SOM - 1/9 - 12.30 - 2.00

# MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
## SEMESTER END EXAMINATION

**B.Tech. (Agril. Engg.)**

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|---|---|---|---|---|---|
| **Semester** | : **V (New)** | **Term** | : **I** | **Academic Year** | : **2016-17** |
| **Course No.** | : FS 353 | **Title** | : **Strength of Materials** | | |
| **Credits** | : 3(2+1) | | | | |
| **Day & Date** | : Tuesday, 15.11.2016 | **Time** | : 14.00 to 17.00 | **Total Marks** | : **80** |

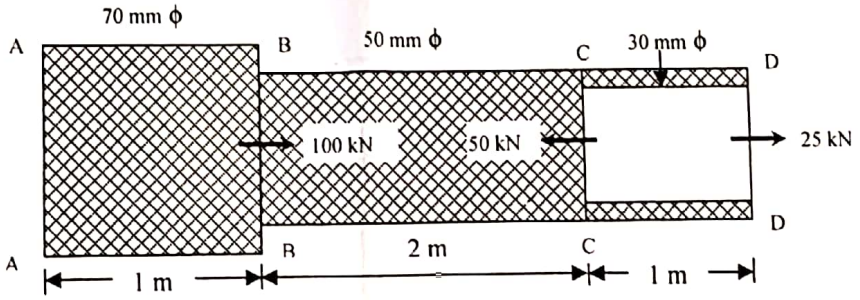
**Note :**
1. Solve **ANY EIGHT** questions from **SECTION "A".**
2. All questions from **SECTION "B"** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagrams wherever necessary.

### SECTION "A"

Q.1 a) A steel rod 2 m long and 20 mm × 20 mm in cross section is subjected to tensile force of 80 kN. Determine elongation of the rod if modulus of elasticity for rod material is 200 GPa.

b) Derive an expression for maximum stress in bar of circular tapering section.

Q.2 A circular steel rod ABCD of different cross sections is loaded as shown in figure. Find maximum stress induced in the rod and its deformation. Take E as 200 GPa.




Q.3 a) A circular bar rigidly fixed at its both ends uniformly tapers from 90 mm at one end to 60 mm at the other end. If its temperature raised through $26^0$K, what will be the maximum stress developed in the bar. Take E as 200 GPa and α as $12 \times 10^{-6}$ / $^0$K for the bar material.

b) Derive an expression for thermal stresses in bar of circular tapering section.

Q.4 a) A steel bar 3 m long, 40 mm wide and 20 mm thick is subjected to an axial pull of 160 kN in the direction of its length. Find the changes in length, width and thickness of the bar. Take E = 200 GPa and Poisson's ratio = 0.3.

b) Derive an expression for volumetric strain, if a rectangular body is subjected to three mutually perpendicular forces.

Q.5 a) Calculate the strain energy stored in bar of 2 m long and 2000 mm$^2$ in cross section area subjected to tensile load of 60 kN. Take E = 200 GPa.

b) Show that stress induced in the body when load is applied suddenly is twice than, the stress induced when same load is gradually applied.

Q.6 A simply supported beam 6 m long is carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Draw the S.F. and B.M. diagram for the beam and also calculate the maximum B.M. on the section.

Q.7 Two plates 10 mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 50 mm. The rivets are 20 mm in diameter and permissible stresses in shearing and bearing of rivets are 70 MPa and 160 MPa, respectively. The permissible stress in tearing of plate is 100 MPa. Determine the efficiency of the joint.

**(P.T.O.)**

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Q.8 a) State the assumptions in the Euler's column theorem.
b) State any two types of end conditions of the column and also formula to calculate crippling load.

Q.9 a) A simply supported beam 3 m long is subjected to a central load of 10 kN. Find maximum slope and deflection of the beam. Take E as 200 GPa and $I = 12 \times 10^6\ mm^4$.
b) State various methods to find the slope and deflection of beam and explain any one.

Q.10 a) Show that bending stress in beam at any point is directly proportional to the distance of it from the neutral axis.
b) Derive formula for limit of eccentricity of a circular section.

## SECTION "B"

Q.11 Define the following terms.

1) Strength of materials
2) Tensile stress
3) Bulk modulus
4) Volumetric strain
5) Poisson's ratio
6) Modulus of resilience
7) Eccentric load
8) Bending stress

Q.12 Choose the correct answer.

1) Modulus of elasticity is the ratio of _____.
   a) Stress to strain
   b) Stress to original length
   c) Deformation to original length
   d) All of these

2) A simply supported beam of span (l) is subjected to uniformly distributed load of (w) per unit length over the whole span. The maximum deflection at centre of beam is _____.
   a) $5wl^5 / 48\ EI$
   b) $5wl^4 / 96\ EI$
   c) $5wl^4 / 192\ EI$
   d) $5wl^3 / 384\ EI$

3) The ratio of lateral strain to the linear strain is called _____.
   a) Modules of elasticity
   b) Modulus of rigidity
   c) Bulk modulus
   d) Poissons ratio

4) The maximum stress produced in bar of tapering section is at _____.
   a) Larger end
   b) Smaller end
   c) Middle
   d) Any where

5) In a composite section, the number of different material are _____.
   a) Only one
   b) Only two
   c) More than two
   d) All of these

6) The section modulus of a circular section of diameter (d) is _____.
   a) $\pi (d^2) / 32$
   b) $\pi (d^3) / 32$
   c) $\pi (d^3) / 64$
   d) $\pi (d^4) / 64$

7) The bending moment at the free end of a cantilever beam carrying any type of load is _____.
   a) Zero
   b) Minimum
   c) Maximum
   d) Equal to the load

8) The maximum eccentricity of a load on a circular section to have same type of stress is _____.
   a) One eighth of diameter
   b) One sixth of diameter
   c) One fourth of diameter
   d) One third of diameter

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