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C14–C–302

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2016

DCE—THIRD SEMESTER EXAMINATION

MECHANICS OF SOLIDS

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. Draw neat sketches of three types of beam.

2. Differentiate between a statically determinate beam and a statically indeterminate beam.

3. Draw the shear force and bending moment diagrams for a cantilever beam of span L meters and is loaded with a uniformly distributed load of W kN/meter on its entire span.

4. Define the following terms : 3

(a) Flexural rigidity

(b) Neutral axis

(c) Section modulus

5. A thin steel rule 25 mm wide and 0·625 mm thick is bent by couples at its ends so that the length in the bent position is 250 mm and subtends a central angle of 60°. Find the bending stress in the steel rule if E 200 kN / mm^2.

6. A simply supported wooden beam 100 mm wide, 200 mm deep and 3 meters long is carrying a udl of 30 kN/m. Determine the maximum shear stress and sketch its variation over the depth of the beam.

7. Mention the maximum slope and maximum deflection values for the following beams : 3

(a) Cantilever loaded with udl on its entire length

(b) Simply supported beam loaded with central point load

(c) Simply supported beam with udl on the whole span

8. Obtain the expressions for slope and deflection at the free end for the cantilever beam of span L with uniformly distributed load of W N/m to a length $L/2$ from the fixed end.

9. A timber beam of rectangular section 100 mm wide and 240 mm deep is simply supported over a span of 4 m. What udl can the beam carry to produce a central deflection of 6 mm? Given E $11\,kN/mm^2$.

10. A simply supported beam of span 4 m carries a udl of 10 kN/m over the entire span. Calculate the max. slope and max. deflection using Mohr's theorems. Take EI $3600\,kN.m^2$.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.
(2) Each question carries **ten** marks.
(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. *(a)* State the location and magnitude of the maximum bending moment developed for the following : 3

(i) Cantilever beam of length L meters and is loaded with a point load of W kN placed at the free end.

(ii) A simply supported beam of span L meters and is loaded with a central point load of W kN

(iii) A simply supported beam of span L meters and is loaded with a udl of W kN/m on its entire span.

(b) A simply supported beam of span 4 meters is loaded with a udl of 12 kN/m over the left half of the span and a point load of 8 kN placed at 1 m from the right support. Find the support reactions and draw the shear force and bending moment diagrams indicating the values at salient points. 7

12. A beam of 12 meters length is supported at left end and 2 meters from the right end. It carries a concentrated load of 4 kN placed at the right end. It also carries a udl of 8 kN/m over a length of 5 meters from the left support. Find the support reactions and draw the shear force and bending moment diagrams indicating values at salient points. Also locate the point of contraflexure.

13. A simply supported beam of 4 m span carries a brick wall, 250 mm thick and 3 m high. Depth of the beam is twice its breadth and maximum permissible bending stress is $10\,N/mm^2$. Find the cross sectional dimensions of the beam if specific weight of brick wall is 24 kN/m^3. Neglect self-weight of the beam.

14. An I section has flanges 200 mm×20 mm, and web 300 mm×20 mm. Find the maximum shearing stress developed in the beam for a shear force of 50 kN. Also sketch the shear stress distribution across the section.

15. (a) Define the following : 2

(i) Slope

(ii) Deflection

(b) Find the slope and deflection at the free end of a cantilever beam of length 4 meters and is loaded with a udl of 5 kN/m. Take $EI \quad 2000\,kN.m^2$. 8

16. A beam of rectangular section is freely supported at the ends and carries a udl. If the max.stress due to bending is to be 7.5 N/mm^2, determine the ratio of depth of the section to span so that the maximum deflection may not exceed 1 / 480 of span. Take E 1 10^4 N/mm^2.

17. *(a)* What is thin cylinder? 2

(b) Calculate the minimum wall thickness required for a thin cylinder of 1·2 m diameter, if it is to withstand an internal pressure of 3 N/sq.mm and longitudinal stress is not to exceed 30 N/sq.mm and Hoop stress is not to exceed 40 N/sq.mm. 8

18. Compare the weights of a solid circular shaft and a hollow circular shaft of the same material, if both shafts have the maximum shear stress under equal twisting moment. Assume the outer diameter of the hollow shaft to be twice that of the inner diameter.

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