

c09-c-**303**

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BOARD DIPLOMA EXAMINATION, (C-09) MARCH/APRIL—2014 DCE—THIRD SEMESTER EXAMINATION

STRENGTH OF MATERIALS AND THEORY OF STRUCTURES

Time : 3 hours]

[Total Marks : 80

3×10=30

PART—A

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. A circular beam of 100 mm diameter is subjected to a shear force of 5 kN. Calculate the maximum shear stress and draw the variation of shear stress along the depth of the beam.
- **2.** Draw the shear stress distribution diagram over a symmetric I-section of overall size $(B \ D)$ and size of web $(b \ d)$.
- **3.** Define stiffness of the beam and flexural rigidity.
- **4.** Obtain the degree of redundancy of a fixed beam subjected to vertical loading only.
- 5. A cantilever of 2 m long carries a load of 350 kN at its free end. Find the deflection at the free end, if $E = 200 \text{ GN/m}^2$ and $I = 210 = 10^6 \text{ mm}^4$. Use moment area method.
- **6.** Write the values of equivalent length (l) for different end conditions of a column of actual length = L.
- 7. Differentiate short and long columns in any three aspects.
- **8.** Differentiate between a dam and a retaining wall in any three aspects.

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- **9.** Name the various methods which are employed in finding out the forces in a frame.
- **10.** Define polar moment of inertia, polar modulus and state their units.

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 cast iron beam of I-section with top flange 150 mm×10 mm, bottom flange 200 mm×20 mm and web 270 mm×10 mm is simply supported over a span of 6 m. If the permissible stresses are 110 N/mm² in compression and 28 N/mm² in tension, what uniformly distributed load can be safely applied on the beam?
- **12.** (a) Calculate the width and depth of the strongest beam that can be cut from a log of wood of 400 mm diameter.
 - (b) Two beams are made of same material, same length and same weight; cross section of one beam is solid circular while that of the other is hollow circular with a diameter ratio of 1.5:1. Compare their strengths.
- 13. (a) A cantilever beam of span 5 m carrying a UDL of w/m. The section of the beam is 100 mm×200 mm and the value of E of the beam material is 2 10^4 mm⁴. Determine the value of w if the maximum deflection is 8 mm. Also find the maximum slope under the load.
 - (b) In the above problem, if the beam is simply supported over the same span and carrying the UDL as obtained above, find the maximum slope and deflection.
- 14. A simply supported beam of 3 m span carries two point loads of 80 kN and 120 kN at a distance of 1 m and 2.4 m respectively from RHS. Find the Macaulay's method (a)the deflection under loads and (b) position and magnitude of $I = 16 = 10^4 \text{ mm}^4$ Take maximum deflection. and 210 kN/mm^2 and $E = 210 \text{ kN/mm}^2$. \boldsymbol{E}

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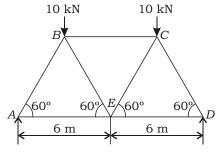
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- **15.** (a) A regular I-section 300 mm×150 mm×15 mm is used as a column of 5 m long with both ends fixed. Find Euler's crippling load, if $E = 210 \text{ kN/mm}^2$.
 - (b) A hollow circular column of 300 mm external diameter and 50 mm thick is of 6 m long with one end fixed and other end hinged. Find the safe load carried by the column with a factor of safety of 4. Take $f_c = 0.56 \text{ kN/mm}^2$ and $a = \frac{1}{1600}$.

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- 16. A braced jib of crane is built up of 4 nos. of 60 mm×60 mm angles forming a square of 400 mm overall. If the length of the jib is 12 m and ends are fixed, calculate the safe axial load using Rankine's formula taking a factor of safety of 4. For each angle, sectional area = 929 mm², I_{xx} I_{yy} 56 10⁴ mm⁴, C_{xx} C_{yy} 21.6 mm. Rankine's constant f_c 330 MPa and $a \frac{1}{7500}$.
- 17. A trapezoidal masonry retaining wall is 12 m high and 2 m wide at top and 5 m wide at bottom with a vertical face retained earth up to its top. Specific weight of masonry and earth are 22 kN/m^3 and 18 kN/m^3 . Angle of repose of soil = 32° . Check the stability of the wall if the allowable pressure on soil is 300 kN/m^2 , coefficient of friction between masonry and the earth is 0.6.
- **18.** Determine the forces in all the members of the truss shown in the figure below, by method of joints. Also, prepare the force table :



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