

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 140322

Roll No.

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B.Tech.

(SEM. III) EXAMINATION. 2015-16

STRENGTH OF MATERIAL

[Time:3 hours]

[MaximumMarks:100]

SECTION-A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (2x10=20)
- (a) Define and explain stress at a point
 - (b) Define major principal and Minor principal stress with the help of Mohr's circle.
 - (c) What do you understand by pure bending?
 - (d) Write maximum deflection for simply supported beam having UDL.
 - (e) Define springs. Name different types of springs.

- (f) Define the terms spring index and spring constant.
- (g) What do you understand by effective length and slenderness ratio of column?
- (h) Discuss Rankine / Gordon's formula for column.
- (i) Write assumptions for pure torsion equation.
- (j) Define shear center for section.

Section-B

Attempt any five questions from this section. (5x10=50)

- 2. In an elastic material, at a certain point on planes at right angles to one another, direct stresses of 120MPa (T) and 100MPa (C) are acting. The major principal stress in the material is to be limited to 160MPa. To What shearing stress the material may be subjected on the given planes? Also find the minimum principal stress and the maximum shearing stress at that point?
- 3. Derive the expression for Three dimensional stress equilibrium equation (Generalised hook's Law).

4. A simply supported beam of 6m span is subjected to a point load of 18kN at 4m from left support. Calculate
 (i) the position and the value of maximum deflection.
 (ii) Slope at mid point (iii) Deflectin at the load point.
 (Given $E=200\text{GPa}$, $I=15 \times 10^6 \text{mm}^4$.)
5. A circular pipe of external diameter 70mm and thickness 8mm is used as a simply supported beam over an effective span 2.5m. Find the maximum concentrated load that can be placed at the center of the span if permissible stress in the tube is 150MPa.
6. A cantilever leaf spring has a clear span of 800mm and carries a load of 10kN at the free end. The bending stress in strip and deflection at free end not to exceed respectively 320MPa and 80mm respectively. Find the number of plates if width of a plate is 8 times the thickness.
7. A hollow cast iron column whose outside diameter is 200mm and has a thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe load by Rankine formulae using a factor of safety of 2.5. Find the ratio of Euler's to Rankine's load. Take $E=1 \times 10^5 \text{Mpa}$ and Rankine's constant $=1/1600$ for both ends pinned case and $f_c=550 \text{Mpa}$.

8. Derive the expression of h^2 for trapezoidal cross-section in curved beams.
9. Derive the expression of shear centre for channel section. (Assume suitable dimensions for channel).

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Attempt **any two** question from this section.

(15x2=30)

10. Two helical springs are nested one inside the other to support a load of 500N. Both the springs are made of the same material with modulus of rigidity $G=82.7\text{GPa}$, the particulars of the springs are tabulated below:

SN	Parameters	Outer Spring	Inner Spring
1	Mean Coil Dia (D)	40mm	28mm
2	Dia. Of Spring wire (d)	5mm	4mm
3	No. of active coil (n)	10	8
4	Free Length	90mm	78mm

Determine the (i) deflection of each springs (ii) Load carried by each springs (iii) Shear stress induced in each springs.

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