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Question Paper Code : 50274

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Third Semester
Aeronautical Engineering
CE 6452 – SOLID MECHANICS
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Draw the stress strain diagram for mild steel material.
2. Define Modulus of rigidity.
3. Define the term point of contraflexure and in which beam it occurs ?
4. What is pure bending ?
5. State Maxwell reciprocal theorem.
6. In what situation we have to use conjugate beam method for finding the deflection ?
7. Define Polar modulus.
8. Write the example for close and open coilded springs.
9. Define Hoop stress.
10. What is the physical significance of Mohr's circle radius ?

PART – B (5×13=65 Marks)

11. a) A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised to 200°C. $E_{steel} = 2.1\times10^5$ N/mm^2 and $E_{copper} = 1\times10^5$ N/mm^2, Co-efficient of friction of linear expansion for steel and copper is given by 11×10^{-6} per °C and 18×10^{-6} per °C.

(OR)

b) A truss of span 5m is loaded as shown in Fig. 1. Find the reactions and forces in the members of the truss.

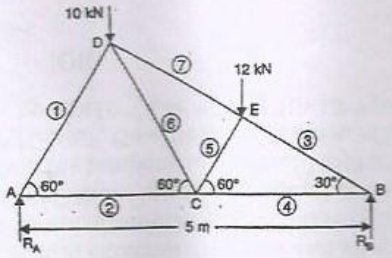

Figure – 1

12. a) A simply supported beam of length10 meter, carries the uniformly distributed load and two point loads. A point load magnituted of 50 kN acts at a distance of 2 meter from left end. Another point load magnituted of 40 kN acts at a distance of 4 meter from right end. Distributed load of intensity 10 kN/m is supplied between 50 kN and 40 kN loads. Draw the shear force and bending moment diagram, also calculate the maximum bending moment.

(OR)

b) The shear force acting on a beam at an I section with unequal flanges is 50 kN. The moment of intertia of the section about N.A is 2.849×10^8 mm^4. Calculate the shear stress at the Neutral axis and also draw the shear stress distribution over the depth of the section. Dimensions of I section is given in Fig. 2

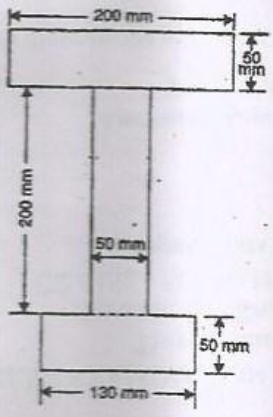

Figure – 2

13. a) A beam ABCD is simply supported at its ends A and D over a span of 30 meters. It is made up of three portions AB, BC and CD each 10 meter in length. The moment of inertia of the section of these portions are I, 3I, and 2I respectively, where $I = 2\times10^{10}$ mm^4. The beam carries a point load of 150 kN at B and a point load of 300 kN at C. Neglecting the weigth of the beam calculate the slopes and deflections at A and B. Take $E = 2\times10^2$ kN/mm^2.

(OR)

b) A beam ABC of length 9 meter has one support of the left end and the other support at a distance of 6 meter from the left end. The beam carries a point load of 12 kN at right end and also carries a uniformly distributed load of 4kN/m over a length of 3 m as shown in Fig. 3. Determine the slope and deflection at point C. Take $E = 2\times10^5$ N/mm^2 and $I = 5\times10^8$ mm^4.

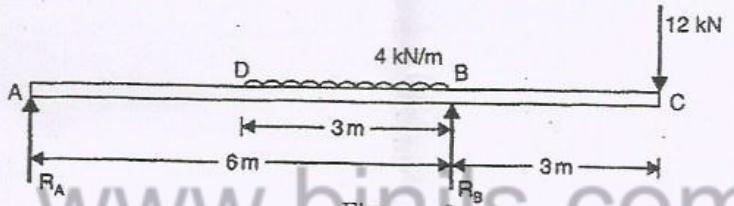

Figure – 3

14. a) A composite shaft consists of a steel rod 60 mm diameter surrounded by a closely fitting tube of brass. Find the outside diameter of the tube so that when a torque of 1000 Nm is applied to the composite shaft, it will be shared equally by the two materials. $C_{steel} = 8.4\times10^4$ N/mm^2 and $C_{brass} = 4.2\times10^4$ N/mm^2. Find also the maximum shear stress in each material and common angle of twist in a length of 4m.

(OR)

b) A solid round bar 3 meter long and 5 cm in diameter is used, determine the crippling load, when the given strut is used with the following conditions.

i) one end of the strut is fixed and the other end is free,

ii) both the ends of the strut are fixed and

iii) one end is fixed and other is hinged. Take $E = 2\times10^5$ kN/mm^2.

15. a) A cylinderical vessel is 1.5 m diameter and 4 meter long is closed at ends by rigid plates. It is subjected to an internal pressure of 3 N/mm^2. If the maximum pirnciple stress is not to exceed 150 N/mm^2, find the thickness of the shell. Assume E = 2 $\times 10^5$ N/mm^2 and Poisson's ratio is 0.25. Find the changes in diameter, length and volume of the shell.

(OR)

b) At a certain point in a material under stress the intensity of the resultant stress on a vertical plane is 1000 N/cm^2 inclined at 30° to the normal to that plane and the stress on a horizontal plane has a normal tensile component of intensity 600 N/cm^2 as shown in Fig. 4. Find the magnitude and direction of the resultant stress on the horizontal plane and the principle stresses by analytical method.

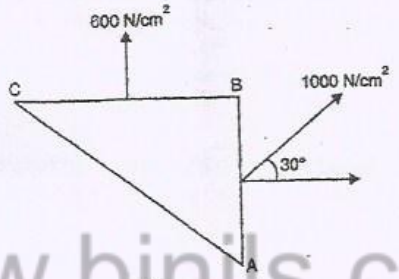

Figure – 4

PART – C (1×15=15 Marks)

16. a) The simply supported beam AB of span length L carries a uniformly distributed load w per unit length. Determine the slope at the ends and the maximum deflection of the beam.

(OR)

b) A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.6 m when beam is simply supported. If the depth of section is to be twice the breath, and the stress in the timber is not to exceed 7 N/mm^2, find the dimensions of the cross-section.