Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80199

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Civil Engineering

CE 6402 — STRENGTH OF MATERIALS

(Common to Fourth Semester Petrochemical Engineering and Third Semester Plastic Technology and Polymer Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A tensile load of 60 kN is gradually applied to a circular bar of 40 m diameter and 5 m long. If $E = 2.0 \times 10^5$ N/mm^2, determine the strain energy absorbed by the rod.

2. State "principle of virtual work".

3. What are indeterminate beams? Give two examples.

4. Write the expression of theorem of three moment equation.

5. What are the causes of failure of a column?

6. What are the methods of reducing hoop stress in cylindrical shells?

7. Define stress tensor.

8. State Guest's theory.

9. Differentiate between symmetrical and unsymmetrical bending.

10. Write Winkler Bach formula and explain the terms.

PART B — (5 × 13 = 65 marks)

11. (a) A tension bar 5 m long is made up of two parts, 3 metre of its length has a cross-sectional area of $10\,cm^2$ while the remaining 2 m has a cross-sectional area of $20\,cm^2$. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5\ N/mm^2$.

Or

(b) State and prove Maxwell's reciprocal theorem.

12. (a) A fixed beam AB of length 6 m carries point loads of 160 kN and 120 kN at a distance of 2 m and 4 m from the left end A. Find the fixed end moments, support reaction, and also draw B.M and S.F. diagrams.

Or

(b) Draw the S.F and B.M diagram of a continuous beam ABC of length 10 m which is fixed at A and is supported on B and C. The beam carries a uniformly distributed load of 2 kN/m length over the entire length. The spans AB and BC are equal to 5 m each.

13. (a) Derive an expression for crippling load when one end of the column is fixed and the other end is force.

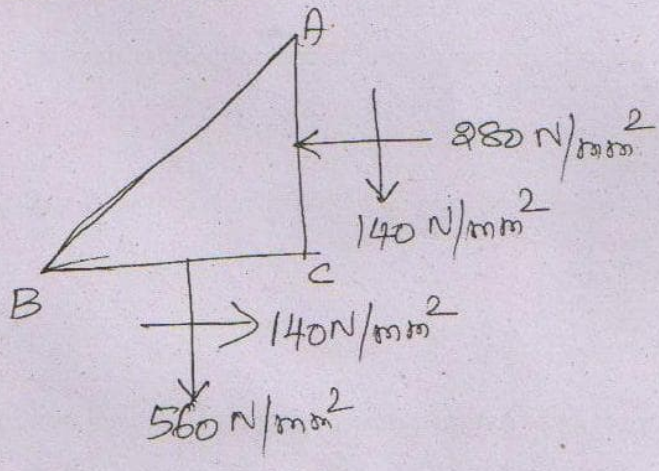
Or

(b) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of $8\ N/mm^2$. Also sketch the radial pressure distribution and hoop stress distribution across the section.

14. (a) At a point in a strained material, on plane BC there are normal and shear stresses of $560\ N/mm^2$ and $140\ N/mm^2$ respectively. On plane AC, perpendicular to plane BC, there are normal and shear stresses of $280\ N/mm^2$ and $140\ N/mm^2$ respectively as shown in Fig. below, Determine the following :

(i) Principal stresses and location of the planes on which they act.

(ii) Maximum shear stress.



Or

(b) According to the theory of maximum shear stress, determine the diameter of a bolt which is subjected to an axial pull of 9 kN together with a transverse shear force of 4.5 kN. Elastic limit in tension is 225 N/mm^2, factor of safety = 3 and Poisson's ratio = 0.3.

15. (a) A beam of T-section (flange : 100 mm × 20 mm; web : 150 mm × 10 mm) is 2.5 metres in length and is simply supported at the ends. It carries a load of 3.2 kN inclined at 20° to the vertical and passing through the centroid of the section. If E = 200 GN/m^2, calculate :

(i) Maximum tensile and compressive stress

(ii) Position of the neutral axis.

Or

(b) Derive the value of 'h^2' for a triangular section of a curved bar.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the following :

(i) Principle of virtual work. (5)

(ii) Castigliano's theorems. (5)

(iii) Strain energy due to torsion. (5)

Or

(b) Explain the following :

(i) The failure of short columns under compression. (7)

(ii) Distortion energy theories. (8)