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BAS-008

B.Tech. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

00375

December, 2014

BAS-008 : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Use of (non programmable, scientific calculator) calculator is permitted.*

1. In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0·09 mm and change in diameter is 0·0039 mm. Calculate the

(a) Poisson's ratio *2*

(b) Young's modulus *4*

(c) Modulus of rigidity *4*

(d) Bulk modulus *4*

2. A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angles to the former. Each of above stresses is accompanied by a shear stress of 100 MPa such that when associated with minor tensile stress tends to rotate the element in anticlockwise direction. Find the

(a) Principal stresses and their directions. *7*

(b) Maximum shear stresses and the direction of the plane on which they act. *7*

3. Principal stresses at a point in an elastic material are 100 MPa tensile, 50 MPa tensile and 25 MPa compressive. Determine the factor of safety against following theories of failure :

(a) Maximum principal stress theory *2*

(b) Maximum shear stress theory *3*

(c) Maximum principal strain theory *3*

(d) Maximum strain energy theory *3*

(e) Maximum shear strain energy theory *3*

4. A beam (Fig. 1) of 9 m span supports a concrete wall of 160 mm thickness. The height of the wall is 1 m at the left end and increases to 2 m at the right end. The beam has two supports one at 2 m from the left end and other at 1 m from the right end. Find the maximum bending moment on the beam if the concrete weighs 25 kN/m^3. Draw shear force and bending moment diagrams. *14*

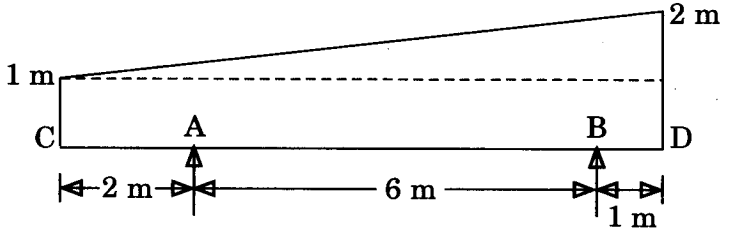

Fig. 1

5. (a) For a given stress compare the moments of resistance of a beam of square section when placed (i) with its two sides horizontal and (ii) with its diagonal horizontal. *6*

(b) Three beams have the same length, the same allowable stress and the same bending moment. The cross-section of the beams are a square, a rectangle with depth twice the width and a circle as showing in Fig. 2.

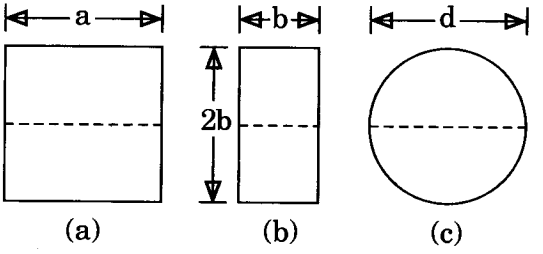

Fig. 2

Find the ratio of weights of circular and the rectangular beam with respect to the square beam. *8*

6. A simply supported beam of 2 m span (Fig. 3) carries a uniformly distributed load of 140 kN per m over the whole span. The cross-section of beam is a T-section with a flange width of 120 mm, web and flange thickness of 20 mm and overall depth of 160 mm. Determine the maximum shear stress in the beam and shear stress distribution for the section. *14*

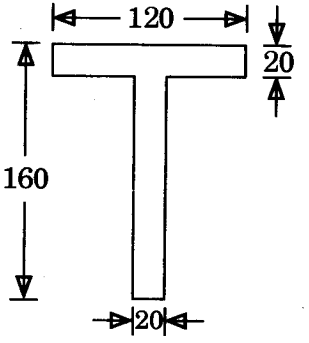

Fig. 3

7. A simply supported beam of span 20 m carries two concentrated loads 4 kN at 8 m and 10 kN at 12 m from one end. Calculate

   (a) the deflection under each load

   (b) the maximum deflection.

   $E = 200{,}000\ N/mm^2$, $I = 10^9\ mm^4$. *14*

8. A steel rod ABC is firmly held between two rigid supports A and C as shown in Fig. 4.

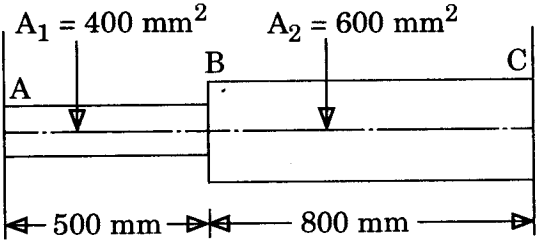

Fig. 4

Find the stresses developed in the two portions of the rod, when it is heated through 15 K. Take $\sigma = 12 \times 10^{-6}/K$ and $E = 200$ GPa. *14*