Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 Level 2nd Semester Examination – Jan./Feb.-2016
SCT 364-2 Strength of Materials

Uva Wellassa University

Instructions to candidates
Duration: 02 hours
Number of questions: 06
Number of questions to be answered: 04
Mark allocation: 100
All symbols carry their usual meaning.

1.

a. Two solid cylindrical rods *AB* and *BC* are welded together at *B* and loaded as shown in Figure 1(a). If d_1 = 50 mm and d_2 = 30 mm, find the average normal stress at the midsection of
   i. rod *AB*, (30%)
   ii. rod *BC*. (20%)

b. Link *BD* is made of brass (E =105 GPa) and has a cross-sectional area of 240 mm^2. Link *CE* is made of aluminum (E = 72 GPa) and has a cross-sectional area of 300 mm^2. Links *BD* and *CE* support the rigid member *ABC* as shown in Figure 1(b). Determine the maximum force **P** that can be applied vertically at point *A* if the deflection of *A* is not to exceed 0.35 mm. (50%)

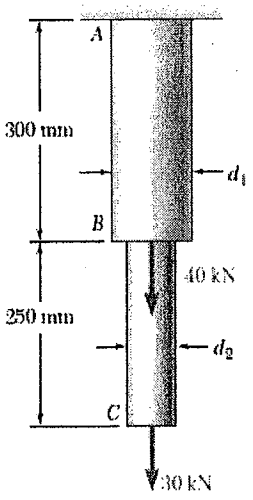

Figure 1(a)

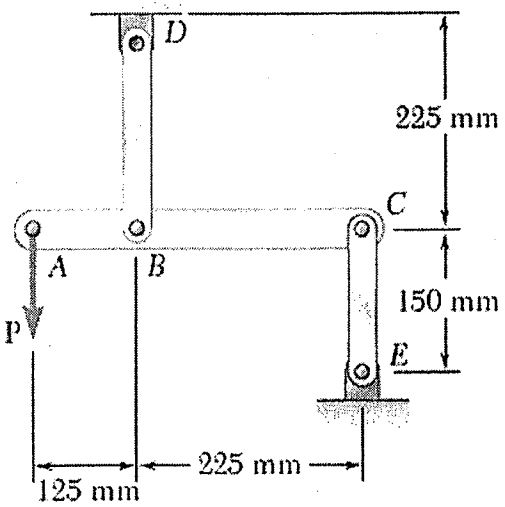

Figure 1(b)

2.

a. The torques shown in Figure 2 (a) are exerted on pulleys *A* and *B*. If both shafts are solid, determine the maximum shearing stress in
   i. shaft *AB*, (30%)
   ii. shaft *BC*. (20%)

28

b. Two solid steel shafts are connected by gears as shown in Figure 2(b). If $G = 80$ GPa for each shaft and that the allowable shearing stress is 55 MPa, determine

i. the largest torque T_0 that may be applied to the end of shaft AB, (35%)
ii. the corresponding angle through which end A of shaft AB rotates. (15%)

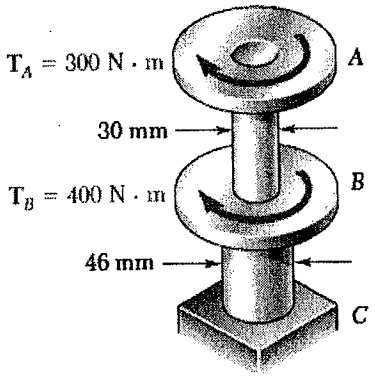

Figure 2 (a)

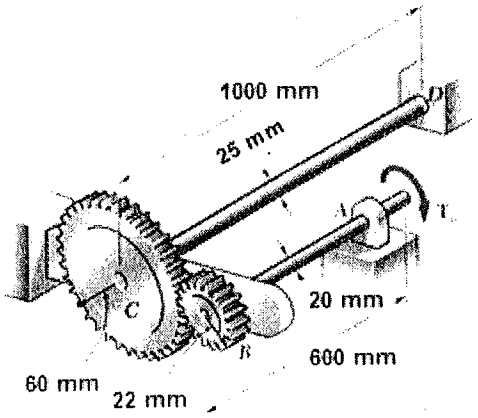

Figure 2(b)

