TED (10) – 3021 Reg. No. .....

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THIRD SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/ TECHNOLOGY — MARCH, 2015

THEORY OF STRUCTURES – I

[Common for CE, AR, QS, EV and WR]

[*Time* : 3 hours

(Maximum marks : 100)

Marks

PART—A

(Maximum marks : 10)

I Answer the following questions in one or two sentences. Each question carries 2 marks.

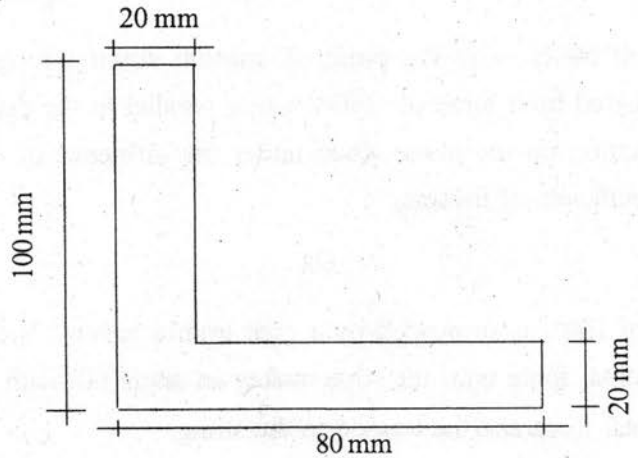
1. Distinguish between resultant and equilibrant.
2. What do you mean by factor of safety ?
3. Differentiate between lateral strain and longitudinal strain.
4. What do you mean by point of contra flexure ?
5. What do you mean by slenderness ratio ? (5×2=10)

PART—B

(Maximum marks : 30)

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

1. Four forces of magnitude 10N, 8N, 12N and 5N act at point O, all away from it. The forces make an angle of 36°, 125° and 227° with the 10N force which may be taken at the horizontal. Find the magnitude and direction of resultant of the system of forces with 10N force.
2. Find the moment of inertia about centroidal axis XX and YY of the section shown in figure.



Marks

3. The young's modulus of a material is 210GPa and its modulus of rigidity is 84GPa. Determine the Poisson's ratio and bulk modulus.

4. A steel bar 4000mm long and its both ends are firmly fixed to two walls. The original temperature of the bar is 40°C. If the bar is cooled to 25°C, determine the thermal strain and stress in the bar.

   Assume E_s = 200kN/mm^2 and coefficient of thermal expansion for steel is $a = 12 \times 10^{-6}$/°C. State the nature of stress.

5. Draw shear force and bending moment diagram for a simply supported beam carrying a UDL of w per unit run over the whole span. Also determine the magnitude of maximum bending moment and its position.

6. A solid circular shaft of 3m length and 200mm diameter is subjected to a torque of 100KNm. Find the relative rotation b/w the end cross section of the shaft. Given C = 1×10^5N/mm^2.

7. A rolled steel joist ISMB 250 is used as a coulmn of 4m length. Its one end is fixed and the other is hinged. Find the safe axial load on the column, allowing a factor of safety of 3. Take f_c = 320N/mm^2 and $a = {}^1/_{7500}$. Properties of column section are as follows : Area = 4755mm^2, $I_{xx} = 5.1316 \times 10^7$mm^4, $I_{yy} = 3.345 \times 10^6$mm^4. (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) The resultant of two forces acting at an angle of 150° is perpendicular to the smaller of these forces. The greatest force being equal to 300N, find the other force and the resultant. 7

(b) A weight of 600N is on the point of motion down a rough inclind plane, when supported by a force of 240N acting parallel to the plane and is on the point of motion up the plane when under the influence of a force of 360N. Find the coefficient of friction. 8

OR

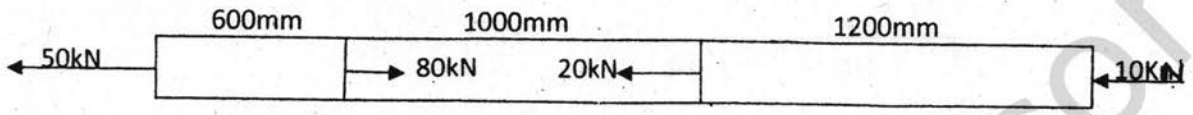
IV (a) A weight of 100N is suspended by a rope from a ceiling. The weight is pulled by a horizontal force until the rope makes an angle 60° with the ceiling. Find the horizontal force and the tension in the string. 7

Marks

(b) A uniform ladder rests with one end on the horizontal ground and the other against a vertical wall, the coefficient of friction being $^3/_5$ and $^1/_3$ respectively. Find the inclination of the ladder to the vertical when it is about to slip down. 8

UNIT—II

V (a) A bar having cross sectional area 1000mm^2 is subjected to axial forces as shown in figure. Find the change in length of the bar. Take E = 0.8 ×10^{5}N/mm^2.



