CBCS SCHEME

USN | | | | | | | | | | |

17MT33

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data may suitably be assumed.

Module-1

1 a. Define the following :
(i) Stress (ii) Elastic limit (iii) Factor of safety (iv) Poisson's ratio **(08 Marks)**

b. Determine the stresses in various segments of circular bar shown in Fig.Q1(b). Compute the total elongation taking Young's modulus E = 195 GPa. **(12 Marks)**

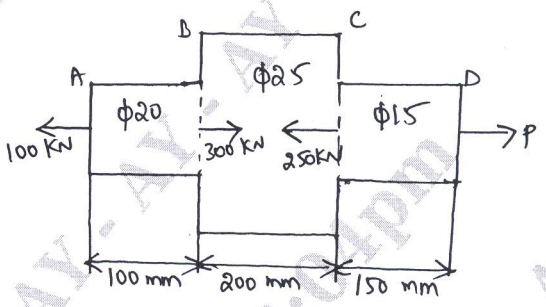

Fig.Q1(b)

OR

2 a. Derive an expression for deformation of uniformly tapering circular bar. **(10 Marks)**

b. Derive a relationship between Young's modulus, Modulus of Rigidity and Bulk modulus. **(06 Marks)**

c. Define : (i) Modulus of Rigidity (ii) Bulk Modulus. **(04 Marks)**

Module-2

3 For the state of stress shown in Fig.Q3, determine principle stress, principal plane also obtain max shear stress and verify by constructing Mohr's circle. **(20 Marks)**

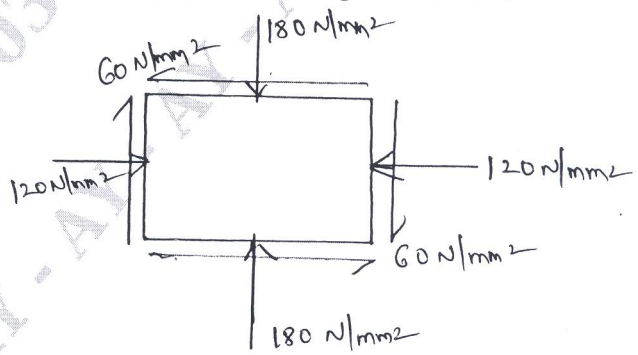

Fig.Q3

OR

4 a. Define : (i) Principle stresses (ii) Principle planes **(04 Marks)**

b. Derive an expression for normal stress, shear stress and resultant stress on a oblique plane inclined at angle "θ" with vertical axis [x-plane] in biaxial stress system subjected to δ_{xy} , σ_y and τ_{xy} . **(16 Marks)**

Module-3

5 a. Explain Statically Determined and Statically Indetermined Beam. **(06 Marks)**

b. Draw the Shear force and Bending moment for the simply supported beam as shown in Fig.Q5(b).

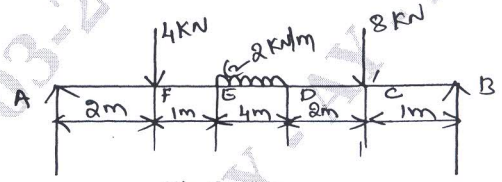

Fig.Q5(b) **(14 Marks)**

OR

6 a. Derive the relationship between Load, Shear force and Bending moment. **(06 Marks)**

b. Draw the Shear force and Bending moment diagram for a beam shown in Fig.Q6(b). Locate point of contraflexture if any.

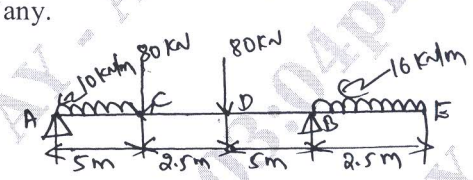

Fig.Q6(b) **(14 Marks)**

Module-4

7 a. With proper assumptions derive the relationship between Bending moment and Radius of Curvature. **(10 Marks)**

b. The cross-section of a beam is an shown in Fig.Q7(b). If the permissible stress is 150 N/mm^2, find its moment of resistance. Compare it with equivalent section of same area, but as a (i) Square section (ii) Rectangular section with depth twice the width (iii) Circular section.

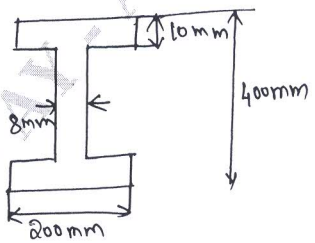

Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive Euler's Bernoulli equation for deflection of beams. **(10 Marks)**

b. Derive an expression for deflection of a Cantilever Beam with point load at the free end. **(10 Marks)**

Module-5

9 a. With assumptions, derive Torsion equation for circular shaft. **(10 Marks)**

b. A shaft is required to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the torque should not exceed 40 N/mm^2 and the twist 1°/m length. Determine the diameter required if (a) A shaft is solid (b) Shaft is hollow with external diameter twice the internal diameter. Take $G = 80\ kN/mm^2$. **(10 Marks)**

OR

10 a. Derive the Euler crippling load for columns both of its ends are hinged. **(10 Marks)**

b. A hollow cast from iron column whose outside diameter is 200mm and thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe load by Rankine formula using a factor of safety of 2.5. Find the ratio of Euler's to Rankine's loads. Take $E = 1\times10^5\ N/mm^2$ and Rankine constant = 1/1600 for both ends pinned and $F_c = 550\ N/mm^2$. **(10 Marks)**

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