Register Number: ……

B.TECH. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

TEXTILE TECHNOLOGY

U07TT301/ U07TT306: Mechanics of Solids

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Hook's law holds good upto

   (a) proportional limit (b) yield point (c) plastic limit (d) elastic limit

2. If a member is subjected to an axial tensile load, the plane normal to the axis of loading carries

   (a) minimum normal stress (b) maximum normal stress

   (c) maximum shear stress (d) minimum shear stress

3. If a beam is supported on more than two supports, it is called

   (a) built in beam (b) continuous beam (c) simply supported beam (d) encastered beam

4. The point of contra flexure occurs only in

   (a) continuous beam (b) cantilever beam (c) overhanging beam (d) simply supported beam

5. The bending moment on a section is maximum where shear force is

   (a) minimum (b) maximum (c) zero (d) changing sign

6. The shear stress required to cause plastic deformation of solid metal is called

   (a) proof stress (b) flow stress (c) rupture stress (d) ultimate stress

7. Torsional rigidity of a shaft is defined as the torque to produce

   (a) maximum twist in the shaft (b) maximum shear stress in the shaft

   (c) minimum twist in the shaft (d) a twist in 1 radian per unit length of shaft

8. A coil is having stiffness k. It is cut into two halves. Then the stiffness of the cut coil will be

   (a) same (b) half (c) double (d) one fourth

9. The Rankine's constant for a given material of a column depends upon

   (a) length of the column (b) diameter of the column

   (c) length and diameter (d) ultimate crushing stress

10. A loaded column fails due to stress due to

    (a) direct load (b) bending (c) both (a) and (b) (d) shear

PART B (10 x 2 = 20 Marks)

11. Define: Young's modulus.

12. Define: Principle planes and Principle stresses.

13. What are Shear force diagram and Bending moment diagram?

14. What is meant by pure bending?
15. Write the relations between curvature, slope and deflection at various sections.
16. What do you mean by shear stresses in beams?
17. Find an expression for strain energy stored in a body due to torsion.
18. Define helical spring. Name two important types of helical springs.
19. Write the assumptions made in Euler's column theory. How far are the assumptions valid in practice?
20. Differentiate between thin cylinder and thick cylinder.

PART C (5 x 14 = 70 Marks)

21. (a) (i) A bar of 30mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.1mm and change in diameter is 0.004mm. Calculate Young's modulus, Poisson's ratio and Bulk modulus. (10)

(ii) Draw the stress-strain diagram for a mild steels and briefly explain. (4)

(OR)

(b) Three bars made of copper, zinc and aluminium are of equal length and have cross-section 500, 750 and 1000 mm^2 respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper $=1.3x10^5$ N/mm^2, for zinc $=1.0x10^5$ N/mm^2 and for aluminium$= 0.8x10^5$ $N/mm^{2.}$

22. (a) A simply supported beam of length 10 m carries the uniformly distributed load and two point loads as shown in Fig.1. Draw the shear force and bending moment diagram for the beam. Also calculate the maximum B.M.

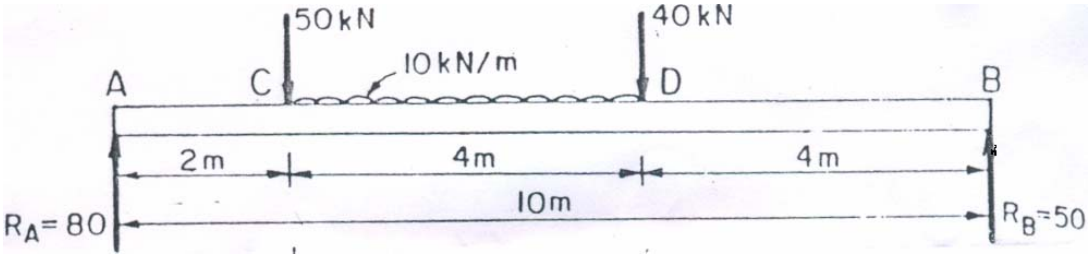

Fig.1

(OR)

(b) (i) A rectangular beam 200 mm deep and 300mm wide is simply supported over a span of 8m. What uniformly distributed load per meter the beam may carry, if the bending stress is not to exceed 120N/mm^2. (10)

(ii) What are the assumptions made in the theory of simple bending? (4)

23. (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 m in length. The moments of inertia of the section of these portions are I, 3I and 2I respectively, where $I = 2x10^{10}$ mm^4. The beam carries a point load of 150 kN at B and a point load of 300 kN at C. Neglecting the weight of the beam calculate the slopes and deflections at A, B, C and D. Take $E = 2x10^2$ kN/mm^2.

(OR)

(b) An I-section beam 350mm x 150mm has a web thickness of 10mm and a flange thickness of 20mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I–section. Sketch the shear stress distribution across the section.

24. (a) A solid cylindrical shaft is to transmit 300 K W power at 100 r.p.m. If the shear stress is not to exceed $80N/mm^2$, find its diameter.

What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same?

(OR)

(b) A closely coiled helical spring is to carry a load of 500N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80 N/mm^2. If the stiffness of the spring is 20N/mm deflection and modulus of rigidity = $8.6x10^4$ N/mm^2, find the number of coils in the closely coiled helical spring.

25. (a) A 1.5 m long column has a circular cross section of 5 cm diameter. One of the ends of the column is fixed in direction and position and other end is free. Taking factor of safety as 3, calculate the safe load using

(1) Rankine's formula take yield stress, $f_c=560N/mm^2$ and a=1/1600 or pinned ends.

(2) Euler's formula, young's modulus for C.I. $=1.2x10^5$ N/mm^2.

(OR)

(b) (i) Derive the expression for circumferential stresses for a thin cylinder. (4)

(ii) A cylindrical pipe of diameter 1.5m and thickness 1.5 cm is subjected to an internal fluid pressure of $1.2N/mm^2$. Determine the longitudinal stress and circumferential stress developed in the pipe. (10)

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