CBCS Scheme

USN | | | | | | | | | | 15MN34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define :
i) Principle of superposition ii) Possion's ratio iii) Factor of safety
iv) Shear modulus v) Hooke's law vi) Modulus of elasticity **(06 Marks)**

b. The following data refers to a mild street specimen tested in a laboratory, determine :
i) Modulus of elasticity ii) Yield stress iii) Ultimate stress iv) Percentage elongation
v) Percentage reduction in area vi) Safe stress adopting a factor of safety of 2.4

Diameter of specimen	=	25mm
Gauge length	=	200mm
Extension under a load of 20kN	=	0.04mm
Load at yield point	=	150kN
Maximum load	=	225kN
Length of specimen after failure	=	275mm
Neck diameter	=	18.25mm

(10 Marks)

OR

2 a. Derive on expression for the deformation of a uniformly tapering Rectangular Bar, subjected to tensile load. **(08 Marks)**

b. Determine the stresses in various segments of the circular bar shown in Fig Q2(b). Compute the total elongation taking E = 195 GPa. Draw free body diagram. **(08 Marks)**

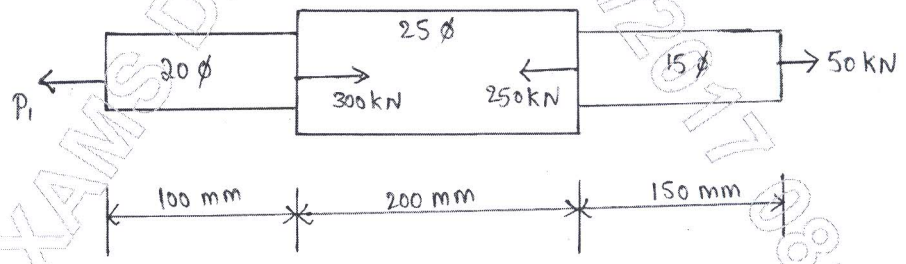

Fig. Q2(b)

Module-2

3 a. Define volumetric strain. Obtain an expression for volumetric strain of a rectangular bar, subjected to normal stress along its axis. **(06 Marks)**

b. For the state of stress shown in Fig Q3 (b), determine :
i) Principal stresses and principal planes
ii) Maximum in plane shear stress and the plane on which it is acting. Also find the normal stress on the maximum shear plane.
iii) Sketch the element aligned with planes of principle stresses and planes of maximum shear. **(10 Marks)**

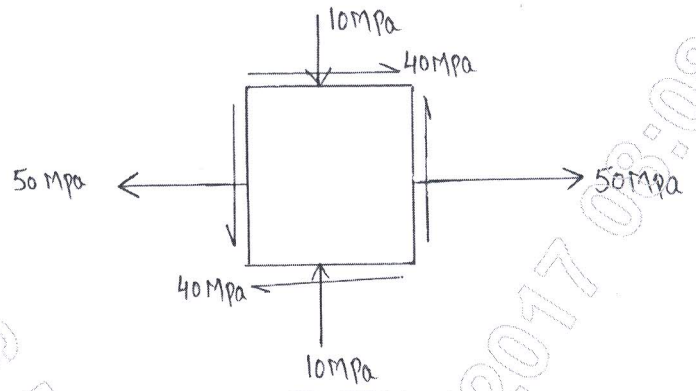

Fig Q3(b)

OR

4 a. Derive relation between Modulus of elasticity and Bulk modulus. **(06 Marks)**

b. A thin cylindrical shell 1m in diameter and 3000mm long has a metal thickness of 10mm. it is subjected to an internal fluid pressure of 3Mpa. Determine :

i) Circumferential and longitudinal stress

ii) Circumferential, longitudinal and Volumetric strain

iii) Change in length, diameter and volume

Also, find the maximum shearing stress in the shell

Assume Poisson's ratio = 0.3 and E = GPa. **(10 Marks)**

Module-3

5 a. Derive the relationship between relating load (w), shear force (F) and Bending moment (M). **(06 Marks)**

b. Draw the SFD and BMD for the cantilever beam loaded as shown in Fig. Q5(b). **(10 Marks)**

