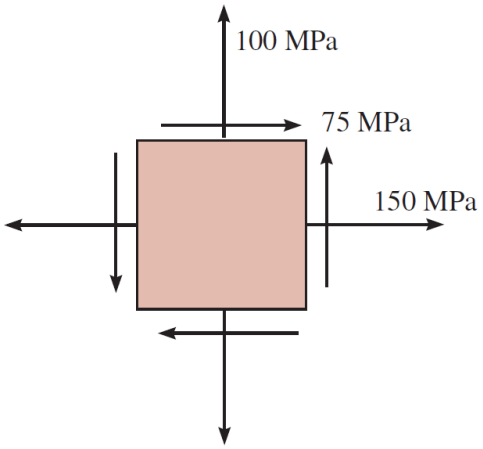

Figure 2(b) A point in a strained material is subjected to the stresses.

(10 marks)

Question 3

(a) Given the allowable stress in section a-a of the hydraulic press shown in Figure 3(a) is 40 MPa in tension and 80 MPa in compression.

(i) Determine the centroid and moment of inertia of the structure. Draw and label all the centroid properly.

(ii) Determine the largest force P that can be exerted by the press.

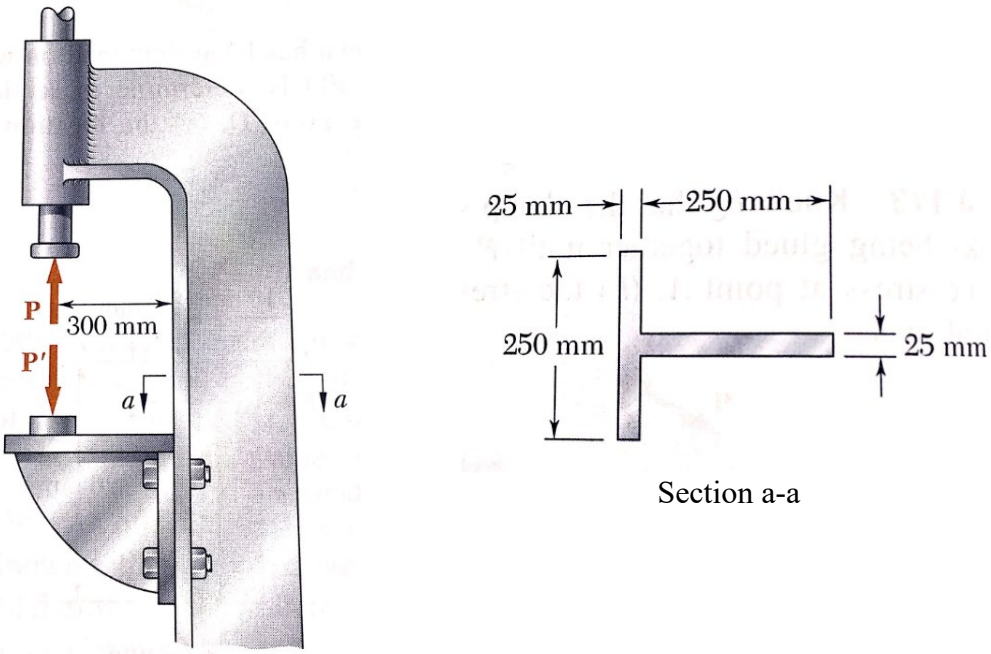

Figure 3(a) Hydraulic press under force

(15 marks)

(b) Figure 3(b) show a 'n' like structure under shear force V,

(i) Calculate the centroid and moment of inertia of the structure. Draw and label all the centroid.

(ii) Determine the largest shear force V that the member can sustain if the allowable shear force is τ_{allow}=56 MPa.

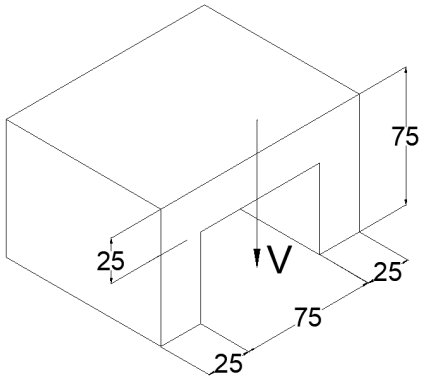

Figure 3(b) 'n' like structure under shear force, V. (Dimensions are in mm)

(10 marks)

Question 4

(a) Figure 4(a) show a beam under a distributed load. The connection at point A is a roller and B is an external pin. Determine the displacement at C and the slope at A of the beam.

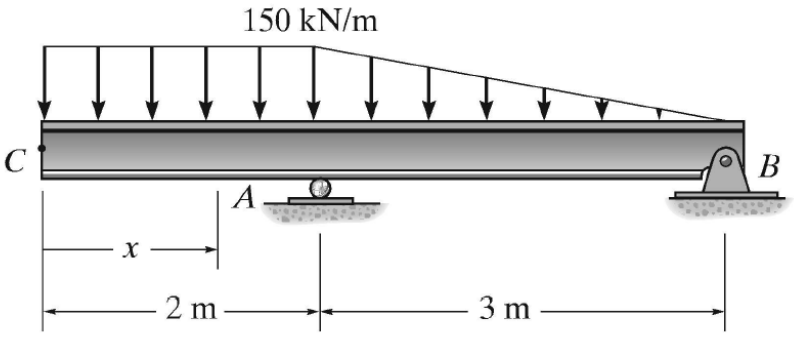

Figure 4(a)

(15 marks)

(b) Figure 4(b) show a beam under a load of 35 kN at point B. Connection at point A is an external pin and at point D is a roller. Given the Young modulus of the beam, $E = 200\text{GPa}$ and area moment of inertia, $I = 23.9 \times 10^{-6}\text{m}^4$, determine the strain energy due to bending for the beam and loading. Draw the free body diagram (FBD) and label all the related forces.

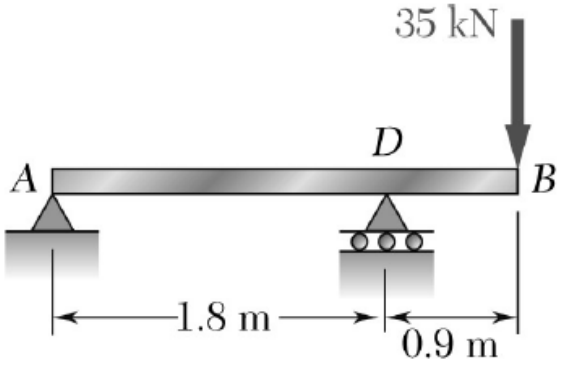

Figure 4 (b)

(10 marks)

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