Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

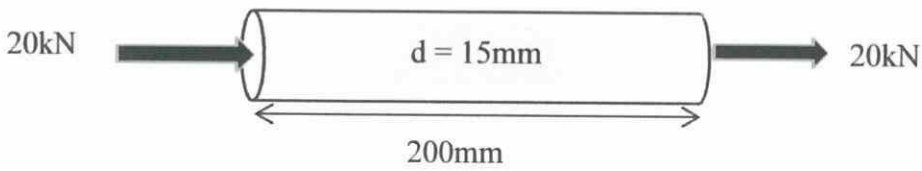
COURSE NAME	:	SOLID MECHANICS
COURSE CODE	:	BBM 30303
PROGRAMME CODE	:	BBA / BBG
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWERS **FOUR (4)** QUESTIONS
		2. THIS FINAL EXAMINATION IS A **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) What are of the Factor of safety (FOS) in the stress and strain analysis.

(2 marks)

(b) A steel rod Figure 1 (b) have Modulus of Elasticity 200 GPa , U= 0.3 with diameter d = 15 mm. Find the change of diameter of the rod.



(13 marks)

Figure 1 (b)

(c) A steel rod Figure 1 (c) 500 mm long and 20 mm x 10 mm in section is subjected to an axial pull of 300kN. If the Modulus of Elasticy is 2×10^5 MPa. Calculate the Stress, Strain and Elongation of the rod.

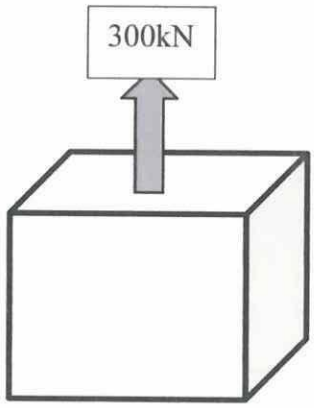


Figure 1(c)

(10 marks)

Q2 (a) Draw a shear force diagram and bending moment diagram for a simple supported beam as shown in Figure 2 (a).

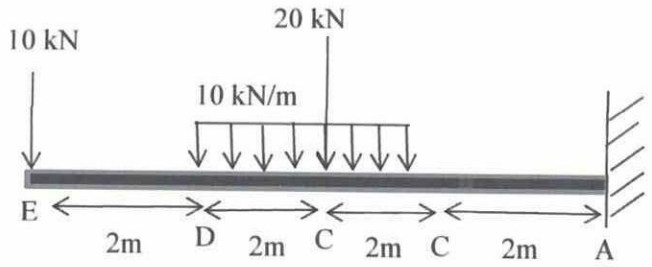


Figure 2 (a)

(i) What is the force at the point A

(9 marks)

(ii) Draw the Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of the beam as in Figure 2 (a).

(16 marks)

Q3 (a) Determine the second moment of area for beam cross-section as shown Figure 3 (a) below:

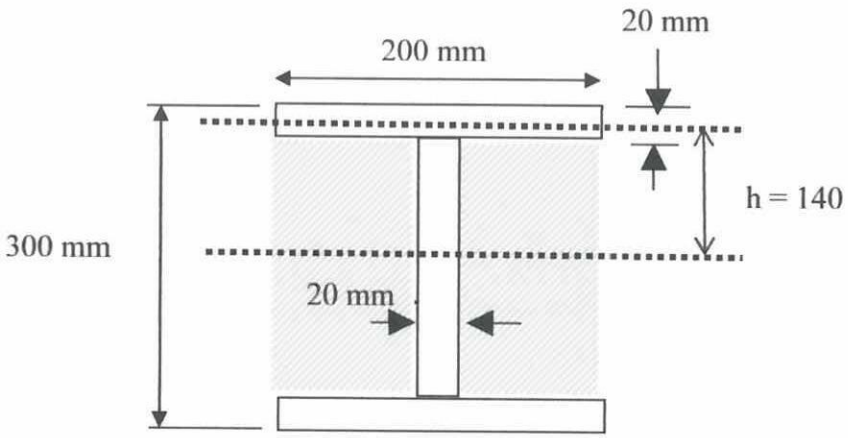


Figure 3(a)

(8 marks)

(b) A cast-iron machine part Figure 3(b) is acted upon by a 3 kNm couple. Knowing E = 165 GPa and neglecting the effects of fillets, determine (a) the maximum tensile and compressive stresses, (b) the radius of curvature.

