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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2019

THEORY OF STRUCTURES — I

[*Time* : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

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

1. Define Force.
2. State Hooke's Law.
3. Define Shear force.
4. Define Poisson's ratio.
5. Write the bending equation. (5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. State the parallel axis theorem and perpendicular axis theorem.
2. A beam 5 metres long supported at the ends. It carries point loads of 140KN, 60KN, 80KN at a distance of 0.5m, 2.5m and 3.5metres respectively from the left end. Find the reactions.
3. A wooden tie is 75mm wide, 150mm deep and 1.5m long. It is subjected to an axial pull of 45KN. The stretch of the member is found to be 0.6330mm. Find the Young's modulus for the material.
4. A rod is 2 metres long at 10°C. Find the expansion of the rod, when the temperature is raised to 80°C. If this expansion is prevented, find the stress in the material. Take E = 1×10^5 N/mm^2 and ∞ = 0.000012 per °C.
5. State the assumptions in Pure torsion.

Marks

6. A cylindrical air receiver for a compressor is 2m in internal diameter and made of plates 12mm thick. If the hoop stress is not to exceed 90N/mm^2 and longitudinal stress is not to exceed 60N/mm^2. Find the maximum safe air pressure.

7. Derive the formula for shear stress at the section of a loaded beam. (5×6 = 30)

PART — C

(Maximum marks : 60)

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

UNIT — I

III (a) A simply supported beam ABCD is of 5m span. Such that AB = 2m, BC = 1m and CD = 2m. It is loaded with 5KN/m over AB and 2KN/m over CD. Calculate the support reactions. 6

(b) Find the centre of gravity of 120mm × 170mm × 50mm of T-section. 9

OR

IV (a) A simply supported beam AB of span 4m is carrying a point load of 4KN at a distance of 1.5m from left end and also a uniformly distributed load of 2KN/m over 1m at a distance of 1.5m from left end. Calculate the support reactions. 6

(b) An I-Section with equal flanges has the dimensions: Flanges - 150mm × 10mm, Web - 280mm × 10mm, Overall depth of the section is 300mm. Determine Moment of Inertia of the I-section about two centroidal axes at right angles to each other. 9

UNIT — II

V (a) List any six mechanical properties of materials. 6

(b) A bar of 30mm diameter is subjected to a pull of 60KN. The measured extension on a gauge length of 200mm is 0.09mm and change in diameter is 0.039mm. Calculate (i) Young's modulus (ii) Modulus of rigidity (iii) Bulk modulus. 9

OR

VI (a) Define the terms (i) Resilience (ii) Proof resilience and (iii) Modulus of resilience. 6

(b) A prismatic metallic bar of rectangular section 500mm × 200mm and 2m long is to a load of 150KN applied gradually on it. If the stress at elastic limit of the bar material is 200N/mm^2 . Determine (i) strain energy at the given load (ii) Proof resilience (iii) Modulus of resilience. 9

UNIT — III

VII (a) A steel shaft 95mm in diameter is required to transmit 220KW at 225 r.p.m and the maximum twisting moment is 40% greater than the mean twisting moment. Find the maximum allowable shear stress in the shaft material. 6

(b) A beam AB 10metre long has supports at its ends A and B. It carries a point load of 5KN at 3 metres from A and a point load of 5KN at 7metres from A and also a uniformly distributed load 1KN/m between the point loads. Draw Shear force and Bending moment diagrams for the beam. 9

OR

Marks

VIII (a) A 900mm diameter pipe contains fluid of pressure 25N/mm^2 and stress in tension is 100N/mm^2. Find the minimum thickness of the pipe, also calculate the longitudinal stress. 6

(b) A beam ABC of 10metres length is simply supported at A and B and has over hanging portion BC such that AB = 8m and BC = 2m. The beam carries a uniformly distributed load of 2KN/m over a length of 4 metres from A, two point loads of 4KN, and 2KN at a distance of 6metres from A and at the free end C respectively. Draw Shear force and Bending moment diagrams for the beam. 9

UNIT — IV

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

(b) A beam of I - section 500mm deep and 190mm wide has flanges 25mm thick and web 15mm thick. It carries a shearing force of 400KN at a section. Calculate the maximum intensity of shear stress in the section assuming the moment of inertia to be 6.45×10^8mm^4. Also calculate the total shear force carried by the web and sketch the shear stress distribution across the section. 9

OR

X (a) A rectangular timber beam 5m long carry a uniformly distributed load of 7.5KN/m run over its entire length. If the permissible bending stress is 10N/mm^2. Determine the size of the beam, taking depth as twice the width. 6

(b) Define the terms (i) Neutral Axis (ii) Moment of Resistance (iii) Section modulus. 9
