

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,  
LONERE – RAIGAD -402 103

Supplementary Winter Semester Examination: Nov. – 2019

Branch: Mechanical Engineering  
Subject: - Strength of Materials (BTMEC403)  
Date:- 30/11/2019

Sem.:- IV  
Marks: 60  
Time:- 3 Hr.

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

- Que.1 a) State and explain following terms 6 Marks  
i Hooke's law  
ii Bulk Modulus  
iii Poisson's ratio
- b) A metallic bar  $300 \text{ mm} \times 100 \text{ mm} \times 40 \text{ mm}$  is subjected to external forces as shown in fig. 1. Determine change in volume of the block. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ ,  $\mu = 0.25$ . 6 Marks

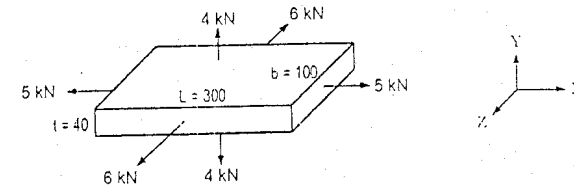


Figure.1

- Que.2 a) A point in a strained material is subjected to stresses shown in fig. 2. Determine normal, tangential and resultant stresses across oblique plane by Mohr's circle method. Also calculate angle of obliquity. 8 Marks

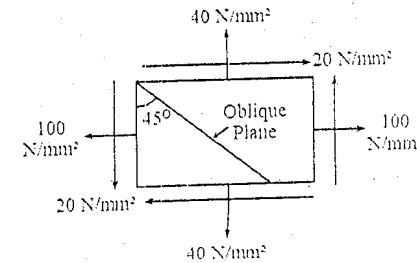


Figure.2

- b) A bar 1.5 m long and 10 mm diameter hangs vertically and has a collar securely fixed at the lower end. Find the maximum stress induced in the bar when a load of 150 N falls on the collar from a height of 25 mm. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ . Also find strain energy stored in the bar. **4 Marks**

- Que.3 a) A square column 300 mm  $\times$  300 mm carries an axial load of 200 kN. Find the position of 30 kN load along the axis bisecting the width of cross section so that end stresses developed at the other extreme of the column will be zero. **6 Marks**

- b) A simply supported beam AB of span 4 m carries an uniformly distributed load as shown in fig. 3. Draw S.F. and B.M. diagrams for the beam. Find magnitude of maximum B.M. **6 Marks**

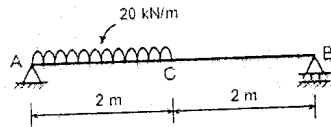


Figure.3

- Que.4 a) A rectangular beam 300 mm wide and 200 mm deep is simply supported over a span of 8 m. What u.d.l. per meter the beam may carry, if the bending stress is not to exceed  $120 \text{ N/mm}^2$ . **4 Marks**

- b) A channel section shown in fig. 5 (a) is used as a beam loaded as shown in fig. 5 (b). Draw the shear stress distribution diagram for the cross-section carrying maximum shear force. **8 Marks**

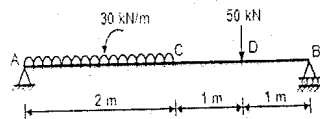


Fig. 5 (a)

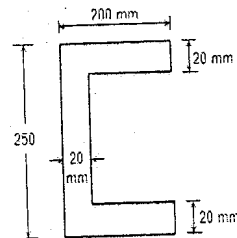


Fig. 5 (b)

- Que.5 a) A simply supported beam carrying a point load is shown in fig.6. Determine **8 Marks**

- 1) Slope at A and B
- 2) Maximum deflection.

Take  $E = 200 \text{ GPa}$ ,  $I = 60 \times 10^6 \text{ mm}^4$ .

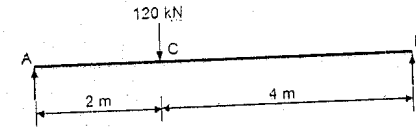


Figure.6

- b) A simply supported beam 5 meter long, carries 10 kN of load at the mid-point. Calculate by moment area method, the slope at the supports and deflection at the mid-span. **4 Marks**

Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 1 \times 10^6 \text{ mm}^4$ .

- Que.6. a) Two shaft AB and BC are connected in series as shown in fig. 7. The diameters of AB and BC are 100 mm and 50 mm respectively and their lengths are 200 mm and 300 mm respectively. Both the shafts are made of the same material having modulus of rigidity as  $8 \times 10^4 \text{ N/mm}^2$ . Determine **6 Marks**

- i) Shear stresses set up in each shaft, and
- ii) The total angle of twist.

The torque applied at the one end is 10 kNm.

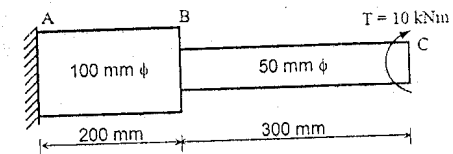


Figure.7

- b) The external and internal diameter of a hollow C.I. column is 5 cm and 4 cm respectively. If the length of its column is 3 m and both of its ends are fixed. Determine the crippling load using Rankine's formula. **6 Marks**

Take  $\sigma_c = 550 \text{ N/mm}^2$  and  $\alpha = 1/1600$  in Rankine's formula.

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