

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 3
Subject Code: 03104203
Subject Name: (Structural Analysis - I)

Date: 25/05/2019
Time: 02:00pm to 04:30pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (Each of one mark) (15)

1. Effective length of a column with both end fixed is
 (a) $L/2$ (b) L (c) $2L$ (d) $L/\sqrt{2}$
2. If in a pin-jointed plane frame $(m + r) > 2j$, then the frame is
 (A) Stable and statically determinate (B) Stable and statically indeterminate (C) Unstable
 (D) None of the above
3. For a two-hinged arch, if one of the supports settles down vertically, then the horizontal thrust
 (A) Is increased (B) Is decreased (C) Remains unchanged (D) Becomes zero
4. The maximum bending moment of a cantilever beam carrying a point load at its free end is at the
 (a) fixed end (b) centre of span (c) free end (d) none of these
5. Principle of superposition is applicable when
 (a) Deflection are linear function of applied force (b) material obey hook's law (c) the action of applied forces will be affected by small deformation of the structures (d) none of the above
6. The value of Rankine's constant for mild steel column with both ends hinged is
7. The formula for bending equation is _____.
8. For a rectangular section, maximum shear stress is equal to _____
9. The section modulus of a circular section of diameter 'd' is _____
10. Conditions of static equilibrium are _____
11. Define static indeterminacy.
12. Define core/kernel of a section.
13. What do you mean by slenderness ratio?
14. Define Kinematic indeterminacy.
15. What is the angle between the planes of maximum and minimum principal stresses?

Q.2 Answer the following questions. (Attempt any three) (15)

- A) Write down the difference between statically determinate structures and statically indeterminate structures.
- B) Difference between column and strut & long column and short column.
- C) Draw representative shear stress distribution diagrams for
 a) Rectangular, b) I section, c) circular section.
- D) Two wheel loads 12 kN and 20 kN with fixed distance 2 m between them and 12 kN load leading, crosses a beam of span 8 m from left to right. Draw the influence line for shear force and bending moment for a point 3 m from left support and find maximum values of shear force and bending moment.

Q.3 A) A three hinged parabolic arch has span 20 m and central rise 3 m. It carries a point load of 10 kN at 7.5 m from the left hinge. Calculate normal thrust, shear and B.M at section 7.5 m from right end hinge. Also calculate maximum positive and negative bending moments and their positions. (07)

- B) Derive Euler's crippling load for column with both ends hinged. (08)

OR

- B) A bar of T section as shown in **Fig 2** is subjected to a longitudinal pull P applied at a point on y-y axis but not on the centroid of the section. Determine the magnitude of P and the position of its line of action if the stresses across the section vary from 9.75 N/mm^2 compression at the top to 117.5 N/mm^2 tension at the bottom. (08)

Q.4 A) The intensity of resultant stress on a plane AB **Fig 1** at a point in a material under stress is 800 N/cm^2 and it is inclined at 30° to the normal to that plane. The normal component of that stress on another plane BC at right angle to plane AB is 600 N/cm^2 . **(07)**

Determine the following

- (1) the resultant stress on the plane BC ,
- (2) the principal stress and their directions ,
- (3) the maximum shear stress and their planes.

OR

A) A rectangular column section ABCD having side $AB=CD=400\text{mm}$ and $BC=AD=300\text{mm}$ carries a compressive load of 300 KN at corner B. Find stresses at each corner A,B,C & D and draw stress distribution diagram for each side. **(07)**

B) An 'I' section has 260 mm depth and 120 mm width. Thickness of flange and web is 10 mm . It is used as a column with one end fixed and other hinged. The length of the column is 8 m . Determine safe load for the column using Euler's formula. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and factor of safety as 3. **(08)**

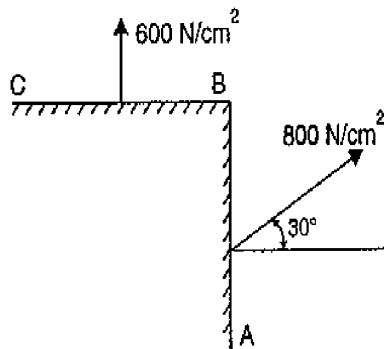


Figure 1

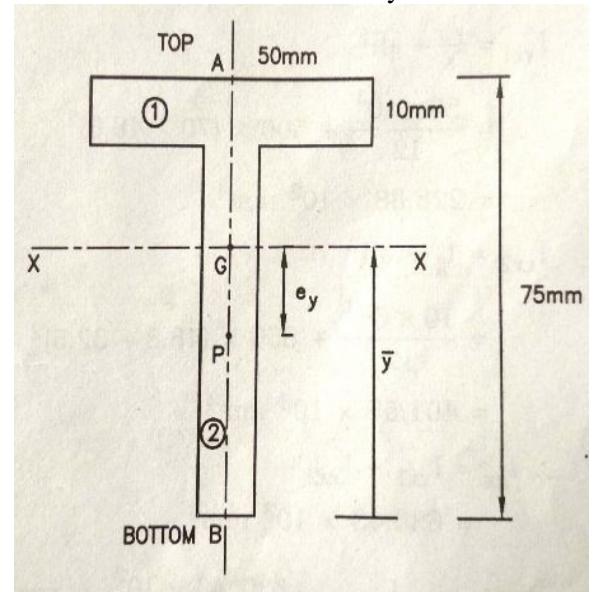


Figure 2