Indian Maritime University

(A Central University, Govt of India)

May-June 2018 End Semester Examinations

B. Tech (Marine Engineering)

Semester-II

STRENGTH OF MATERIALS-I (UG11T3204)

Date: 17.06.2018 Max Marks:100 Marks

Time: 3 Hrs Pass Marks: 50 Marks

PART-A Marks:10X3 =30

(All questions are Compulsory)

1.

(a) Define Thermal stress? Mention the examples of deformation induced by thermal stress.

(b) A load of 5 KN is to be raised with the help of a steel wire. Find the diameter of steel wire, if the maximum stress is not to exceed 100 MNm^2.

(c) Write the equation of Strain Energy stored in the bar and name the terms used in it?

(d) Define shear force and Bending Moment.

(e) What is section modulus? Write the formula of section modulus for rectangular section?

(f) Define the term circumferential stress & longitudinal stress.

(g) Derive the equation of hoop stress for Spherical shell.

(h) What are the advantages of welded joints?

(i) Define the term torsion. List few examples of torsion in engineering practice.

(j) Define Torsional Stiffness and Torsional flexibility.

PART-B Marks: 5X14=70

(Answer any 5 of the Following)

2. A mild steel bar 250 mm long and 100 mm X 100 mm in cross-section is subjected to longitudinal axial compressive force of 1000 KN. Determine the values of lateral forces necessary to prevent any transverse strain. Also find change in length and volume.

Assume E =200 GPa and μ= 0.3. (14 marks)

3. **a)** A composite bar shown in Figure 1 is rigidly fixed at the two ends. There is no stress in the bar at a temperature of 20°C. If the temperature of the bar is raised to 40°C, find the forces applied by the rigid wall on the bar.

Take: E = 200 GN/m^2 for both and α =11.7 x 10^{-6}/^{0}C for both.

(06 marks)

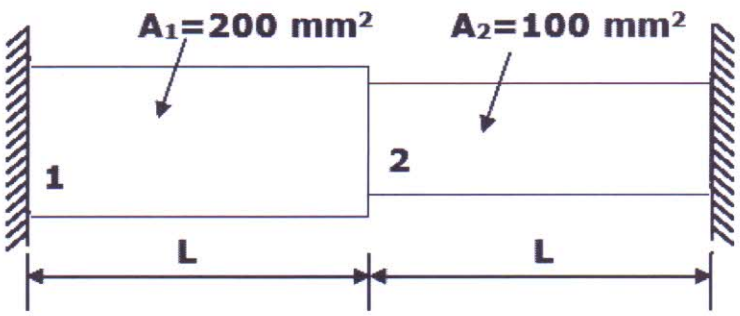

Figure: 1

b) Draw a stress strain diagram for a ductile material and show the elastic limit, yield point and ultimate strength. Explain any one of these three.

(08 marks)

4. a) A vertically suspended steel bar, circular cross-section, is subjected to a load of 5 KN which falls by 20 mm on rigid collar provided at lower end of bar. If maximum allowable strain for bar is 1/1250, find suitable diameter of the rod. Assume E=200GPa and length of bar=2 m.

(07 Marks)

b) A plate 10 cm wide and 1.20 cm thick is joined with another plate by a single fillet lap weld and a double parallel fillet weld as shown in figure 2.The maximum tensile and shear stresses are 75 N/mm^2 and 55 N/mm^2 respectively. Find the length of each parallel fillet, if the joint is subjected to a total load of 90KN. (07 Marks)

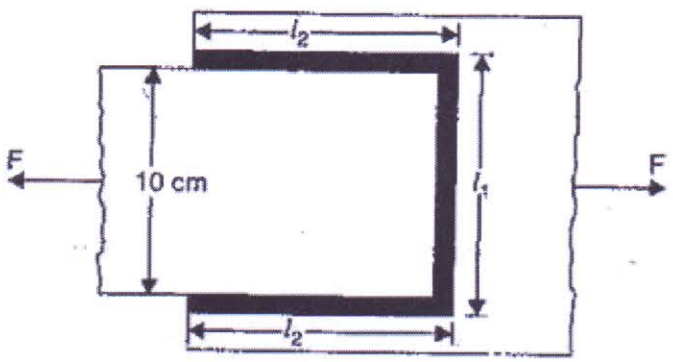

Figure: 2

5. The beam is supported & loaded as shown in figure 3. Draw Shear Force & Bending Moment diagrams indicating all important values. (14 Marks)

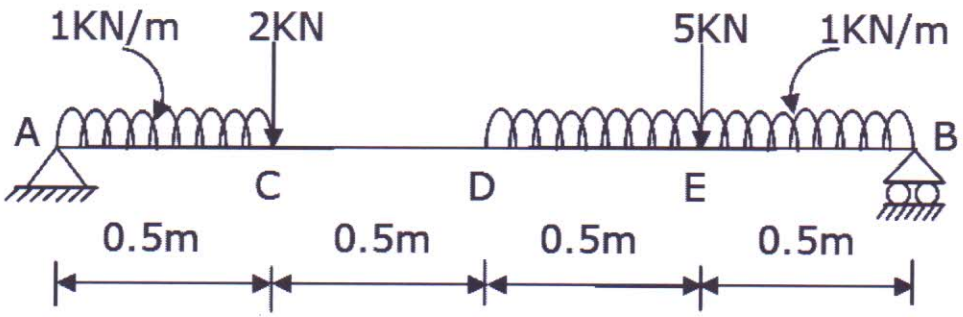

Figure: 3

6. A cylindrical shell 3 m long which is closed at the ends has internal diameter of 1m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions (ie. δd, δL and δv) of the shell, if it is subjected to an internal pressure of 1.5 MN/m^2 Take E = 200 GN/m^2 and poison's ratio =0.3. (14 Marks)

7. Two wooden planks 150mm X 50 mm each are connected to form a 'T' section of a beam. If a moment of 3.4 KN-m is applied around the horizontal neutral axis, including tension below the neutral axis, find the stresses at the extreme fibres of the cross-section. Also calculate the total tensile force on the cross section. (14 Marks)

8. a) Drive the relation for a circular shaft when subjected to torsion as given below: $T/J = \tau/R = G\,\theta/L$ (8 Marks)

b) A closed helical spring is made out of 10 mm diameter steel rod. The coil consist of 10 complete turns with a mean diameter of 120 mm. The spring carries an axial pull of 200 N. Find the maximum shear stress induced in the section of the rod. If G= 80 GN/m^2, find the deflection in the spring ,stiffness and maximum shear stress. (6 Marks)