(Please write your Exam Roll No.) Exam Roll No.

END TERM EXAMINATION

THIRD SEMESTER [B.TECH.]- DECEMBER 2009

Paper Code: ETCE-201	**Subject: Structural Analysis**
Paper ID: 34201	

Time : 3 Hours **Maximum Marks :75**

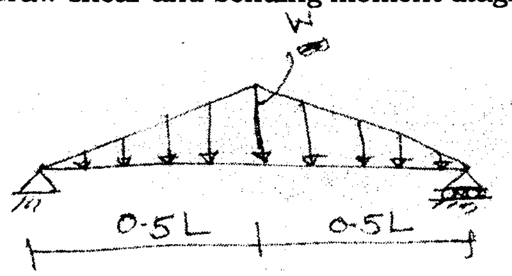
Note: Q.No.1 is compulsory. Attempt one question from each unit.

Q.1 (a) Brief about simple strain. **(1.5)**

(b) A concrete cylinder of 150 mm diameter and 300 mm height is loaded with 80 KN load. If the cylinder contracts by 0.5 mm determine the average strain over a normal cross-section and the compressive strain. **(2.5)**

(c) Brief the construction of Mohr's circle when principal stresses are given. **(3)**

(d) A simply supposed beam AB is loaded with a triangular load as shown in fig 1(d). Draw shear and bending moment diagrams. **(3)**



(e) What are the assumptions and limitations in the flexture formula? **(3)**

(f) Briefly comment on the moment area method and conjugate beam method. **(3)**

(g) State Betti's theorem, Castigliano's first and second theorem. **(3)**

(h) Brief are assumptions mode for deriving the torsion formula. **(3)**

(i) With suitable example show just rigid and over rigid trusses. **(3)**

UNIT-I

Q.2 (a) A flat steel plate is a trapezoidal form of uniform thickness of 10 mm and tapers uniformly from a width of 50 mm to 100mm in a length of 400 mm. Determine the elongation of the plate under an axial force of 50 KN at each end. Take $E = 2.05 \times 10^5\ N/mm^2$. **(6)**

(b) A composite bar made up of aluminum and steel is held between two supports as shown in fig 2(b). The bars are stress free at a temperature of 40°C. What will be the stresses in the two bars when the temperature drops to 20°C if the supports are unyielding? **(6.5)**

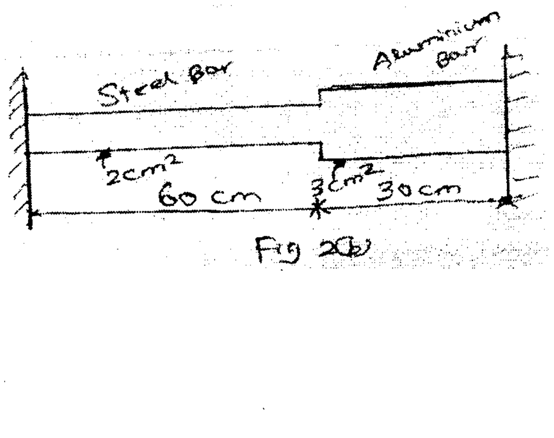
Take $E_a = 0.7 \times 10^5 N/mm^2$

$E_s = 2.1 \times 10^5 N/mm^2$

$\alpha_a = 23.4 \times 10^{-6}/°C$

$\alpha_a = 11.7 \times 10^{-6}/°C$

The cross sectional area of steel bar is 2 cm^2 and that of aluminum bar is $3cm^2$.



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OR

Q.2 (a) Draw the Mohr stress circle for direct stresses of 60N/mm² (tensile) and 40 N/mm²(comp) and estimate the magnitude and direction of the resultant stresses on planes making angles of 25° and 70° with the plane of the first principal stress. Find also the normal and tangential stresses on these planes. **(5)**

(b) At a certain cross-section of a shaft 100 mm in diameter there is a bending moment of 5 KN-m and a twisting moment of 7.5 KN-m. Calculate the maximum direct stress induced in the section and specify the position of the plane on which its acts. If Poisson's ratio is 0.3, Find the stress which, acting alone, will produce the same maximum (i) strain ((ii) strain energy. **(7.5)**

