Total No. of printed pages = 8

END SEMESTER EXAMINATION–2019

Semester : 3rd

Subject Code : CT-303

STRENGTH OF MATERIALS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

The Question Paper consists of two parts : PART-A and PART-B. Both are compulsory.

PART – A

Marks – 25

1. Choose the correct answer : 15

   (i) Tortional member are subjected to

   (a) Bending moment

   (b) Twisting moment

   (c) Combined moments

   (d) None of the above

[Turn over

(ii) Shafts are made up of

(a) Mild steel (b) Alloy steel

(c) Copper alloy (d) Any of the above

(iii) The polar moment of inertia of a circular shaft of diameter (d) is

(a) $\pi d^4/8$ (b) $\pi d^4/16$

(c) $\pi d^4/32$ (d) $\pi d^4/64$

(iv) At a point on the beam where shear force changes sign, the bending moment is

(a) Zero (b) Maximum

(c) Increasing (d) Decreasing

(v) A point of contraflexure is a point where

(a) Shear force is zero

(b) Shear force is maximum

(c) Bending moment is zero

(d) Bending moment is maximum

(vi) The resistance per unit area to deformation is called

(a) Strain (b) Stress

(c) Pressure (d) Modulus of elasticity

(vii) The unit of stress is

(a) Nmm (b) N/mm

(c) mm (d) no unit

(viii) Hooke's law holds good up to

(a) Yield point (b) Elastic limit

(c) Plastic limit (d) Breaking point

(ix) Whenever a material is loaded within elastic limit stress is

(a) Equal to strain

(b) Directly proportional to strain

(c) Inversely proportional to strain

(x) The ratio of linear stress to linear strain is called

(a) Modulus of rigidity

(b) Modulus of elasticity

(c) Bulk modulus

(d) Poissons ratio

(xi) When a change in length takes place, the strain is known as

(a) Linear strain (b) Lateral strain

(c) Volumetric strain (d) Shear strain

(xii) Young's modulus is the ratio of

(a) Linear stress to lateral strain

(b) Lateral strain to linear strain

(c) Linear stress to linear strain

(d) Shear stress to shear strain

(xiii) Modulus of rigidity may be defined as the ratio of

(a) Linear stress to lateral strain

(b) Lateral strain to linear strain

(c) Linear stress to linear strain

(d) Shear stress to shear strain

(xiv) The deformation per unit length in the direction of the force is known as

(a) Linear strain (b) Lateral strain

(c) Volumetric strain (d) Shear strain

(xv) A beam which is fixed at one end and free at the other is called

(a) Simply supported beam

(b) Fixed beam

(c) Over hanged beam

(d) Cantilever beam

2. Read the following statements. Write True or False against each. 5

(a) When a body is subjected to forces and as a result of which the body tends to reduce its length, the stress and strain induced is compressive.

(b) The unit of Young's modulus is same as that of stress.

(c) Poissons ratio is the ratio of linear strain to the volumetric strain.

(d) A beam supported at its both ends is not a simply supported beam.

(e) A load which acts at a point on a beam is called uniformly distributed load.

3. Fill in the blanks : 5

(a) The neutral axis of a beam is subjected to _____ stress.

(b) The bending stress in a beam is _____ to section modulus.

(c) When a beam is loaded, the compressive stresses are developed at _____ fibre.

(d) In a beam subjected to pure bending the intensity of stress in any fibre is _____ to the distance of the fibre from the neutral axis.

(e) The section modulus of a circular section about an axis through its CG is _____.

PART – B

Marks – 45

Answer any *five* questions.

4. (a) A bar ABCD 950 mm long is made up of three parts AB, BC and CD of lengths 250 mm, 450 mm and 250 mm respectively. AB and CD are cylindrical having diameters 25 mm and 15 mm respectively. The rod BC is square section 30 mm × 30 mm. The rod is subjected to a pull of 26000N. Find stresses in the three parts of the rod, extension of the rod. Given $E = 2 \times 10^5$ N/mm^2. 6

(b) A steel bar 50 mm wide, 12 mm thick and 300 mm long is subjected to an axial pull of 84 kN. Find change in length, width and thickness. 3

5. A cast iron bracket subjected to bending has a cross section of I form with unequal flanges. The total depth of the section is 280 mm and the metal is 40 mm thick throughout. The top flange is 200 mm wide and the bottom flange is 120 mm wide. Find the position of the neutral axis and the moment of inertia of the section about the neutral axis and determine the maximum bending moment that should be imposed on this section if the tensile stress in the top flange is not to exceed 20 N/mm^2. What is the value of maximum compressive stress in the bottom flange ? 9

6. (a) List the various assumptions made in the theory of pure bending. 4

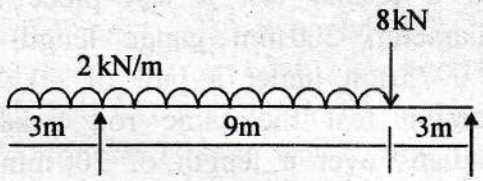
(b) In a tensile test a test piece 25 mm in diameter, 200 mm gauge length stretched 0.0975 mm under a pull of 50000N. In a torsion test the same rod twisted 0.025 radians over a length of 200 mm, when a torque of 400 Nm was applied. Evaluate the Poisson's ratio and the three elastic moduli for the material. 5

7. Draw Mohr's stress circle for principal stresses of 80 N/mm^2 tensile and 50 N/mm^2 compressive and find the resultant stresses on planes making 22° and 64° with the major principal plane. Also find the normal and tangential stresses on these planes. 9

8. (a) Derive a relationship for section modulus of hollow circular section of external diameter D and internal diameter d. 4

(b) A cast iron beam 20 mm × 20 mm in section and 1m long and supported at the ends fails when a central load of 640 N is applied. What UDL will break a cantilever of the same material 50 mm wide, 100 mm deep and 2m long ? 5

9. Draw the shear force and bending moment diagram for the given beam as below. Also indicate the location and magnitude of maximum bending moment. 9



10. Draw the shear force and bending moment diagram for the given beam as below. Also find the magnitude of maximum bending moment. 9