C20-C–302

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BOARD DIPLOMA EXAMINATION, (C-20)

NOVEMBER/DECEMBER—2022

DCE - THIRD SEMESTER EXAMINATION

MECHANICS OF SOLIDS AND THEORY OF STRUCTURES

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Write any three assumptions in theory of simple bending.

2. Sketch the shear stress distribution across a tee beam.

3. State Mohr's theorem–I.

4. Obtain the expressions for the values of maximum slope and deflection for a simply supported beam of length *L*, carrying an u.d.l of w/m over the entire length of the beam

5. Calculate the value of effective length of 5 m long column when it is *(a)* fixed at both ends, *(b)* hinged at both ends and *(c)* one end fixed and the other end hinged.

6. List any three forces acting on a dam.

7. Calculate the horizontal water pressure acting on the trapezoidal dam of base width 6 m, top width 3 m and a height of 10 m retaining water to a depth of 9 m on its vertical face.

8. Sketch the BMD for a propped cantilever beam with point load at mid-span and prop at free end.

9. Calculate the degree of static indeterminacy of *(a)* propped cantilever, *(b)* fixed beam and *(c)* two-span continuous beam.

10. State the three methods of analysis of frames.

PART—B

8×5=40

Instructions : (1) Answer **either** *(a)* **or** *(b)* of each question from *Part—B*.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Calculate 'maximum shear stress' and 'maximum bending stress' for a cantilever beam of span 2·5 m carrying an u.d.l. of 5 kN/m over a length of 1·5 m from free end and a point load of 8 kN acting at a distance of 0·5 m from the fixed end. The cross-section of the beam is a rectangle of 200 mm wide and 350 mm deep.

(OR)

(b) A beam of *I*-section, 150 mm deep and 75 mm wide, has top and bottom flanges 8 mm thick, web 4 mm thick is simply supported and carries an u.d.l. of 35 kN/m over its entire span. Find the 'maximum permissible span' without exceeding the shear stress of 50 N/mm^2. Take I_{xx} = 688·20 × 10^4 mm^4 and A = 1808 mm^2.

12. *(a)* A simply supported beam of span 5 m carries a point load of 60 kN acting at 3 m from left hand support. Find the 'maximum deflection' using Macaulay's method. Assume EI = 4500 kN/m^2.

(OR)

(b) Two concentrated loads of 60 kN and 100 kN are placed on a cantilever beam of span 3 m at free end and 1·5 m from free end respectively. Determine the deflections under the two point loads, taking EI = 3000 kN/m^2.

13. *(a)* A stanchion is made up of an ISLB 300 mm × 150 mm with two plates 180 mm × 10 mm, one at the top and one at the bottom flanges. If it is used as a column 4 m long with both ends hinged, find the safe load using Euler's formula, with a factor of safety of 3. For the given ISLB, I_{xx} = 73·329 × 106 mm^4, I_{yy} = 3·762 × 106 mm^4, area = 4808 mm^2. Take E = 210 kN/mm^2.

(OR)

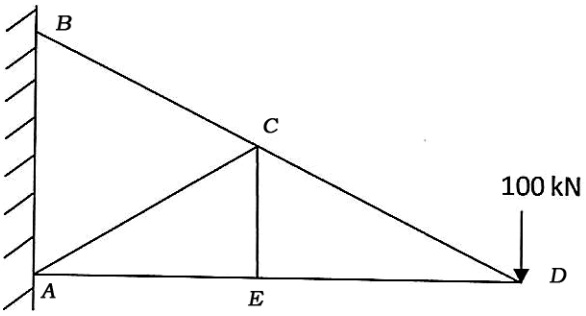
(b) A hollow circular cast iron column is 5 m long with one end fixed and the other end hinged. Design the column to carry and axial load of 400 kN. Use Rankine's formula and adopt a factor of safety of 4. The internal diameter may be taken as 0·75 times the external diameter. Take f_c = 550 N/mm^2 and α = 1/1600.

14. *(a)* A trapezoidal concrete dam 4 m wide at top and 20 m high with its vertical face on water retaining side. A free board of 3 m is to be provided. Find the base width for most economical section of the dam. Take specific weight of concrete = 24 kN/m^3 and specific weight of water = 10 kN/m^3.

(OR)

(b) A concrete retaining wall of trapezoidal section is 15 m high and retains soil in level with the top. The width at the top is 3 m and at the bottom is 8 m and the earth retaining face is vertical. Find the maximum and minimum intensities of stresses at the base. Density of masonry is 24 kN/m^3, unit weight of soil = 17 kN/m^3, angle of repose of the soil = 35°.

15. *(a)* Find the member forces of the cantilever truss shown in the figure below and tabulate the results using method of sections. AB = 3 m, AC = 3 m, BC = 3 m, CD = 3 m, $\angle BAD = 90°$, $\angle CED = 90°$.



(OR)

(b) Explain the method of calculating forces in the members of a truss by the method of sections.

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and criterion for valuation is the content but not the length of the answer.

16. Analyze the two-span continuous beam of spans AB = 4 m, BC = 6 m. AB is subjected to an u.d.l. of 15 kN/m over the entire span and BC is subjected to a point load of 40 kN at a distance of 2 m from the support C. Use moment area method. Draw SFD and BMD, also locate the points of contraflexure, if any exists.

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