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**Question Paper Code : 40782**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Third/Fourth Semester

Civil Engineering

CE 6402 – STRENGTH OF MATERIALS

(Common to Petrochemical Engineering, Plastic Technology, Polymer Technology)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A

(10×2=20 Marks)

1. Define Strain Energy.
2. State Castigliano's Second Theorem.
3. Find the reaction at prop in a propped cantilever of span 2m carrying a UDL of  $6 \text{ kN/m}^2$  over the entire span.
4. State the theorem of three moments.
5. Define core of a section.
6. What are compound cylinders ?
7. What is principal plane and principal stress ?
8. Explain Tresca's theory.
9. What are the assumptions made in Winkler-Bach formula ?
10. What is Unsymmetrical bending ?

PART – B

(5×13=65 Marks)

11. a) A beam 4 cm wide, 8 cm deep is freely supported over a span of 2 m. A weight of 2 kg is dropped on to the middle of the beam from a height of 4 cm. Calculate the maximum instantaneous stress and deflection.  $E = 2 \times 10^6 \text{ kg/cm}^2$ .

(OR)

- b) A beam simply supported over a span of 3.5 m carries a UDL of 25 kN/m over the entire span. Taking  $EI = 2.5 \text{ MNm}^2$  and using Castigliano's theorem, determine the deflection at the center of the beam.



12. a) A continuous beam ABCD is simply supported at A, B, C and D,  $AB = BC = CD = 5$  m. Span AB carries a load of 30 kN at 2.5 m from A. Span BC carries an UDL of 20 kN/m. Span CD carries a load of 40 kN at 2 m from C. Draw the shear force and bending moment diagrams.

(OR)

- b) A fixed beam of 5m length is loaded with equal point loads of 130 kN each at distance 1.5 m from each support. Draw the bending moment and shear, a force diagram where  $E = 2 \times 10^8$  kN/m<sup>2</sup>,  $I = 1 \times 10^8$  mm<sup>4</sup>.
13. a) Derive an expression for Euler's crippling load when one end of column is fixed and other end is hinged.

(OR)

- b) A thick cylinder of internal diameter 10 cm, external diameter 20 cm, is subjected to an internal pressure of 100 kg/cm<sup>2</sup>. Draw diagrams showing the distribution of radial pressure and hoop stress in the wall of the cylinder.
14. a) In a material the principal stresses are 60 MN/m<sup>2</sup>, 48 MN/m<sup>2</sup> and 26 MN/m<sup>2</sup>, Calculate ; total strain energy. Volumetric strain energy, shear strain energy and factor of safety on the total strain energy criterion if the material yields at 120 MN/m<sup>2</sup>.

(OR)

- b) Explain the following :
- Maximum Shear stress theory
  - Maximum strain energy theory
15. a) Find shear center of a channel section 300 mm  $\times$  150 mm with thickness of 20 mm from first principles.

(OR)

- b) A curved bar is formed of a tube of 120 mm outside diameter and 7.5mm thickness. The centre line of this curved bar is a circular arc of radius 225 mm. A bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses set up in the bar.

PART - C

(1 $\times$ 15=15 Marks)

16. a) A cantilever of length L and uniform section carries a point load W at the free end. Find the strain energy stored in the beam and calculate the deflection at the free end.

(OR)

- b) Determine the principal moments of inertia for an unequal section 60 mm  $\times$  40 mm  $\times$  6 mm.