INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Second Semester – Strength of Materials – I (UG11 T2204/T1204)

Date : 15.06.2016 **Max Marks: 100**
Time: 3 Hrs **Pass Marks: 50**

Part-A **(3 x 10 = 30 Marks)**
Compulsory Question

1. a) Define Poisson's ratio.
   b) Define Point of Contrafluxure.
   c) Draw the sheer force and bending moment diagram for a cantilever beam subjected to uniformly distributed load.
   d) Calculate the bursting pressure for cold drawn seamless steel tubing of 60mm inside diameter with 2mm wall thickness. The ultimate strength of steel is $300MN/m^2$.
   e) What is stiffness of a closed-coil Helical spring?
   f) What is neutral axis and why there is no stress at this section?
   g) What is hoop stress and Longitudinal Stress of a thin cylinder under internal Pressure?
   h) A steel rod having cross-section 15 X 25 mm^2 is to carry an axial load of 200 KN (tensile). Calculate the length of the steel rod if the extension of the rod is 0.069 mm. Given the modulus of Elasticity, $E=2.14 \times 10^8$ KN/m^2.
   i) What is 'load factor' and what is 'impact factor'?
   j) Define the term 'polar modulus'. Find the expressions for the polar modulus for a solid shaft and a hollow shaft.

Part-B **(14 x 5 =70 Marks)**
Answer any Five Questions

2) a. Define Hooke's law.
   b. A rigid bar is supported by three rods in the same plane and equidistant. The outer rods are of the brass and of length 600mm and diameter 30mm. the central rod is of steel is 900mm length and of 37.5mm diameter. Calculate the forces in the bars due to an applied force P, if the bar remains horizontal after the load has been applied. Take $\mathbf{E_s / E_b=2}$ (4+10)

3) A compound bars made of a central steel plate 60mm wide and 10mm thick to which copper plates 40mm wide by 5mm thickness are connected rigidly on each side. The length of the bar at normal temperature is 1m. If the temperature is raised by 80^0C, determine the stresses in each metal and the change in length.
   Take $Es=200GN/m^2$ $Ec=100GN/m^2$
   $\alpha s= 12x10^{-6}/^0C$ $\alpha c= 17x10^{-6}/^0C$ (14)

4) A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shells if it subjected to an internal pressure of $1.5MN/m^2$.Take $E=200GN/m^2$ and 1/m=0.3. (14)

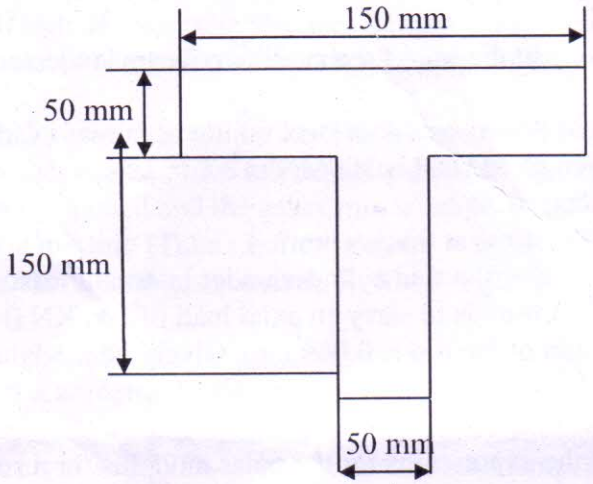
5) a) Prove that $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$ in case of torsion of a cylindrical shaft. Notions have their usual meaning

b) A solid steel shaft has to transmit 100KW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceed the mean by 20%. (6+8)

6) a) Derive an expression of strain energy under gradual loading.

b) Calculate the strain energy stored in a Bar 2 m long 50 mm wide and 40 mm thick. When it is subjected to tensile load of 60 KN. Take Young Modulus as 200 GPa. (6+8)

7) A Beam having cross-section as shown below in the figure 3, is subjected to a bending moment of 3.5 KNm. Find the Tensile and the compressive stresses (at extreme fibres) developed in the beam. What will be the bending stress at a distance of 10 mm from the neutral axis? (14)

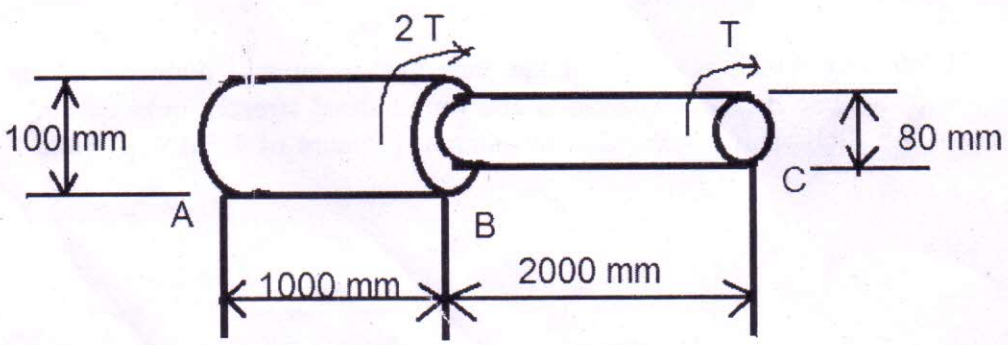


8) a) A beam 10 m long and simply supported at each end, has a uniformly distributed load of 1000 N/m extending from the left end up to the centre of the beam. There is also an anti-clockwise couple of 15 KNm at a distance of 2.5 m from the right end. Draw the S.F and B.M diagrams.

b) How will you draw the S.F and B.M diagrams for a beam which is subjected to inclined loads? (10+4)

9) a) Internal diameter of a hollows shaft is two-third of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material.

b) A stepped steel shaft is subjected to a torque T at the free end and a torque 2T at the junction of the two sizes as shown in figure. Find the total angel of twist at the free end, if the maximum shear stress in the shaft material is limited to 70 N/mm2. Take the modulus of rigidity as 0.8×10^5 N/mm^2. (7+7)



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