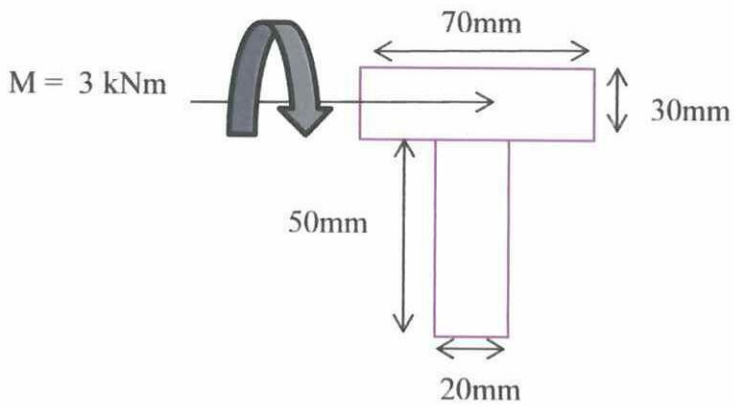


Figure 3(b)

(17 marks)

Q4 (a) Pulleys D and E, which are attached to solid circular DE and EG, are subjected to the torque illustrated in Figure 4(a). Determine the minimum diameter of shaft EG for which the maximum shearing stress in the assembly is not raised in order to lower the overall mass of the assembly.

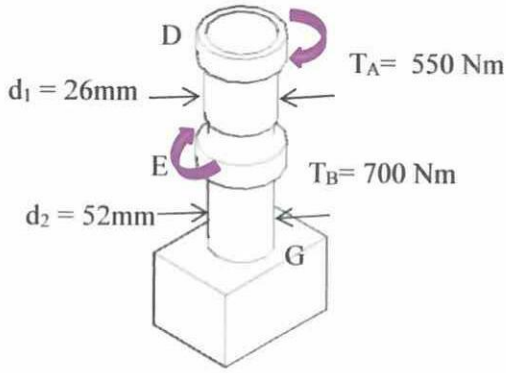


Figure 4(a)

(10 marks)

(b) Two solid shaft AB and BC of aluminium and steel are rigidly fastened together at B and attached to rigid support A and C as shown in Figure 4(b). A torque of 200Nm is applied at junction B. Modulus of rigidity of aluminium and steel are $3x10^4$ N/mm^2 and $9x10^4$ N/mm^2.The diameter of steel is 40mm. Calculate minimum shearing stress in each material and the angle of twist at the junction.

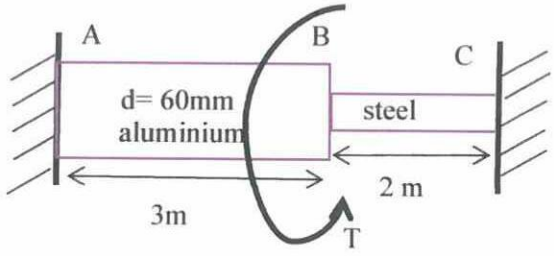


Figure 4(b)

(15 marks)

Q5 (a) A cylindrical pressure vessel is 20 mm thick. The diameter of vessel is 500mm and length is 3 m if hoop stress is 140 MPa. What is the internal pressure and change in length of vessel. E= 210GPa, μ =0.28

(10 marks)

(b) A closed cylinder vessel made of steel -plates 4 mm thick with plane ends carries fluid under a pressure of 3 N/mm^2. The diameter of the cylinder is 250mm and length is 750 mm. Calculate longitudinal and hoop stress in the cylinder wall and determine change in diameter ,length and volume of cylinder . E= 2.1 x 10^5 N/mm^2, μ = 0.286

(15 marks)

Q6 (a) Find the $\sigma x'$, $\sigma y'$, $\tau xy'$ for the element shown in Figure 5(a) if the element was rotate 60° clockwise.

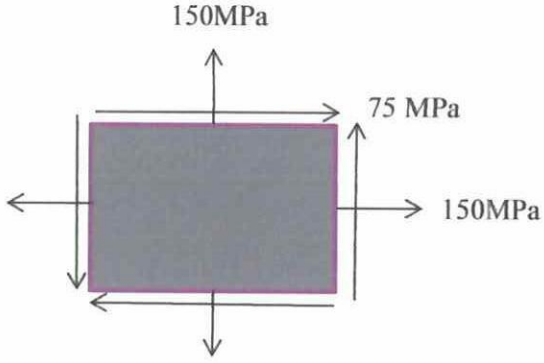


Figure 5(a)

(10 marks)

(b) The state of plane stress at point on a body is represented on the element shown in Figure 5(b) . Determine the maximum in plane shear stress and associated average normal stress.

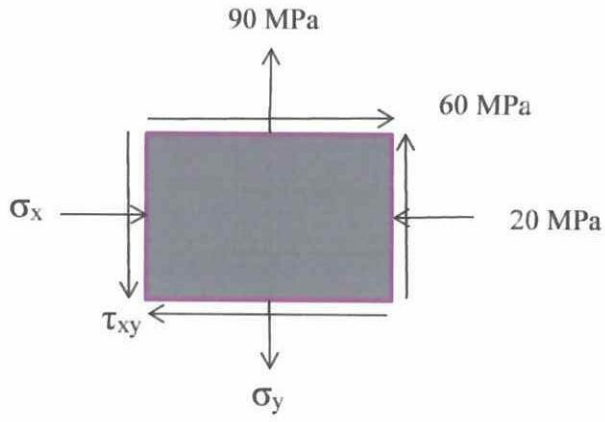


Figure 5(b)

(15 marks)

-END OF QUESTIONS –