INDIAN MARITIME UNIVERSITY

Time Bound Assignment September/October 2020

B Tech (ME) Arrear Examinations

Strength of Materials – I

UG11T3204

Date: 26/09/2020 Maximum Marks: 70

Time: 3 Hrs Pass Marks: 35

Part – A (compulsory)

Answer the following (10x2=20 marks)

Q1. Define Nominal Breaking Stress and Actual Breaking Stress.

Q2. Define Poisson's ratio and state the relationship between Modulus of Elasticity, Modulus of rigidity and Bulk Modulus.

Q3. Define the terms Resilience and Proof Resilience of a material.

Q4. Using the proper notations state the relationship between the Loading Intensity, Shear Force and the Bending Moment.

Q5. State any four assumptions made in Theory of Simple Bending.

Q6. Define a Thin Pressure Vessel & state the assumption made with respect to the circumferential stress.

Q7. A uniform steel bar having E = 200 GPa, of length 2.5 m length and 20 mm in diameter is subjected to a pull of 60 KN. Determine strain energy stored and the resilience in the bar when the pull is suddenly applied.

Q8. State the two types of welds used in practice. Write the relationship between size of the weld and the throat of weld.

Q9. Define Torsional Stiffness and Torsional Rigidity.

Q10. Define Stiffness of spring and with suitable notations write the formula for Stiffness of spring under the load.

Part – B

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

Q11. (a) A steel bar 200 mm long, 40 mm x 40 mm in cross-section is subjected to a stress of 100 N/mm^2 along the length and 40 N/mm^2 on the other two faces all tensile in nature and change in volume was observed to be 125 mm^3. Find the Poisson's ratio. Take E = 200 GPa. **(5 Marks)**

(b) A copper rod 36 mm diameter is encased and rigidly attached to a steel tube which is 50 mm external diameter, having a thickness of 5 mm. The composite bar is subjected to an axial pull of 100 KN. Find the stress induced in each metal and extension if the length of the composite bar is 1.5 m. Take E_s = 200 GPa and E_c = 110 GPa. **(2+2+1 Marks)**

Q12. (a) A steel bar is square in cross-section having side 40 mm, 4 m long is heated through 75^{0}C with its ends clamped before heating. Calculate the force exerted by the bar on clamps: (i) If the clamps do not yield, (ii) If the clamps yield by 0.75 mm. Take E = 200 GPa and α = 11.5 x 10^{-6}/^{0}C.

(3+3 Marks)

(b) A steel bar consists of two sections connected in series. The length of each section is 1 m. The diameters of each section being 30 mm and 50 mm respectively. Find the total strain energy of the bar when it is subjected to an axial pull of 150 KN. Take E_s = 200 GPa. **(4 Marks)**

Q13. An unknown weight falls through 10 mm on a collar rigidly attached to the lower end of a vertical bar, 3 m long having a cross sectional area of 600 mm^2 & rigidly fixed at the top end. If the maximum instantaneous extension is 2 mm, Find the instantaneous stress and the value of unknown weight. Take E = 200 GPa. **(4+6 Marks)**

Q14. A simply supported beam has a span of 4 m between the two supports. The beam has an overhang of 2 m from the right hand support. The beam carries an uniformly distributed load of 2 KN/m throughout its entire length and a point of 2 KN at the end of the overhang. Draw the Shear Force Diagram & Bending Moment Diagram. Also locate the position of the point of contraflexure. **(10 Marks)**

Q15. A simply supported beam of rectangular cross section has breadth 50 mm and depth 100 mm. It carries a uniformly distributed load of 500 N/m over its entire length. It also carries a point load of 4,000 N at its mid span. The maximum bending stress developed at the mid span is 144 MN/m^2. Find the length of the beam. **(10 Marks)**

Q16 (a) A tie member is connected to a plate by a fillet weld along the two side lengths of the tie member. The size of the fillet weld is 8 mm. Length of the weld is 165.75 mm. The working stress for the side weld is 80 N/mm^2. Find the safe load the joint can carry. **(5 Marks)**

(b) A cylindrical shell 3 m long, 1 m in diameter is subjected to an internal pressure of 1 N/mm^2. If the thickness of the shell is 12 mm, find the circumferential and longitudinal stresses. Find also the maximum shear stress and change in diameter of the shell. Take E = 200 GPa, 1/m = 0.3.

(1+1+1+2 Marks)

Q17 (a) A hollow shaft transmits 450 KW power at 100 RPM. Find the necessary diameters of hollow circulations if the inside diameter is ¾ times the external diameter. Allowable shear stress is 75 N/mm^2. **(5 Marks)**

(b) A closed coil helical spring of mean coil diameter 90 mm and stiffness 70 N/mm is to be provided to support an axial load 2,300 N. Determine the diameter of the steel wire from which the spring must be made and the number of coils required if the shear stress in the spring material is not to exceed 225 N/mm^2. Take G = 80 GPa. **(5 Marks)**