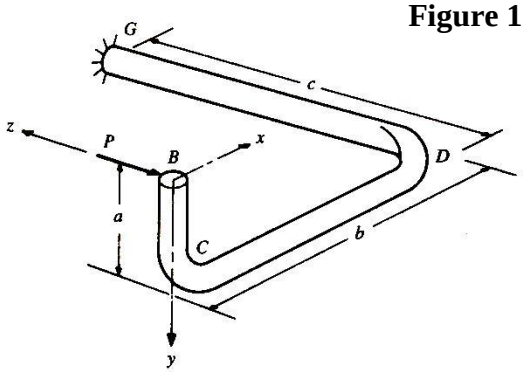
BITS Pilani K.K. Birla Goa Campus
First Semester 2019-2020
Comprehensive Exam (Open Book)

Course No.	: ME F312	Duration	: 3 hours
Course Title	: ADVANCED MECHANICS OF SOLIDS	Weightage	: 80 marks
Date of Exam	: 04/12/2019 (AN)		

Note: All questions carry equal marks. Start each question from a fresh sheet.

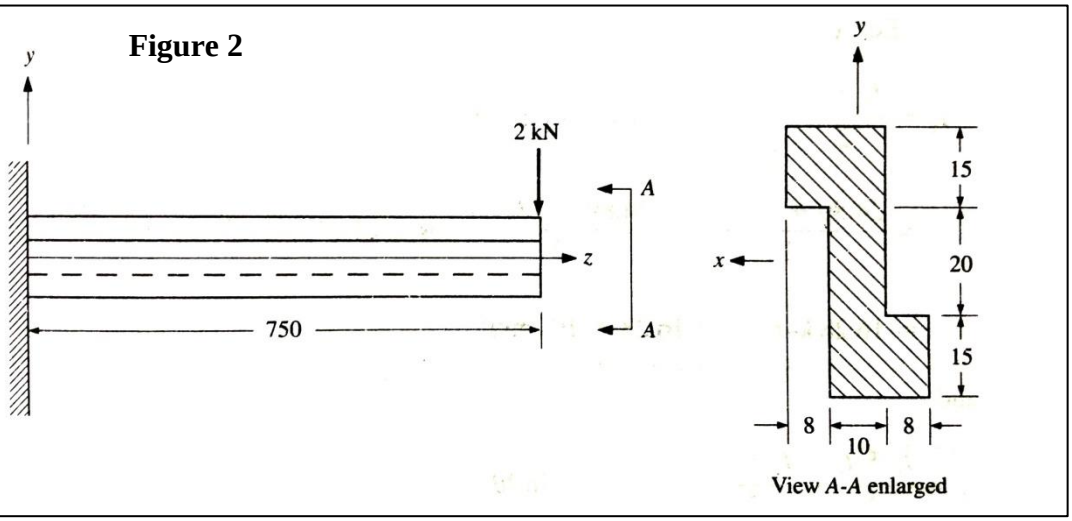
(Q1) For a wire form shown in Figure 1, draw the free body diagram and determine the deflection of point B in the direction of the applied force *P*. The diameter of the wire is *d*, the modulus of elasticity is *E* and poisons ratio is *v*. Neglect direct shear effects.

Figure 1



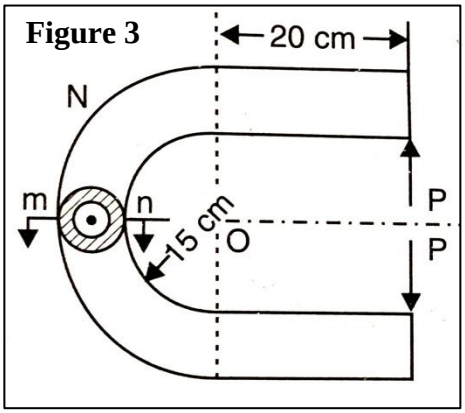
(Q2) For a cantilever beam shown in Figure 2, determine the bending stresses at (13, 25) and (-13,-25) mm. Solve the problem with reference to principal axes. Also locate the neutral axis.

