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 (UG11T2204/1204)

Date: 17.06.2018 Max Marks:100 Marks

Time: 3 Hrs Pass Marks: 50 Marks

PART-A (3x10=30 MARKS)

(COMPULSORY QUESTIONS)

1. a) Explain briefly the term "Factor of Safety".

   b) Explain briefly the term "Poisson's Ratio".

   c) Write any two relations between E, G, K, m.

   d) Explain the term the "Point of Contraflexure".

   e) Explain the terms "Resilience" and "Proof Resilience".

   f) State three assumptions made in the "Theory of Bending".

   g) Define a thin cylindrical shell. Write formulae for the Circumferential stress & the Longitudinal Stress.

   h) Explain the term "Torsional Rigidity" or "Torsional Stiffness".

   i) State three assumptions made in the derivation of the "Torsion Equation".

   j) Explain briefly by a sketch the "Sign Conventions" used for drawing the Shear Force Diagram & the Bending Moment Diagram.

PART -B (5x14=70 Marks)

(ANSWER ANY 5 QUESTION)

2. A copper rod 36 mm diameter is encased inside a steel tube. It is rigidly attached to the steel tube which has 50 mm external diameter, thickness of metal being 5 mm. The composite section is then subjected to an axial pull of 100 KN. Calculate each of the following: (a) the stress in the copper rod, (b) the stress in steel tube, (c) the extension on the length of 1.5 m.

   Take : E_s = 200 GN /m^2 , E_c = 110 GN/m^2. (5+5+4)

3. (a) An unknown weight falls through a height of 22 mm on to a collar rigidly attached to the lower end of a vertical bar 3.0 m long fixed at the top end. The bar is 500 mm^2 in cross section. If the maximum instantaneous extension of the bar is not to exceed 2.5 mm, find the corresponding stress and the magnitude of the falling weight.

Take E =200 GN/m^2. (8)

(b) Obtain an expression for the stress induced σ (N/m^2) in a vertical rod of cross sectional area A (m^2), length L (m), modulus of elasticity E (N/m^2), due to a falling load W (N) through a height h (m). Assume any additional data if necessary. (6)

4. A simply supported beam carries a concentrated load of 20 KN at mid span & an uniformly distributed load of 8 KN/m spread over its entire length. The beam has a rectangular cross section with a width of 200 mm & a depth of 300 mm. Calculate the length of the beam between the supports if the maximum stress induced in the beam is not to exceed 16.667 N/m^2 . (14)

5. A cylindrical thin shell one metre internal diameter and 3 m long has a metal thickness of 10 mm. If it is subjected to an internal pressure of 3 N/mm^2, determine change in length, change in diameter, change in volume. Take E = 210 GN/m^2, Poisson's Ratio 1/m = 0.3. (14)

6. a) State the two types of the weld, the two advantages & the two disadvantages of the welded joint over a riveted joint. (6)

b) A tie member 120 mm width x 20 mm thick is welded on to an another plate. The tie member is welded only along the length of the member by a fillet weld of size 8 mm. The tensile stress in the tie member is limited to 140 N/mm^2 & the shear stress in the weld is limited to 100 N/mm^2. Calculate the minimum length of the weld required. (8)

7. A thin rod is bent in the form of arc of circle without exceeding the elastic limit. The radius of the arc of circle formed by the bent rod is 1.4 m. The stress at the elastic limit is 250 MN/m^2. The modulus of elasticity of the material of the rod is 200 GN/m^2. Calculate each of the following, (a) the depth of the cross section of the rod, (b) the moment of the resistance for a square cross section, (c) the moment of the resistance for a circular cross section. (6+4+4)

8. An intermediate shaft with the flange coupling on either ends transmit 16 MW power at 100 rpm. The flange coupling has 12 bolts on the pitch circle diameter . The pitch circle diameter is 1.6 times the shaft diameter. The allowable shear stress in the shaft material is 80 MN/m^2. The allowable shear stress in the bolt material is 90 MN/m^2. Calculate each of the following, (a) the diameter of the shaft, (b) the diameter of the bolt. (7+7)