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INDIAN MARITIME UNIVERSITY
(A Central University)
DEPARTMENT OF MARINE ENGINEERING
B.TECH-MARINE ENGINEERING
SEMESTER EXAMINATION-June 2011

Course code:UG/ME/BS/T/124 Sub.name: STRENGTH OF MATERIALS

TIME : 3 hours Max.marks:100

Part A (3 × 10 = 30 Marks)

Answer all the Questions

1. (a) The ultimate stress for a hollow steel column which carries an axial load of 1.9 MN is 480 N/mm^2 if the external diameter of the column is 200 mm. Determine the internal diameter. Take the factor of safety as 4.

(b) Determine the value of Young's Modulus and Poisson's ratio of metallic bar of Length 30 cm, breadth 4 cm and depth 4 cm when the bar is subjected to an axial compressive load of 400 KN. The decrease in length is given as 0.075 cm and increase in breadth is 0.003 cm.

(c) Explain in detail about the Thrust Diagram .What are the sign conventions for shear Force and bending moment in Beams.

(d) How many points of contra flexure you will have for simply supported beam overhanging at one end only.

internal or external dia. ?

(e) A hollow cylindrical Drum 700 mm in diameter and 3M long has a shell thickness of 10 mm. If the drum is subjected to an internal air pressure of 3N/mm^2. Determine the increase in its volume. Take E = 2x10^5 N /mm^2 and Poisson's ratio = 0.3 for the material.

(f) A spherical shell of internal diameter 0.9 m and of thickness 10 mm is subjected to an Internal pressure of 1.4 N/mm^2. Determine the increase in diameter and increase in Volume,

Take E = 2x10^5 N /mm^2 and Poisson's ratio = 1/3 for the material.

(g) Two plates of width 12 cm and thickness 1.15 cm are welded by a single V Butt Joint. If the safe stress in the weld is 140 N/mm^2. Find the permissible load carried by the plates.

(h) Write short notes on (i)Neutral axis (ii) Moment of Resistance.

(i) A solid steel shaft has to transmit 75 KW at 200 rpm. Taking allowable shear stresses as 70 N/mm^2. Find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 30 %.

(j) The external and internal diameters of a hollow shaft are 40 cm and 20 cm. Determine the maximum strain energy stored in the Hollow shaft if the maximum allowable shear stress in 50 N/mm^2 and length of the shaft is 5 M. Take $C = 8 \times 10^4$ N/mm^2.

Part B (14 × 5 = 70 Marks)

Answer any five of the following

2. A cylindrical sea vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MN/m^2. Also calculate increase in length, diameter and volume of the vessel.
The modulus of Elasticity, E=200 G Pa, The Poisson's ratio,γ=0.3 (14)

* 3. A beam of circular cross section is 200 mm in diameter. It is simply supported at the each end loaded by two concentric loads of 100 KN each, applied 250 mm from the ends of the beam. Determine the radius of curvature and the maximum bending stress in the beam. If the cross section of the beam is 150 mm X 250 mm find the bending stress at a distance of 65 mm from the top. Given the modulus of Elasticity E=200 G Pa. (14)

Total length of beam is not given ??

* 4. A compound vertical circular shaft AC fixed at A, whose two parts re AB and AC. The length and diameter of AB are 1m and 100 mm respectively, while the length and diameter of AC are 1m and 75 mm respectively. At the lower extremity of this compound shaft is subjected to a torque of 5 KN-m and at the junction it is subjected to a torque of 8 KN-m in the direction opposite to that at the first torque.

→ Should BC ??

Determine the total strain energy of the compound shaft. Given the Modulus of Rigidity G=80 G Pa. (14)

5. A hollow shaft is to transmit 400 KW at 100 R.P.M. If the shear stress is not to exceed 70 MN/m^2 and the internal diameter is 0.5 times of the external diameter, find the value of the internal and he external diameters assuming that the maximum torque is 1.5 times the mean torque. If the shaft is a solid circular shaft and transmits same torque developing same shear stress calculate the diameter of the solid shaft. (14)

6. A beam AB has following portions, AC=1m, CD=1m, DE=2m, EF=1m, FB=1m. The beam AB is simply supported at the two ends A and B. Two concentrated loads of 1 KN and 4 KN acts at point C and F. There is a distributed load of 2 KN/m at the portion DE. Draw the Shear force and Bending Moment diagram showing the maximum Bending Moment point and determine the value of the maximum Bending Moment. (14)

7. A straight uniform bar AD is clamped at both ends and loaded as shown in the figure 1. Initially the bar is stress free. Determine the stresses at all the portions AB, BC, CD if the cross sectional area of the bar is 1000 mm^2. (14)

8. a) Derive the expression for power Transmitted by a shaft. (7)

   b) A solid shaft has to transmit 75 KW at 200 R.P.M. Taking Allowable shear stress as 70 MN/m^2, find suitable diameter of the shaft, if the maximum torque transmitted in each revolution exceed the mean by 30 %. (7)