(b) What do you understand by the term strain energy ? Derive an equation for strain energy stored in a material, when the load is applied gradually. 8

OR

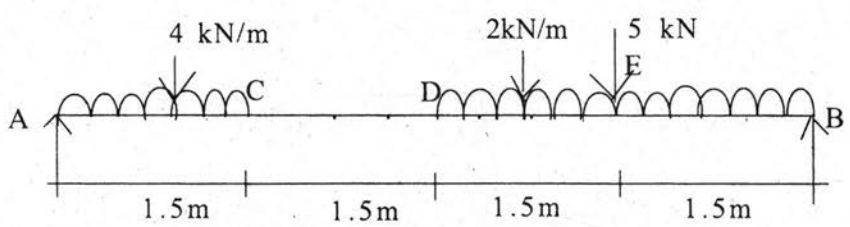
VI (a) An RCC column of cross sectional dimensions 300mm × 300mm is subjected to an axial load of 360kN. The colum is provided with 8 bars of 200mm diameter. Find the stress in the steel and concrete. Take E_s = 2.1×10^{5}N/mm^2, E_c = 0.14×10^{5}N/mm^2. 7

(b) A steel bar 50mm wide, 12mm thick and 300mm long is subjected to an axil pull of 84kN. Find the changes in the length, width, thickness and volume of the bar. Take E = 2 × 10^{6}N/mm^2 and poissons ratio = 0.32. 8

UNIT—III

VII (a) A hollo shaft of 20mm outside diameter and 16mm inside diameter is subjected to a torque of 40Nm. Find the shear stress at the outside and inside of the shaft. 7

(b) A simply supported beam AB, 6m long is loaded as shown in figure. Draw shear force and bending moment diagram for the loaded beam. Also find the maximum value of bending moment and its position.



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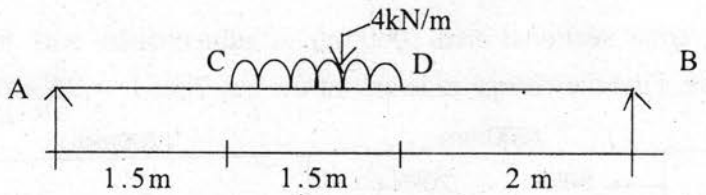
OR

Marks

VIII. (a) Find the power that can be transmitted by a shaft 60mm diameter at 180 rpm, if the permissible shear stress is 85N/mm^2. 7

(b) Draw the shear force and bending moment diagram for a beam shown in figure. Also find the position and magnitude of the maximum bending moment.



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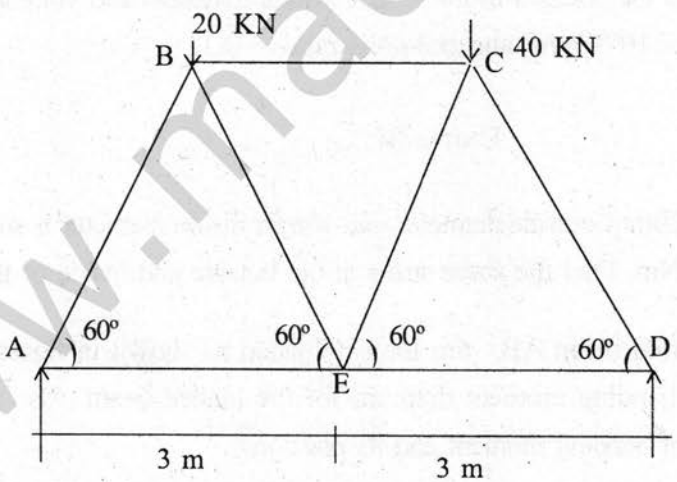
UNIT—IV

IX (a) A cylindrical air receiver for a compressor is 2m in internal diameter and made of plates of 12mm thick. If the Hoop stress is not to exceed 90N/mm^2 and the axial stress is not to exceed 60N/mm^2, find the maximum safe air pressure. 7

(b) A strut 2.50m long is 60mm in diameter. One end of the strut is fixed while its other is hinged. Find the safe compressive load for the members using Euler's formula, allowing a factor of safety 3.5. Take E = 2.1 × 10^{5}N/mm^2. 8

OR

X Find the magnitude and nature of forces in all the members of the truss shown in figures by method joints.



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