GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Third Semester – Regular) Examinations, December – 2020

BPCME 3030 – MECHANICS OF SOLIDS

(Mechanical Engineering)

Time: 2 hrs   Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)   **(1 x 10 = 10 Marks)**

Q.1. Answer *ALL* questions

a. Shear stress on mutually perpendicular planes of an infinitesimal element are
   (i)not equal   (ii)equal
   (iii)zero   (iv)infinity

b. A block of steel is loaded by a tangential force on its top surface when the bottom surface is held rigidly. The deformation in the block is due to
   (i)bending only   (ii)shear only
   (iii)bending and shear   (iv)torsion

c. In a composite system of equal lengths subjected to temperature rise, the component having highest coefficient of expansion will develop
   (i)tensile stress   (ii)shear stress
   (iii)compressive stress   (iv)no stress

d. For maximum bending moment, shear fore at that section should be
   (i)zero   (ii)maximum
   (iii)minimum   (iv)none of these

e. If a thin cylinder is wound with a wire under tension, the hoop (circumferential) stress is
   (i)tensile stress   (ii)compressive stress
   (iii)shear stress   (iv)zero

f. The radius of Mohr's circle gives the value of
   (i)maximum normal stress   (ii)minimum normal stress
   (iii)maximum shear stress   (iv)minimum shear stress

g. Neutral axis of a beam is the axis at which
   (i)the shear stress is zero   (ii)the section modulus is zero
   (iii)the bending stress is maximum   (iv)the bending stress is zero

h. The ratio of the moment of inertia about neutral axis to the distance of the most distant point of the section from the neutral axis is called
   (i)modulus of rigidity   (ii)polar moment of inertia
   (iii)moment of inertia   (iv)section modulus

i. When two shafts are connected in series, which of the following statement is correct
   (i)shear stress in each shaft is the same   (ii)torque in each shaft is the same
   (iii)angle of twist of each shaft is the same   (iv)torsional stiffness of each shaft is the same

j. Due to axial load the closed coil helical spring is subjected to
   (i)direct shear and bending moment   (ii) direct shear and torsional moment
   (iii) direct tensile stress and bending moment   (iv)bending moment only

PART – B: (Short Answer Questions)   **(2 x 5 = 10 Marks)**

Q.2. Answer *ALL* questions

a.   Define Bulk-modulus

b.   What causes thermal stress?

c.   Define point of contra flexure? In which beam it occurs?

d.   Explain the Theorem for conjugate beam method?

e.   Why hollow circular shafts are preferred when compared to solid circular shafts?

PART – C: (Long Answer Questions)   **(6 x 5 = 30 Marks)**

Answer *ANY FIVE* questions   Marks

3.   Find the Young's modulus of a brass rod of diameter 30 mm and of length 260 mm which is subjected   (6)
     to a tensile load of 50 kN when the extension of the rod is equal to 0.3 mm

4.   Determine the Poisson's ratio and bulk modulus of a material, for which Young's modulus is 1.2×10^5 (6)
     N/mm^2 and modulus of rigidity is 4.8×10^4 N/mm^2.

5.   A cylindrical vessel is 1.5m diameter and 4m long is closed at ends by rigid plates. It is subjected to an   (6)
     internal pressure of $3N/mm^2$. If the maximum principal stress is not to exceed $150N/mm^2$, find the
     thickness of the shell. Assume E= 2×10^5 N/mm^2 and Poisson's ratio, μ=0.25. Find the changes
     indiameter, length and volume of the shell.

6.   A cantilever beam of length 2 m carries the point loads as shown in Fig.2 Draw the shear force and   (6)
     B.M. diagrams for the cantilever beam.
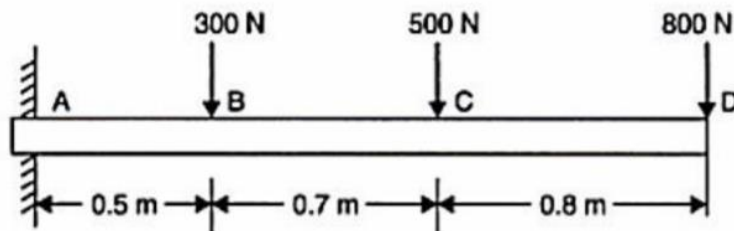

Fig.2

7.   The T-section shown in Fig.3 is subjected to a shear force of 60 kN at a cross section. Calculate the   (6)
     maximum shear stress in the section. Also sketch the shear stress distribution across the section.
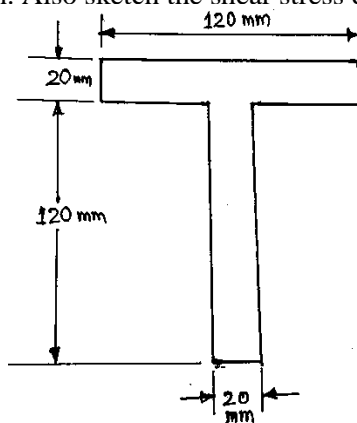

Fig.3

8.   Obtain an equation for the maximum deflection of a cantilever beam with a concentrated load at free   (6)
     end.

9. A hollow steel shaft transmits 200 kW of power at 150 rpm. The total angle of twist in a length of 5 m of the shaft is 3°. Find the inner and outer diameters of the shaft if the permissible shear stress is 60 MPa. Take G- 80 GPa. (6)

10. A closely coiled helical spring of round stell wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 200 N. determine (i) deflection of the spring (ii) maximum shear stress in the wire and (iii) stiffness of the spring. Take $C= 8x10^4$ N/mm^2. (6)

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