Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	SOLID MECHANICS
COURSE CODE	:	DAM 11203
PROGRAMME CODE	:	DAM
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FIVE (5)** QUESTIONS ONLY

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

Q1 (a) Describe point load and distributed load with the aid of sketch.

(4 marks)

(b) Two solid cylindrical roads AB and BC are welded together at B and loaded as shown in fugure Q1(b). Knowing that d1 = 30 mm and d2 = 50 mm, find the average normal stress in the mid section of (a) rod AB, (b) rod BC.

(4 marks)

(c) A specimen of steel 20 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 80 kN and the load at elastic limit is 102 kN. The Poisson ratio is 0.907. Calculated

(i) The stress at elastic limit

(3 marks)

(ii) Young's modulus.

(3 marks)

(iii) Decrease in diameter.

(3 marks)

(iv) Calculate a free expansion of the specimen length as temperature increase from 15°C to 65°C before load been applied.($\alpha = 12 \times 10^{-6}$ per °C)

(3 marks)

Q2 (a) List out 2 types of load:

(2 marks)

(b) Explain and draw the type of supports beams below

(i) Cantilever with end load

(2 marks)

(ii) Simply supported beam carrying a uniformly distributed load of w per unit run over the whole span

(2 marks)

(iii) Simply supported beam with equal overhangs and carrying a uniformly distributed load of w per unit run over the whole length

(2 marks)

(c) A cantilever beam AB 10 meters long, as shown in **Figure Q2 (b).**

(i) Draw shear force and bending moment diagrams

(10 marks)

(ii) Determine the location and magnitude of the maximum value of the bending moment.

(2 marks)

Q3 (a) Explain in diagram the stress variation across beam section when it is subjected to a positive bending moment.

(5 marks)

(b) A cross- sectional area of the beam is shown in **Figure Q3(b)**. If the limiting bending for the material of the beam are 160 MPa in torsion and 80 MPa in compression. Find length of the beam, L if the beam is simply supported at both ends with uniform distributed load along the beam of 3 kN/m

(15 marks)

Q4 (a) List **three (3)** examples of assumption to determine the relationship of the shearing stress in circular shaft subjected to torsions

(2 marks)

(b) A solid steel shaft is transmit a torque of 10 kN/,. If the shearing stress is not exceed 45 Mpa, find the diameter of the shaft.

(6 marks)

(c) The horizontal shaft *AD* is attached to a fixed base at *D* and is subjected to the torques shown in **Figure Q4 (c).** A 44-mm-diameter hole has been drilled into portion *CD* of the shaft. Knowing that the entire shaft is made of steel for which $G = 77$ GPa, determine the angle of twist at end *A*.

(12 marks)

Q5 (a) Give **Three (3)** example of cylindrical pressure vissel.

(3 marks)

(b) A boiler of 500 mm diameter is built of steel plate. If a 4 MPa pressure is applied to the boiler, calculate the thickness of the steel plate. Given the maximum longitudinal stress is 400 MPa

(4 marks)

(c) A boiler with 500 mm diameter and 5 m long constructed from 4mm thick steel plate is subjected to an internal pressure 6 MPa If the Modulus of Elasticity 200 GPa, and Poisson ratio of 0.3. Determine;

(i) the change in the diameter

(4 marks)

(ii) the change in the length

(4 marks)

(iii) the change in the volume

(5 marks)

Q6 (a) Give two (2) methods to compute principal stresses.

(2 marks)

(b) Explain the procedures for analysis, if state of stress at a point is known for a given orientation of an element of material.

(4 marks)

(c) For the state of plane stress shown in **Figure Q6 (c)**, determine

(i) The principal planes

(2 marks)

(ii) The principal stresses

(2 marks)

(iii) The maximum shearing stress and the corresponding normal stress.

(4 marks)

(iv) Draw the Mohr's Circle for the state of plane loaded

(6 marks)

-END OF QUESTIONS –