

Course Title: Strength of Materials and Stress Analysis

Date: 29-8- 2019

Course Code: MPD (Summer Course)

Allowed time: 3 hrs.

Year: 1st level Mechatronics

(Final Term Exam)

No. of pages: 2

Answer all the following questions: (Assume any missing data)

Q1. (5 marks)

a- Draw normal force, shear force and bending moment diagrams for the cranked cantilever beam shown in Figure 1. Insert all the principal values.

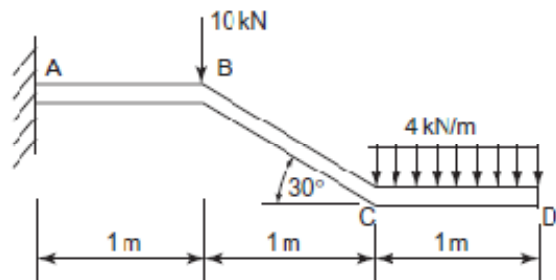


Fig (1)

Q2. (15 marks)

a) The cranked cantilever ABC shown in Fig. 2 carries a load of 3 kN at its free end. And have square cross section $5 \times 5 \text{ cm}^2$. Determine the following:

- 1- The maximum tensile and the maximum shear stresses in the rod by the following.
 - a- Analytical method
 - b- Graphical method
- 2- Draw the stress distribution at cross section A.
- 3- Draw shear force, bending moment and torsion diagrams for the complete beam.

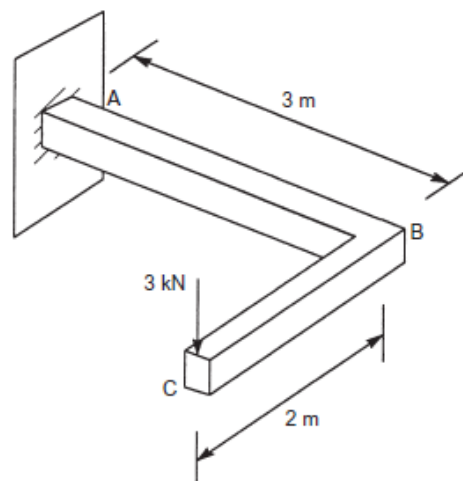


Fig (2)

Q3.

(15 marks)

1- For the beam shown in Fig. 3 .Find the factor of safety using:

- 1) Maximum shear stress theory.
- 2) Maximum distortion energy theory.
- 3) Draw the bending moment diagram.

Take the tensile yield strength of the material as **300 MPa**.

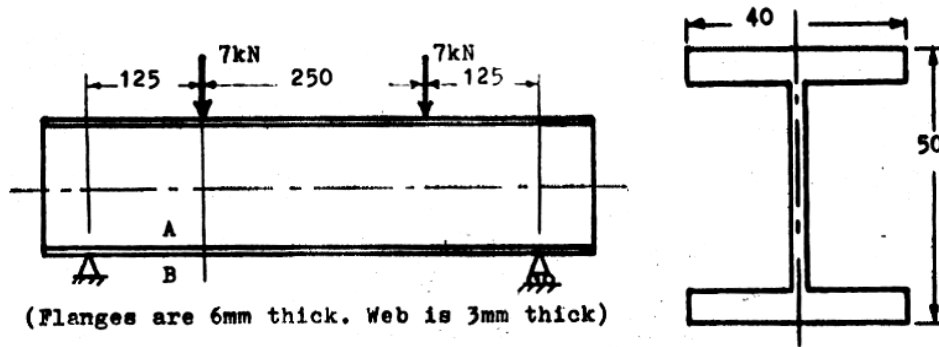


Fig (3)

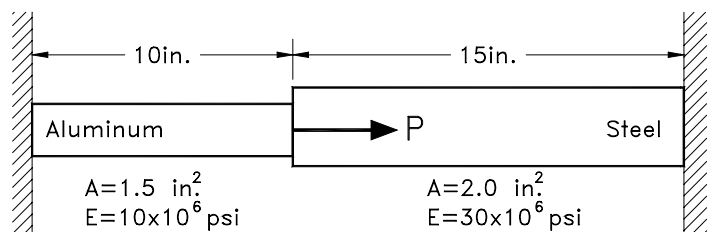
2- A thin-walled spherical shell is fabricated from steel plates and has to withstand an internal pressure of **0.75 N/mm²**. The internal diameter is **3 m** and the joint **efficiency 80%**. Calculate the thickness of plates required using a working stress of **80 N/mm²**. (Note, effective thickness of plates **50.83** actual thickness).

Q3.

(5 marks)

1. The composite bar shown is firmly attached to unyielding supports at the ends and is subjected to the axial load P shown. If the aluminum is stressed to **10,000 psi**, find the stress in the steel.

- A. 1000 psi
- B. 2000 psi
- C. 5000 psi
- D. 10,000 psi
- E. 20,000 psi



Also, draw the deformation in the composite bar?

With my best wishes

Dr. Eng. Maher .R. Elsadaty