Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 level 1st Semester Examination – July/ August 2016
SCT 364-2 Strength of Materials

Uva Wellassa University

Instructions to candidates
Duration: 02 hours
Number of questions: 06
Mark allocation: 100
Number of questions to be answered : 04 (four)

1.

a. A point load of 16 kN is applied at point D in the structure shown in Figure 1(a). The structure is made of steel with ultimate tensile strength of 450 MPa. The structure is designed using a factor of safety of 3. Find,

i. The tension in the link BC (6 marks)

ii. The width of the member BC, w, if it's cross section is rectangle and thickness is 6 mm. (7 marks)

b. Two horizontal 20 kN forces are applied to pin B of the assembly shown in Figure 1(b). Pins of diameter-1.5 cm are used at each connection. Determine the maximum value of the average normal stress,

i. in link AB (6 marks)

ii. in link BC (6 marks)

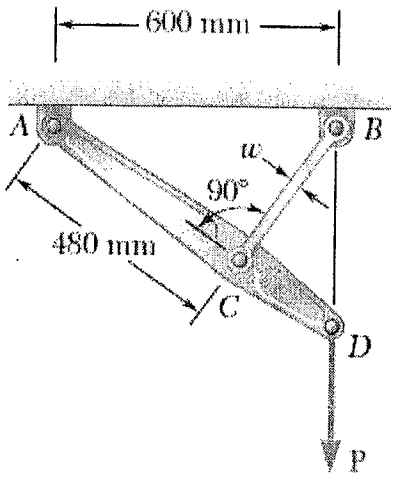

Figure 1(a)

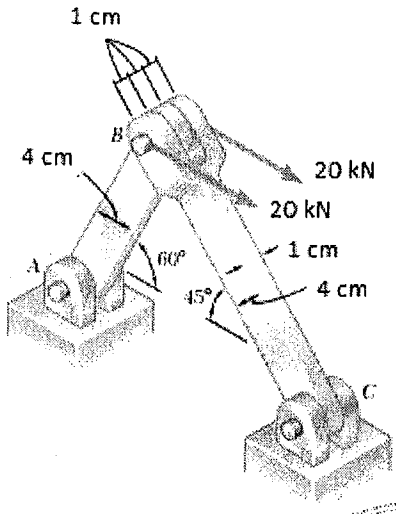

Figure 1(b)

02

2.

a. Consider the aluminum shaft shown in Figure 2 (a). Determine

i. The torque T that causes an angle of twist of 48 (7 marks)

ii. the angle of twist caused by the same torque T in a solid cylindrical shaft of the same length and cross-sectional area. (8 marks)

Take the modulus of rigidity of aluminum as G = 27 GPa.

b. A torque of magnitude T = 100 Nm is applied to shaft AB of the gear train shown in Figure 2(b). The diameters of the three solid shafts are, AB = 21 mm, CD= 30 mm, and EF = 40 mm respectively. Determine the maximum shearing stress in shaft EF. (10 marks)

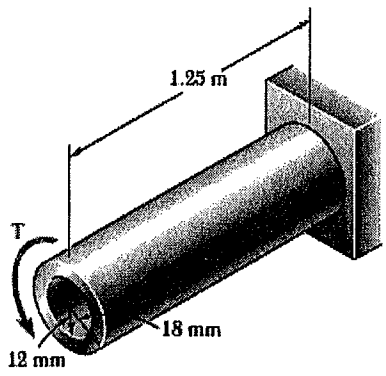

Figure 2(a)

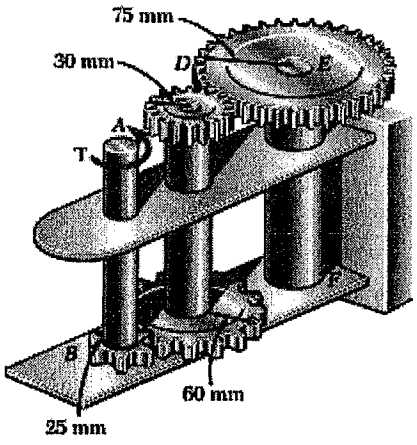

Figure 2(b)

3.

a.Cross-section of a beam is shown in Figure 3(a). Find,

i. Location of the neutral axis for bending in longitudinal direction. (7 marks)

ii. Second moment of area about the neutral axis. (8 marks)

b. A horizontal force P = 8 kN is applied at point D in the structural member shown in Figure 3(b). Determine the stresses at points A and B. (10 marks)