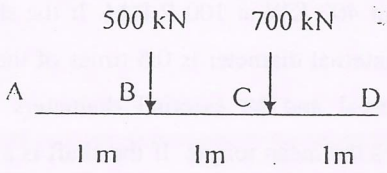

Fig. 1 for Question No. 7

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Roll No

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SEMESTER EXAMINATION-June 2011

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TIME : 3 hours **Max.marks:100**

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   (f) A spherical shell of internal diameter 0.9 m and of thickness 10 mm is subjected to an Internal pressure of 1.4 N/mm^2. Determine the increase in diameter and increase in Volume,

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INDIAN MARITIME UNIVERSITY
SEMESTER EXAMINATION- Dec 2011

Course code: UG/ME/BS/T/124 Sub. Name: Strength of Material -I
Time: 3 hours Max. Marks: 100

PART A (3 x 10 = 30 Marks)
Answer all the Questions

1

a) Define Young's modulus, Modulus of rigidity and Bulk modulus of elasticity

b) During a tensile test on mild steel specimen of 40 mm diameter and 200 mm long, elongation with 40 kN load within proportionality limit was observed to be 0.0304 mm. Determine Young's modulus of elasticity.

c) What is point of contraflexure?

d) What is a cantilever beam, simply supported beam and an overhanging beam?

e) Which types of stresses are developed in a thin cylinder when it is subjected to internal fluid pressure?

f) A circular plate of diameter 150 mm is welded on to another plate by means of 10 mm fillet. Determine the maximum twisting moment which can be applied to the circular plate if the permissible shear stress is 100 MN/m^2

g) Calculate the pressure for a cold drawn seamless steel tubing of 60 mm inside diameter with 2 mm wall thickness. The ultimate strength of steel is 380 MN/m^2

h) A 250 mm deep and 150 mm wide rectangular beam is subjected to maximum bending moment of 750 kN m. If Young's modulus is 200 GN/m^2. Find radius of curvature for that portion of the beam where the bending is maximum.

i) What must be the length of a 5 mm diameter aluminum wire so that it can be twisted through one complete revolution without exceeding a shearing stress of 42 MN/m^2, if the modulus of rigidity is 27 GN/m^2

j) Write torsion equation and name the terms used in it.

Part B (14 x 5 = 70 Marks)
Answer any five of the following

2. The following data relate to a bar subjected to a tensile test:

Diameter of the bar = 30 mm

Tensile load = 54 kN

Gauge length = 300 mm

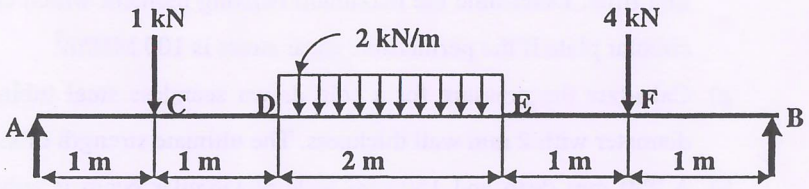
Extension of the bar = 0.112 mm

Change in diameter = 0.00366 mm

Calculate Poisson's ratio, Young's modulus, modulus of rigidity and Bulk modulus. (14 Marks)

3. Two similar bars A and B are each 30 cm long. Bar A has 2 cm diameter for span of 10 cm and diameter 4 cm for the remaining span of 20 cm. Bar B has 2 cm diameter for span of 20 cm and diameter 4 cm for the remaining span of 10 cm. The bar A receives an axial blow, which produces a maximum stress of 200 MN/m^2. Find maximum stress produced by the same blow on bar B .If the bar B is stressed to 200 MN/m^2 determine the ratio of energy stored by the bars A and bar B. (14 Marks)

4. Draw the shear force and bending moment diagram for the beam shown in the figure. Clearly mark the position of the maximum bending moment and determine its value. (14 Marks)



5. A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15 mm. calculate the circumferential and longitudinal stresses induced if it is subjected to an internal pressure of 1.5 MN/m^2. Also calculate the change in length, diameter and volume of the shell. Take Young's modulus =200 GN/m^2 and Poisson's ratio = 0.3 (14 Marks)

6. Two wooden planks 150 mm x 150 mm each are connected to form a T-section of a beam. If a moment of 3.4 kNm is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the stresses at the extreme fibers of the cross section. Also calculate the total tensile force on the cross section. (14 Marks)

7 A solid steel shaft is subjected to a torque of 45 kNm. if the angle of twist is 0.5 per meter length of the shaft and the shear stress is not to be allowed to exceed 90 MN/m^2. Find

(i) suitable diameter for the shaft

(ii) Final maximum shear stress and angle of twist

(iii) Maximum shear strain in the shaft

Take modulus of rigidity 80 GN/m^2 (14 Marks)

8. The external diameter of a hollow shaft is twice the internal diameter. If the shaft is required to transmit 5400 kW at 110 r.p.m. With uniform torque, the maximum torque not exceeding 84 MN/m^2. Determine the shaft diameters and energy stored per unit volume. (14 Marks)