SoE - Sem III - OLD - Civil - SOM

Date 26/05/2015

(4)

QP Code : 4521

(OLD COURSE)

3 Hours

[Total Marks 100]

N.B.

(1) Q.No.1 is compulsory.
(2) Attempt any four questions out of the remaining questions.
(3) Assume suitable data if required and justify the same.
(4) Figures to the right indicate full marks.

Q.1 (A) Derive the torsion formula with usual notations for a circular shaft subjected to equal and opposite torque T. 06

(B) State the advantages of welded joints over the riveted joints. 04

(C) Prove that the maximum shear stress occurs at h/2 level for a triangular section of a beam subjected to transverse shear force. 06

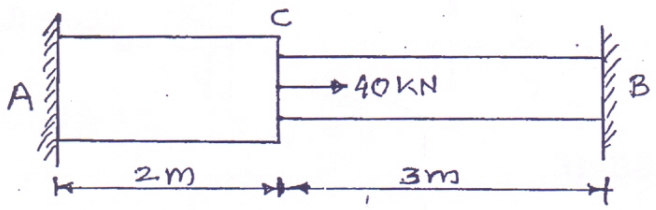
(D) Derive with usual notations $e_v = e_2 + 2 e_1$ for a thin cylindrical shell. 04

Q.2. (A) Find the area of the core for the T section symmetrical about y axis whose dimensions are as follows: Flange – 400mm x 100mm and web – 300mm x 100mm. overall depth being 400mm. 10

(B) Draw the shear stress distribution diagram for the symmetrical I section which is subjected to shear force S. The I section has flanges 200 mm wide and 25mm thick while the web is 20 mm thick, the overall depth of the section being 500mm. Find the percentage of shear force resisted by the web alone. 10

Q.3. (A) The modulus of rigidity of a material is 38 kN/mm^2. A 10mm diameter rod is subjected to an axial tensile force of 5kN and change in diameter is observed to be 0.002mm. Calculate the Poisson's ratio and modulus of elasticity. 10

(B) A bar ACB (AC =2m and CB=3m), 5m long is held firmly at A and B as shown in fig. Bar segment AC has cross-section 4cm x 4cm and segment CB has cross-section 2cm x 2cm. Modulus of elasticity for the entire bar is 2 x 10 ^{11}N/m^2. Calculate reactions at A and B when an axial force 40kN is applied at C. 10



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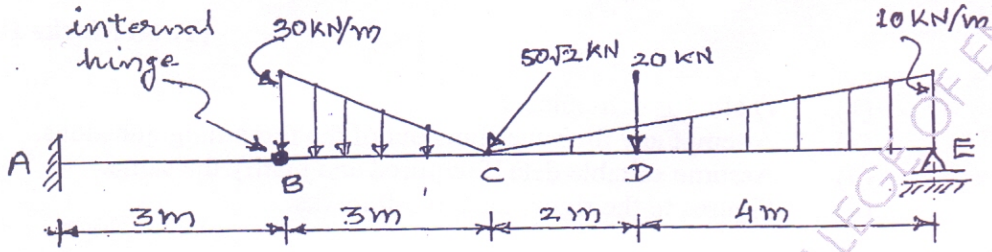
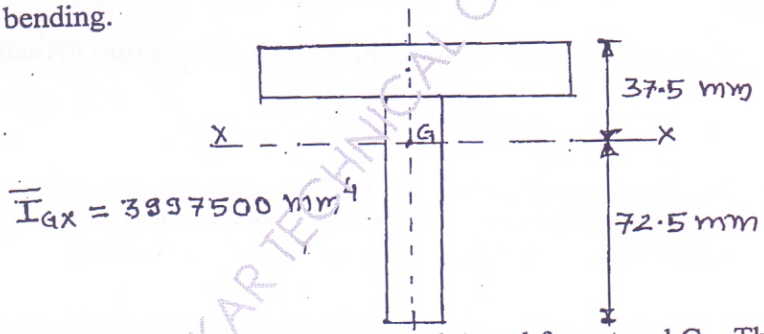
Q.4 (A) Draw Shear force, Bending Moment and Axial Force diagram for the given beam, including all values at the relevant points. 14



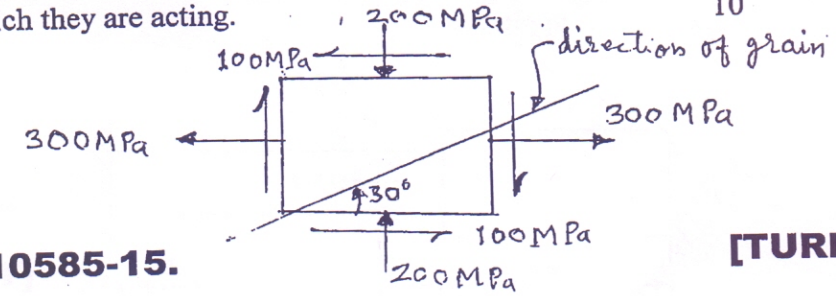
(B) Derive the relation among bending moment, shear force and the rate of loading. 06

Q.5. (A) A 6 m long cantilever is subjected to a uniformly distributed load of 4kN/m throughout its length and an upward point load of 10kN at its free end. The properties of the section of the cantilever are as shown in figure. Determine the maximum tensile and maximum compressive stress induced due to bending. 10



(B) A solid circular shaft ABC is fixed at end A and free at end C. The lengths AB = L and BC = L/3. The diameter for AB and BC are 90mm and 50mm respectively. The shaft is subjected to 2.1KN-m torque at B and 0.7KN-m torque at free end C both clockwise. Determine the lengths of shafts AB and BC, if total angle of twist between A and C is 3^0. Also determine the stresses induced in the shafts AB and BC.
Take G = 84 GPa. 10

Q.6. (A) At a particular point in a wooden member, the state of stress is as shown in figure. The direction of the grain in the wood makes an angle of 30^0 with respect to +ve x-axis in anticlockwise direction. The allowable shear stress parallel to the grain is 150MPa for this wood. Is the state of stress permissible? Justify your answer with calculations. Also find the principle stresses and the planes on which they are acting. 10



(B) A spherical vessel with a diameter of 6m contains a corrosive gas at a pressure of 1.4 MN/m^2. The vessel can withstand a maximum tensile stress of 85 MN/m^2. Due to corrosion the metal wall is eaten at the rate of 0.3 mm per year. If the thickness of metal used is 28 mm initially determine the life of the spherical vessel. 06

(C) Because of corrosion the thickness of thin cylindrical shell is reduced by 2.5mm. This increases the hoop stress by 10% under the same internal pressure. Find the thickness of the shell. 04

Q.7. (A) Two plates each of thickness 10mm and 12mm are connected by a double riveted lap joint. Find the efficiency of the joint if 20mm rivets are used in two rows with a pitch of 60mm c/c. Take the stresses in tension, bearing and shear as 600MPa, 800MPa and 400MPa respectively and a factor of safety of 5. 10

(B) A timber beam 250mm wide and 400mm deep is strengthened by steel plate 250mm wide and 10mm thick connected to its lower face so that the overall section is 250mm x 410mm. Find the stresses in steel and timber when the beam section is subjected to a sagging moment of 75 KN-m. Assume E for steel 20 times that of timber. 10

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