UNIT-II

Q.3 (a) A simply supported beam of span 'L' is loaded with a triangular load with intensity zero at one end to w/unit length at the other end. Plot the bending moment and shear force diagram indicating principal values. **(7)**

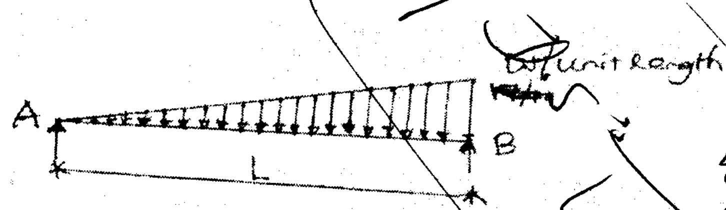

Fig 3(a)

(b) Derive the relationship between bending moment and shear force. **(5.5)**

OR

Q.3 (a) What are the assumptions made in the theory of simple bending. **(4)**

(b) (i) A T-beam has a cross-section as shown in fig 3 b(i). It has span of 5 m. If the maximum permissible stress is 150 MPa, find the maximum uniformly distributed load it can safely carry.

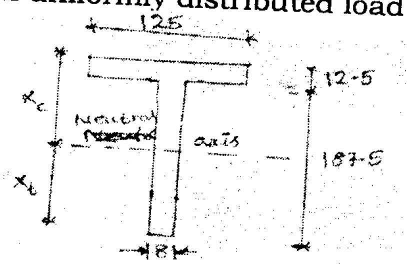

Fig 3(b)(i)T-section mm

(ii) If this section is used as a cantilever beam of 2m span as shown in fig. 3 b(ii), find the point load which can be safely placed at its tip. **(8.5)**

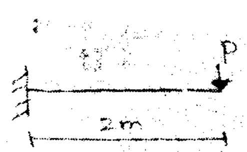

Fig 3 b(i)

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UNIT-III

Q.4 Determine the slopes at A and D and the deflections at C and D by conjugate beam method for the overhanging beam as shown in fig 4(a). $E = 2 \times 10^5$ N/mm², $I = 2 \times 10^7$ mm⁴ **(12.5)**

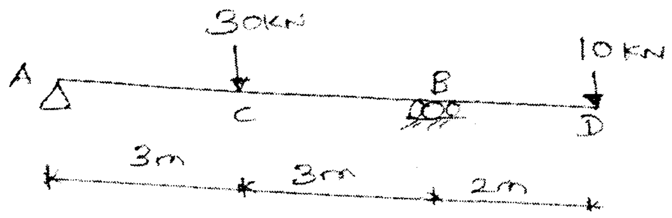

Fig 4

OR

Q.4 State and prove castigliano's first and second theorems. **(12.5)**

Unit — IV

Q.5 (a) A solid circular shaft 200 mm in diameter is to be replaced by a hollow shaft the ratio of external diameter to internal diameter being 5:3. Determine the size of the hollow shaft if maximum shear stress is to be same as that of a solid shaft. Also find the percentage economy in mass. **(7.5)**

(b) A straight rectangular steal bar, 40 mm wide by 20 mm deep and 500mm long, is subjected to a pure torque of 250 Nm. Calculate the maximum shear stress set up and the angle of twist, taking $G = 0.8 \times 10^5$ N/mm². **(5)**

OR

Q.5 (a) Briefly discuss the methods available for analyzing a truss. **(4)**

(b) Analyse the truss shown in fig 5(b). **(8.5)**

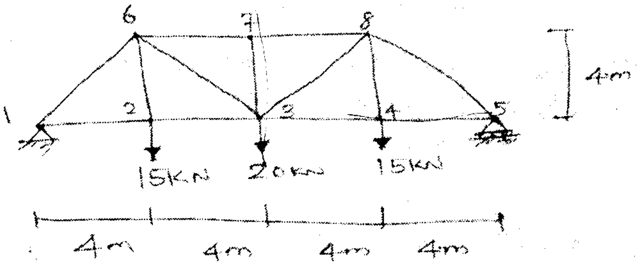

Fig 5(b)

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