

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
End Semester Examination Dec 2019/Jan 2020
B Tech (Marine Engineering)
Semester –II
UG11T1204/2204- Strength of Materials - I

Date: 08.01.2019
Time: 3 Hours

Max Marks: 70
Pass Marks: 35

Part – A (compulsory)

Answer the following (10x2=20 Marks)

- 1) Define stress and name its type.
- 2) Define Thermal stress.
- 3) Write the equation of Strain Energy stored in the bar and name the terms used in it?
- 4) Define shear force and Bending Moment.
- 5) What stresses are developed in thin cylinder because of internal fluid pressure?
- 6) Write down the equation of bursting force in spherical shell ?
- 7) Write down the formula for throat thickness of the weld?
- 8) Define section modulus?
- 9) Differentiate between torque and torsion. List few examples of torsion in engineering practice.
- 10) Write down the formula for stiffness of closely coiled helical spring and specify the notation used in it.

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

- 11.** A steel bar of 60 mm X 60 mm in section and 180 mm long is loaded and are subjected to:
- (a) 300 KN tensile load along the longitudinal axis and
 - (b) 750 KN and 600 KN tensile loads on the lateral faces.

Find the change in the dimensions of the bar and the change in the volume, if $E = 200 \text{ GN/m}^2$ and poisson ratio = 0.3

(10 marks)

- 12. a)** A copper rod 15 mm diameter, 0.8 m long is heated through 50°C. What is its expansion when free to expand? Suppose the expansion is prevented by gripping it at both ends, find the stress, its nature and the force applied by the grips, when:
(i) The grips do not yield. (ii) One grip yields back by 0.5 mm.

Take: $E_c = 1.25 \times 10^5 \text{ N/mm}^2$, $\alpha_c = 18.5 \times 10^{-6}/^\circ\text{C}$ (05 marks)

- b)** Derive relation for change in length of the bar of uniformly tapering circular section of diameter d_1 at bigger end to d_2 at smaller end with subjected to an axial tensile load P . Take the length of the bar L and the modulus of elasticity as E .

(05 marks)

- 13. a)** A steel specimen 1.5 cm^2 in cross section stretches 0.05 mm over 5 cm gauge length under an axial load of 30 kN. Calculate the strain energy stored in the specimen at this point. If the load at the elastic limit for specimen is 50 kN, Calculate the elongation at the elastic limit.

(05 Marks)

- b)** A plate 40 mm wide carrying a load of 100 kN is to be welded by four equal fillets to another plate as shown in figure 1. Find the necessary size of each fillet. Allowable working stress of 70 MN/m^2 in the side fillets and 100 MN/m^2 in the end fillets.

(05 Marks)

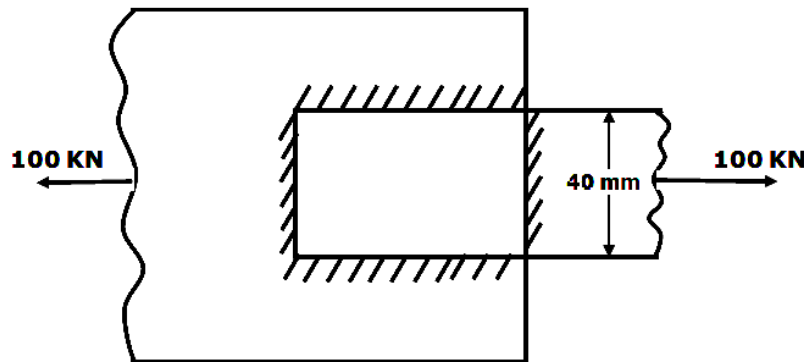


Figure: 1

14. The beam is supported & loaded as shown in figure 2. Draw Shear Force & Bending Moment diagrams indicating all important values.

(10 Marks)

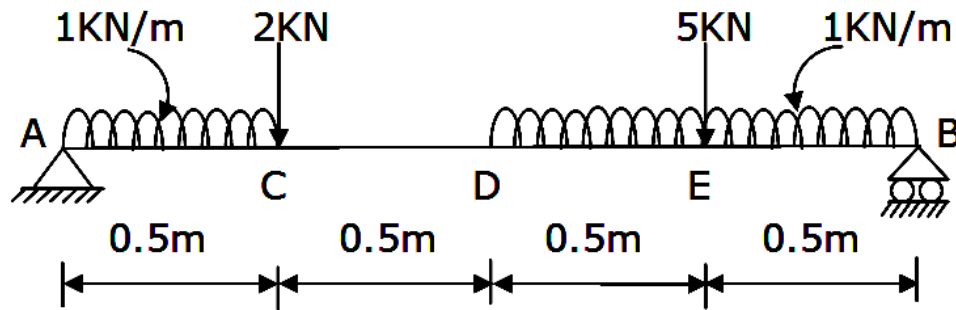


Figure: 2

15. A boiler shell is to be made of 15 mm thick plate having tensile stress of 120 MN/m^2 . If the efficiencies of the longitudinal and circumferential joints are 70 % and 30 % respectively. Determine Maximum permissible diameter of the shell for an internal pressure of 2 MN/m^2 .

(10 Marks)

16. A cast iron water main 12 meters long of 500 mm inside diameter and 25 mm wall thickness runs full of water and is supported at its ends. Calculate the maximum stress in the metal, if density of cast iron is 7200 kg/m^3 and that of water is 1000 kg/m^3

(10 Marks)

17. a) A solid circular shaft transmits 75 kw power at 200 rpm. Calculate the shafts diameter, if the twist in the shaft is not to exceed 1° in 2 meters length of shaft, and the shear stress is limited to 50 MN/m^2 . Take $G = 100 \text{ GN/m}^2$

(5 Marks)

b) For close-coiled helical spring subjected to an axial load of 300 N having 12 coils of wire diameter of 16 mm and made with the coil diameter of 250 mm, Find:

- i) Axial Deflection ii) Strain energy stored

Take $G = 80 \text{ GN/m}^2$.

(5 Marks)
