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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2021

THEORY OF STRUCTURES I

[Maximum Marks: 75] [Time: 2.15 Hours]

PART-A

(Answer ***any three*** questions in one or two sentences. Each question carries 2 marks)

I

1. Define couple.
2. State the principle of moments.
3. Define thermal stress.
4. Write down the torsion equation.
5. Define moment of resistance of a section beam. (3 x 2 = 6)

PART-B

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

II

1. Find the reactions of a simply supported beam 5m long carrying a uniformly distributed load of 10kN/m on the entire span.
2. Find the young's Modulus of a brass rod and diameter 25mm and of length 250mm which is subjected to a tensile load of 50kN when the extension of the rod is equal to 0.3m.
3. A tensile load of 60kN is suddenly applied to a circular load of 4cm diameter and 5m long. If the value of $E=2x10^5$ N/mm^2. Determine (i) Maximum instantaneous stress induced (ii) Instantaneous elongation in the rod and (iii) strain energy absorbed in the rod.
4. A cantilever beam AB, 2m long carries a uniformly distributed load of 1.5kN/m over a length of 1.6m from the free end. Draw S.F. and B.M. diagram for the beam.
5. Derive the expression for longitudinal stresses developed in a thin cylindrical shell under fluid pressure.
6. Write the assumptions made in the theory of bending.
7. A simply supported beam has a span of 4m and rectangular cross section 100x200mm; find the udl it can carry, if the maximum shear stress is not to exceed 0.6N/mm^2. (4 x 6 = 24)

PART-C

(Answer ***any of the three units*** from the following. Each full question carries 15 marks)

UNIT – I

III (a) Calculate the support reactions of a simply supported beam 6m long carrying uniformly distributed load of 5kN/m over a length of 4m from right end and a point load of 10kN at a distance of 2m from left end. (7)

(b) Find the position of centre of gravity of L section of longer leg 10cm x 2cm and short leg 6cm x 2 cm. (8)

OR

IV (a) Calculate the support reactions of a simply supported beam 6m long carrying two point loads of 10kN and 40kN at a distance of 2m and 4m respectively from left end. (7)

(b) Find moment of Inertia of T section with flange 150mm x 50mm and web as 150mm x 50mm about XX and YY axes through centre of gravity of the section. (8)

UNIT – II

V (a) A load of 2MN is applied on a short concrete column 500mm x 500mm, the column is reinforced with four steel bars of 10mm diameter, one in each corner. Find the stresses in the concrete and steel bars. Take $E_S = 2.1 \times 10^5$ N/mm^2 and $E_C = 1.4 \times 10^4$ N/mm^2. (7)

(b) A steel rod of 3cm diameter and 5m long is connected to two grips and the rod is maintained a temperature of 95^0C. Determine the stress and pull exerted when the temperature falls to 30^0C, if (i) the ends do not yield (ii) the ends yield by 0.12cm Take E= 2×10^5MN/mm^2 and a=$12 \times 10^{-6}/^0$C. (8)

OR

VI (a) A steel bar 50mm x 50mm in cross section is 1.2m long. It is subjected to an axial pull of 200kN. What are the changes in length, width and volume of the bar, if the value of poisson's ratio is 0.3? Take E as 200 GPa. (7)

(b) Explain the term (i) Strain energy (ii) Resilience (iii) Modules of resilience (iv) Proof resilience. (8)

UNIT- III

VII (a) A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in figure 1. Draw the S.F and B.M diagram for the beam. Also calculate the maximum bending moment. (7)

(b) Determine the diameter of a solid shaft which will transmit 300kW at 250 r.p.m. The maximum shear stress should not exceed 30N/mm^2 and twist should not be more than 1^0 in a shaft length of 2m. Take modulus of rigidity = 1 x 10^5 N/mm^2. (8)

OR

VIII (a) Draw the S.F and B.M. diagrams for the overhanging beam carrying uniformly distributed load of 2kN/m over the entire length and a point load of 2kN as shown in figure 2. Locate the point of contraflexure. (7)

(b) Calculate (i) the changes in diameter (ii) change in length and (iii) change in volume of a thin cylindrical shell 100cm diameter, 1cm thick and 5m long when subjected to internal pressure of 3 N/mm^2 and poisson's ratio μ=0.3. (8)

UNIT - IV

IX (a) A rectangular beam 300mm deep is simply supported over a span of 4m. Deterimine the uniformly distributed load per m which the beam may carry, if the bending stress should not exceed 120N/mm^2. Take 1= 8x10^6 mm^4. (7)

(b) A beam of triangular cross section having base width of 100mm and height of 150mm is subjected to a shear force of 13.5kN. Find the value of maximum shear stress, and the sketch the shear stress distribution along the depth of the beam. (8)

OR

X (a) A beam is simply supported and carries a udl of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500mm. If the maximum stress in the material of the beam is 120 N/mm^2 and I = 7 x 10^8 mm^4. Find the span of the beam. 7

(b) An I section, with rectangular ends, has the following dimensions: Flanges 150 mm x 20 mm. Web 300 mm x 10 mm. Find the maximum shearing stress developed in the beam for a shear force of 50kN. 8

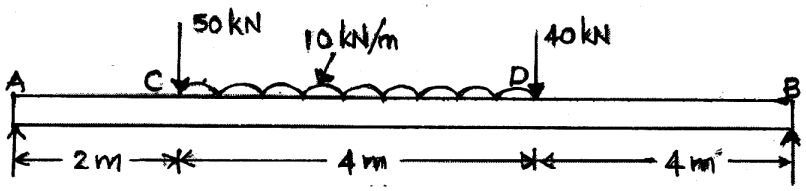

Figure 1

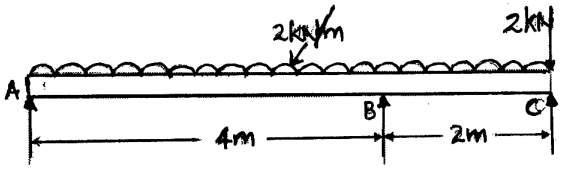

Figure 2

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