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Question Paper Code: 50143

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Civil Engineering

15UCE403 - MECHANICS OF SOLIDS II

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The stress due to suddenly applied load is _____ times that of gradually applied load.

   (a) two (b) three (c) four (d) five

2. The deflection at the free end of a cantilever of length *l* carrying a point load *W* at its free end is given as

   (a) $Wl / 2EI$ (b) $Wl^2 / 2EI$ (c) $Wl^3 / 2EI$ (d) $Wl^3 / 3EI$

3. A beam of length *l*, fixed at both the ends carries a uniformly distributed load *w* per unit length throughout span. The bending moment at the end is

   (a) $Wl^2 / 8$ (b) $Wl^2 / 12$ (c) $Wl^3 / 12$ (d) $Wl^2 / 24$

4. The ratio of equivalent length of the column to the minimum radius of gyration is called

   (a) Poisson's ratio (b) Buckling factor
   (c) Factor of safety (d) None of these

5. When the loads pass through the bending axis of a beam then there shall be

   (a) Pure bending of the beam (b) Twisting of the beam
   (c) Bending shall be accompanied by twisting (d) Non bending of beam

PART - B (5 x 3 = 15 Marks)

6. State Castigliano's first and second theorem.

7. Explain the theorem for conjugate beam method.

8. Differentiate the statically determinate structures and statically indeterminate structures.

9. What are the assumptions made in Euler's theory?

10. Define unsymmetrical bending and state the reasons for unsymmetrical bending.

PART - C (5 x 16 = 80 Marks)

11. (a) A bar 50cm long has 1.5cm^2 cross sectional area for 30 cm of its length and 1 cm^2 for the remaining length. If a load of 50N falls on the collar which is provided at the end of the rod, the other end being fixed, from a height of 3 cm, find the maximum stress induced in the bar. Take E = 200GN/m^2. (16)

Or

(b) A beam simply supported over a span of 3m carries a uniformly distributed load of 20kN/m over the entire span. Taking EI=2.25 MNm^2 and using Castigliano's theorem determine the deflection at the center of the beam. (16)

12. (a) A cantilever of 3m length and a uniform rectangular cross section 150 mm wide and 300 mm deep is loaded with a 30kN load at its free end. In addition to its carries a uniformly distributed load of 20kN per meter run over its entire length, calculate the maximum slope and maximum deflection by double integration method. (16)

Or

(b) A cantilever 2m long carries a load of 15kN at a distance of 1m from the fixed end and a load of 10kN at the free end. Determine the deflection at the free end use conjugate beam method. Take E= 200 x 10^6kN/m^2, I = 15 x 10^{-6} m^4. (16)

13. (a) A fixed beam AB of length 6m carries point loads of 160kN and 120kN at a distance of 2m and 4m from the left end A. Find the fixed end moments and the reactions at the support. Draw Bending moment and Shear force diagrams (16)

Or

(b) A continuous beam ABCD of length 15 m rests on four supports covering 3 equal spans carries a uniformly distributed load of 1.5 kN/ m length. Calculate the

moments and reactions at the supports. Draw shear force and bending moment diagrams. (16)

14. (a) Derive the Euler's crippling load for a column with one end is fixed and other end is free (16)

Or

(b) A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 250 kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take ultimate crushing stress 550 N/mm^2 and $\alpha = 1/1600$ in Rankine's formula. (16)

25. (a) A 80 mm x 80 mm x 10 mm angle is used as a simply supported beam over a span of 2.4 m. It carries a load of 400 N along the vertical axis passing through the centroid of the section. Determine the resulting bending stress on the outer corners of the section, along the middle section of the beam . (16)

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. (16)