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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, NOVEMBER - 2024

THEORY OF STRUCTURES - I

[Maximum marks: 100] [Time: 3 Hours]

PART – A
Maximum marks: 10

I. (Answer ***all*** the questions in one or two sentences. Each question carries **2** marks)

1. Define moment of a force about a point.
2. Define centroid.
3. State Hooke's law.
4. What is torsion equation?
5. What is bending equation? (5 x 2 = 10)

PART – B
Maximum marks: 30

II. (Answer any ***five*** of the following questions. Each question carries **6** marks)

1. List and define any three types of loading.
2. State parallel axes theorem. Determine the polar moment of inertia of a circular shaft of internal diameter 30 mm and external diameter 50 mm.
3. A straight bar 450 mm long is 20 mm in diameter for the first 250 mm length and 10 mm diameter for the remaining length. If the bar is subjected to an axial pull of 10 kN find the extension of the bar. Take $E = 2 \times 10^5$ N/mm^2.
4. An axial pull of 10 kN is gradually applied on a steel rod 4 m long and 20 mm diameter. Calculate the strain energy which can be absorbed in the rod. Take $E = 200$ kN/mm^2.
5. A cantilever beam 4 m carries a point load of 10 kN at the free end and an udl of 2 kN/m over 2 m from the fixed end. Sketch its SFD and BMD.
6. Write any 6 assumptions made in the theory of pure torsion.
7. Draw the shear stress distribution diagram of a symmetrical I section showing the shear stress distribution in the web and flanges.

(5 x 6= 30)

PART – C

Maximum marks: 60

(Answer ***one full*** question from each unit**.** Each full question carries **15** marks)

UNIT – I

III. (a) Calculate the support reactions of a simply supported beam 8 m carrying two point loads of 20 kN and 10 kN at 2 m and 6 m respectively from left end. It also carries a udl of 100 kN/m over the entire span. (6)

(b) Find the centroid of an unequal angle section 80 mm x 60 mm x 10 mm. (9)

OR

IV. (a) An overhanging beam PQR carries an udl of 50 kN/m over the entire span. The overhanging length QR = 2 m carries a point load 20 kN at its free end. The span PQ = 4 m and it carries a central point load of 10 kN. Find the support reactions at P and Q. (6)

(b) Find the moment of inertia about the centroidal axes of a channel 200 mm x 100 mm with flange thickness = 15 mm and web thickness 10 mm. (9)

UNIT - II

V. (a) List and explain any six mechanical properties of metal. (6)

(b) An RCC column 30 cm x 30 cm, in section has 4 reinforcement bars of steel each 20 mm diameter. Calculate the safe load for the column if the allowable stress in the concrete is 5 N/mm^2. E for steel = 15 x E of concrete. (9)

OR

VI. (a) Write any 3 equations connecting modulii of elasticity. (6)

(b) A prismatic metallic bar of rectangular section 500 mm x 200 mm and 10 m long is subjected to a load of 160 kN applied suddenly on it. If the stress at elastic limit of the bar material is 200 N/mm^2 determine (i) Strain energy at the given load (ii) Proof resilience (iii) Modulus of resilience. Take E = 200 GPa. (9)

UNIT - III

VII. (a) Define the terms

(i) Shear force (ii) Bending moment (iii) Point of contraflexure. (6)

(b) An overhanging beam ABC of span 6 m is carrying an udl of 20kN/m over 2 m from left end A. Span AB is 4m. Overhanging length BC is 2 m and carries a point load of 6kN at the free end. Draw the SFD and BMD for the beam and mark salient points on it. (9)

OR

VIII. (a) Define the terms

(i) Polar modulus of a section (ii) Torsional rigidity and (iii) Thin shell. (6)

(b) A boiler shell is to be made of 15 mm thick plates having a limiting tensile stress of 120 N/mm^2. If the efficiency of longitudinal joint and efficiency of circumferential joint are 70% and 30% respectively determine what maximum diameter of shell should be allowed for a maximum pressure of $4N/mm^2$. (9)

UNIT – IV

IX. (a) List any six assumptions made in the theory of simple bending. (6)

(b) A beam of I section 300 mm x 120 mm has flanges 20 mm thick and web 10 mm thick. Calculate the uniformly distributed load this section will carry over a span of 5m, if the permissible bending stress is limited to 120 N/mm^2. (9)

OR

X. (a) Define (i) Neutral axis (ii) Section modulus (iii) Flexural rigidity. (6)

(b) A rectangular beam 100 mm x 300 mm subjected to a maximum shear force of 60 kN. Determine (i) Average shear stress (ii) Maximum shear stress and (iii) Shear stress at a distance of 40 mm above neutral axis. (9)