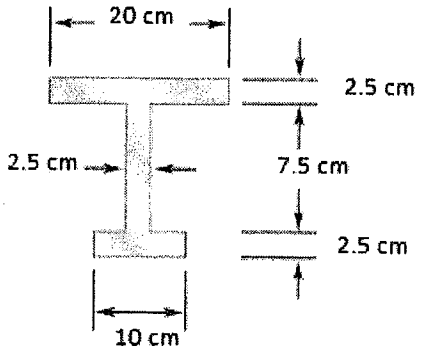

Figure 3(a)

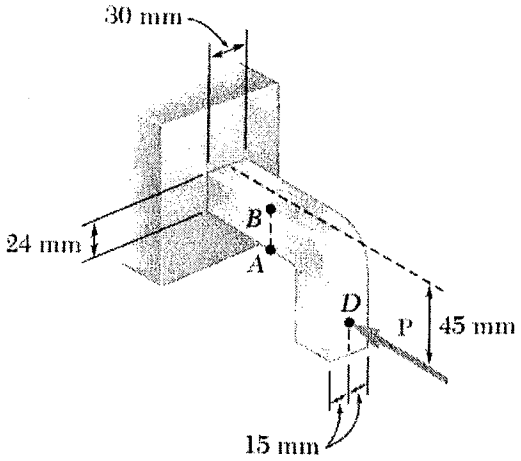

Figure 3(b)

4. Draw the shear and bending-moment diagrams for the rectangular beam and loading shown in Figure 4(a). Hence, determine the maximum normal stress due to bending on a transverse section at C. (25 marks)

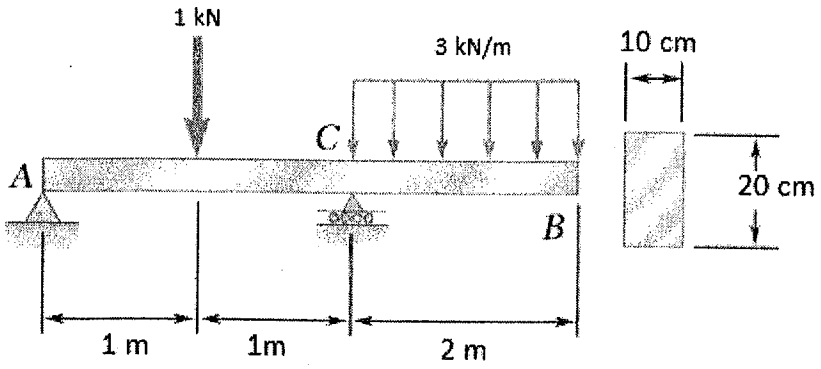

Figure 4(a)

5. Construct the Mohr's circle for the given state of stress shown in Figure 5. Hence determine,

   i. The principal stresses (7 marks)
   ii. The principal planes (6 marks)
   iii. Maximum shear stress (6 marks)
   iv. Plane at which the maximum shear occurs (6 marks)

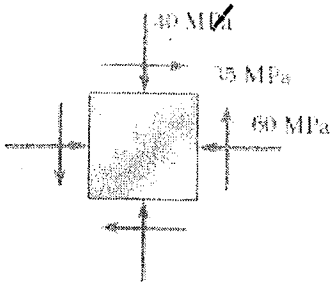

Figure 5

6. A vertical force P of magnitude 300 N is applied to the crank at point as shown in Figure 6. The diameter of the shaft BDE is 18 mm. Determine the principal stresses and the maximum shearing stress at point H located at the top of the shaft, 50 mm to the right of support D.

(25 marks)

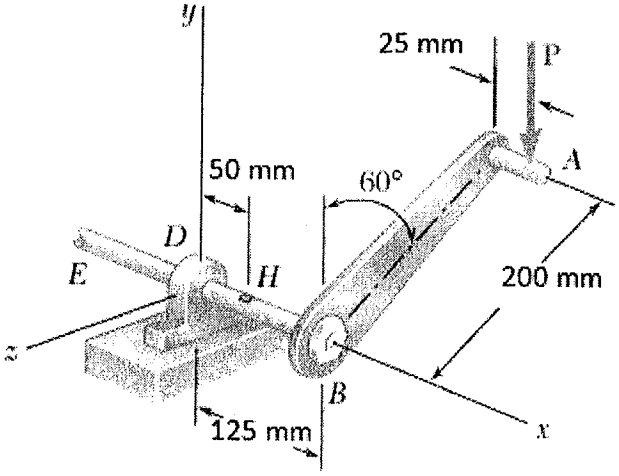

Figure 6