CBCS SCHEME

USN | | | | | | | | | | 17MT33

Third Semester B.E. Degree Examination, Aug./Sept.2020
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following:
(i) Hooke's law (ii) Poisson's ratio (iii) Principle of superposition
(iv) Proof stress (v) Bulk modulus **(10 Marks)**

b. Find the extension of the bar shown in Fig.Q1(b) under axial load of 20 kN, E = 200 GN/m^2.

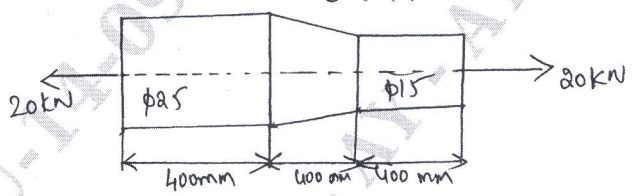

Fig.Q1(b) **(10 Marks)**

OR

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

b. Determine the stresses in various segments of circular bar shown in Fig.Q2(b). Compute the total Elongation taking Young's modulus = 195 GPa.

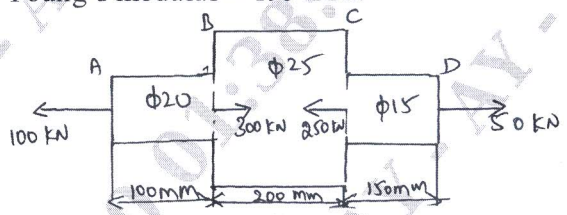

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Define the following :
(i) Principle stress (ii) Principle planes (iii) Shear stress **(06 Marks)**

b. Derive the expression for normal and tangential stress for the plane θ in a general 2-D stress system. **(14 Marks)**

OR

4 The state of stress in a 2-D stressed body as shown in Fig.Q4. Determine principal stresses, principle planes, maximum shear stress and shear planes. Also verify your answer by constructing Mohr's circle.

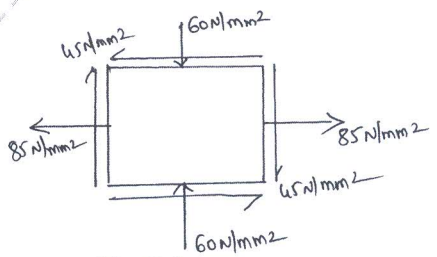

Fig.Q4 **(20 Marks)**

Module-3

5 a. Define statically determined and statically indetermined beam. **(04 Marks)**

b. Draw shear force and bending moment diagram for a beam shown in the Fig.Q5(b). Locate point of inflextion if any.

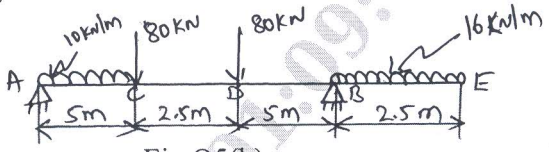

Fig.Q5(b) **(16 Marks)**

OR

6 a. Define beam. Explain the types of beams. **(06 Marks)**

b. A beam ABCD is simply supported at B and C, 4.5 m apart. Overhanging part AB and CD are 1.5 m and 2m long respectively. The beam carries a uniformly distributed load of 10 kN/m between A and C. There is a clockwise couple at 60 kNm at D. Draw shear force and bending moment diagram and mark salient features on beam. **(14 Marks)**

Module-4

7 a. With assumptions, derive $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$. **(10 Marks)**

b. A cross section of a beam is as shown in Fig.Q7(b). If permissible stress is 150 N/mm^2. Find its moment of resistance compare it with equivalent section of same area for a square section.

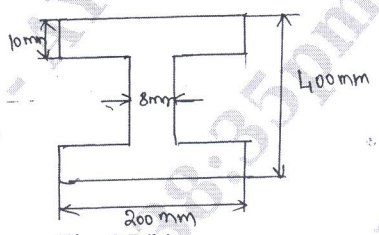

Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive the expression for Euler Bernoulli equation for deflection. **(10 Marks)**

b. Derive an expression for deflection of a cantilever beam with uniformly distributed load as shown in Fig.Q8(b).

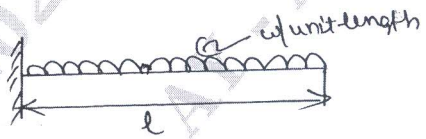

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Derive the expression for torsion equation for a circular shaft. **(10 Marks)**

b. A Hallow circular shaft 200 mm external diameter and metal thickness 25 mm is transmitting power at 200 rpm. The angle of twist over a length of 2m was found to be 0.5°. Calculate the power transmitted and the maximum shear stress induced. Take G = 84 kN/mm^2. **(10 Marks)**

OR

10 a. Explain the assumption in Euler's column theory. **(06 Marks)**

b. A 1.5 m long column has a circular cross section of 50 mm diameter. One end of the column is fixed in direction and position and the 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 $\alpha = 1/1600$. (ii) Euler's formula, taking $E = 1.2 \times 10^5$ N/mm^2. **(14 Marks)**