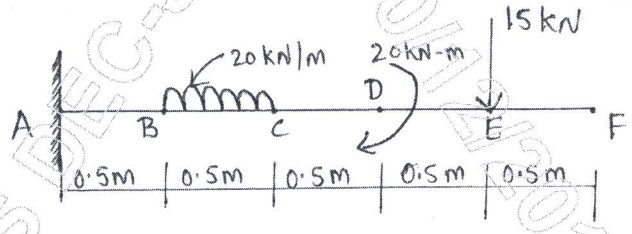

Fig Q5(b)

OR

6 a. Define:

i) Shear Force ii) Bending moment iii) Point of contra flexure. **(06 Marks)**

b. Draw SFD and BMD for the beam shown in Fig. Q6(b). **(10 Marks)**

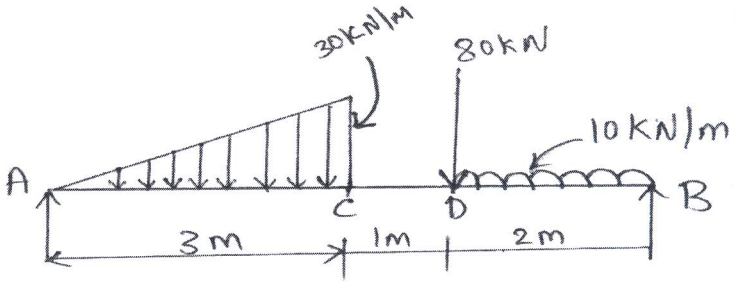

Fig Q6 (b)

Module-4

7 a. Enumerate the assumptions made in theory of simple bending. Write the bending equation with usual notations. **(06 Marks)**

b. A beam of an 'I' section 200mm × 300mm has web thickness 10mm. It carries a shearing force of 10kN at a section. Sketch the shear stress distribution across the section. **(10 Marks)**

OR

8 A beam of length 6m is shown in Fig. Q8.
Determine :
i) Deflection under each load ii) Maximum defection iii) The point at which maximum deflection occurs.
Take $E = 2\times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4 **(16 Marks)**

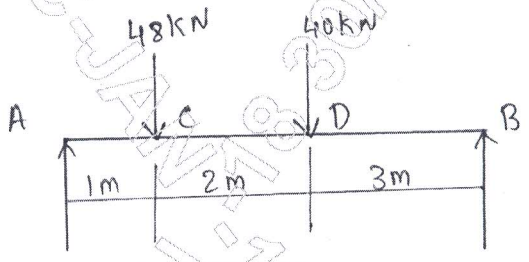

Fig. Q8

Module-5

9 a. Define :
i) Pure Torsion ii) Torsional strength **(02 Marks)**

b. List the assumptions made in the theory of pure torsion. **(04 Marks)**

c. A solid circular shaft has to transmit a power of 1000kW at 120 rpm. The maximum torque 1.25 times of its mean. Find the diameter of the solid shaft, if the shear stress of the material must not exceed 80 N/mm^2. What percentage of saving in material would be obtained if the shaft is replaced by a hallow one whose internal diameter is 0.6 times its external diameter, the length, material and maximum shear stress being same. **(10 Marks)**

OR

10 a. Define slenderness ratio. Derive an expression for the critical load in a column subjected to compressive load, when both ends are hinged (pinned). **(08 Marks)**

b. A 150cm long column has a circular cross-section of 50mm diameter one end of the column is fixed in direction and position and other end is free. Taking the factor of safety as 3, calculate the safe load using.

i) Rankine's formula taking yield stress 560 N/mm^2 and $\alpha = \frac{1}{1600}$

ii) Euler's formula, taking $E = 1.2 \times 10^5$ N/mm^2 **(08 Marks)**

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