Figure 2



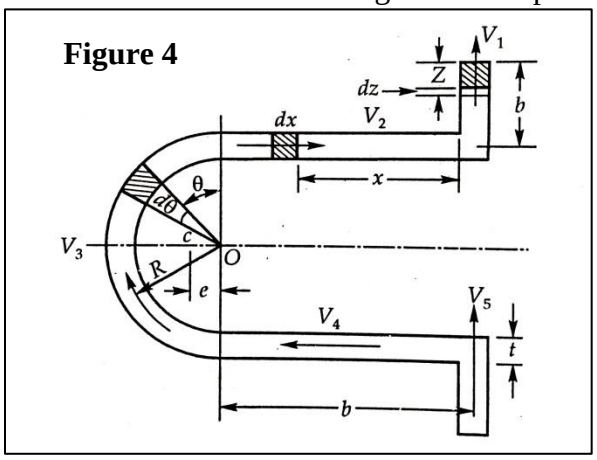
(Q3) A curved member as shown in Figure 3 is made of a tube having outside diameter of 10 cm and inside diameter of 8 cm. The curved portion is a semicircle having its center at a distance of 15 cm from the innermost fiber of the curved portion. It is subjected to load '*P*' at the end of the straight portion of the member as shown in the Figure. If allowable stresses in tension and compression are 150 MPa and 200 MPa respectively, find maximum allowable value of *P* and the neutral axis of the section.

Figure 3



(Q4) For the thin section shown in Figure 4, derive the position of shear center from the center O. Represent shear center in terms of geometrical parameters and moment of Inertia (*I*).

Figure 4



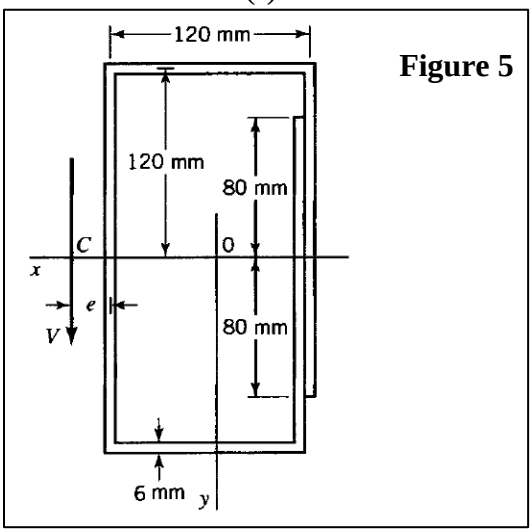


Figure 5

(Q5) A 6-mm thick plate of steel is formed into the cross section shown in Figure 5. Locate the shear center for the cross section.

(Q6) A curved beam is build up by welding together rectangular and elliptical cross section curved beams (cross section is shown in Figure 6). The center of curvature is located 20 mm from *B*. The curved beam is subjected to a positive bending moment M_x. Determine the stresses at point B and C in terms of M_x. Also determine the radial stress in terms of M_x if the thickness of the web at the weld is 10 mm.

Figure 6

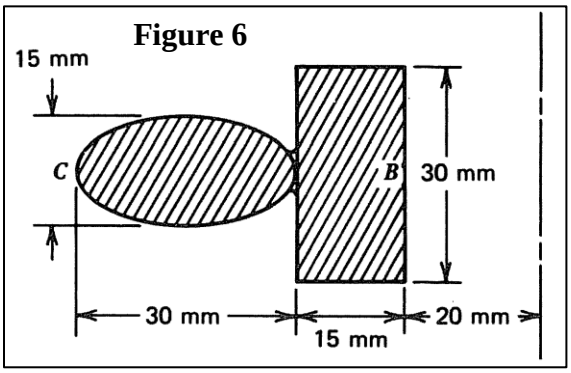
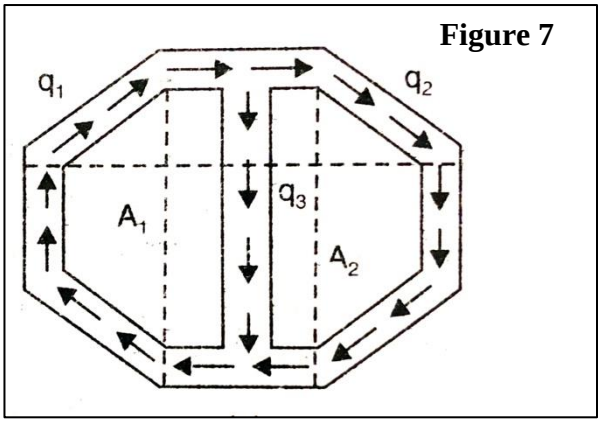


Figure 7



(Q7) Derive the relation for the shear stress distribution on the x-axis of the equilateral triangle cross section of torsional member. Also, derive the expression for torque and angle of twist per unit length.

(Q8) A shaft having a cross section of thin regular octagon stiffened by a vertical member (Figure 7) is subjected to angle of twist per unit length of 0.024°/m. By considering mean length of a side of the octagon is 100 mm and uniform thickness of 20 mm, determine the torque resisting capacity of the shaft and the shear stresses in different branches. Take G = 80 GPa.

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