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, (25%)
ii. second moment of area about the neutral axis. (25%)

b. A W 200 x 31.3 rolled-steel beam is subjected to a couple **M** of moment 45 kNm. If the Young's modulus, $E = 200$ GPa and the Poisson's ratio, $\nu = 0.29$, determine

i. the radius of curvature ρ, (25%)
ii. the radius of curvature ρ' of a transverse cross section. (25%)

Note: An extract of the tables of properties of wide-flange sections is provided

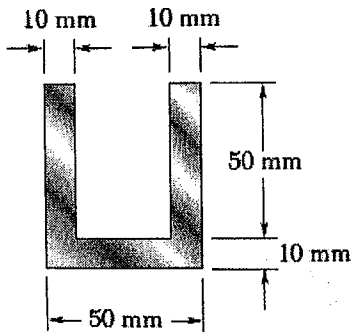

Figure 3(a)

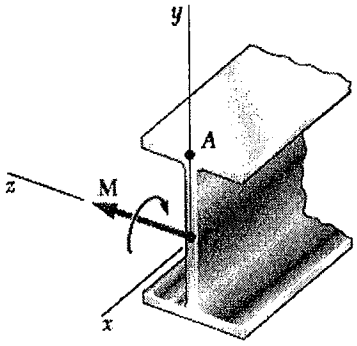

Figure 3(b)

4. Draw the shear and bending-moment diagrams for the rectangular beam and loading shown in Figure 4(a). (60%)
The cross section of the beam is shown in Figure 4(b). Determine the maximum absolute value
   a. of the shear, (15%)
   b. of the bending moment, (15%)
   c. of the normal stress. (10%)

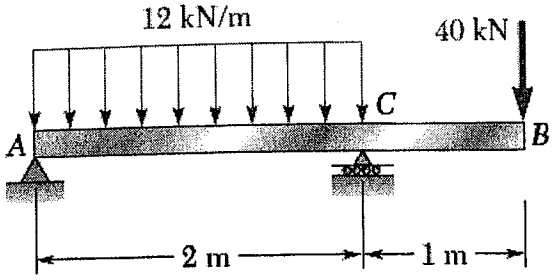

Figure 4(a)

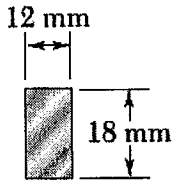

Figure 4(b)

5.
   a. For the state of plane stress shown in Figure 5(a), determine the largest value of σ_y for which the maximum in-plane shearing stress is equal to or less than 75 MPa. (50%)
   b. For the state of stress shown in Figure 5(b), determine the normal and shearing stresses after the element shown has been rotated through
      i. 25^0 clockwise, (30%)
      ii. 10^0 counterclockwise. (20%)

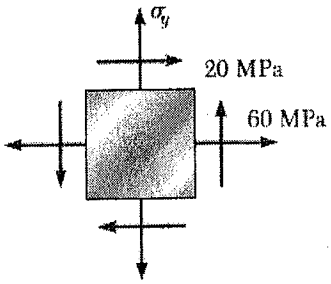

Figure 5(a)

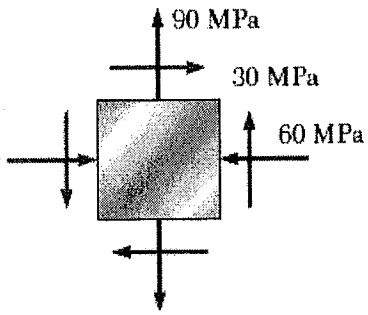

Figure 5(b)

6. Consider the beam and loading shown in Figure 6. If a= 5.2 m, w = 50 kN/m, and E = 200 GPa, determine,
   a. the slope at support A, (50%)
   b. the deflection at the mid-point C. (50%)

Note: An extract of the tables of properties of wide-flange sections is provided

28

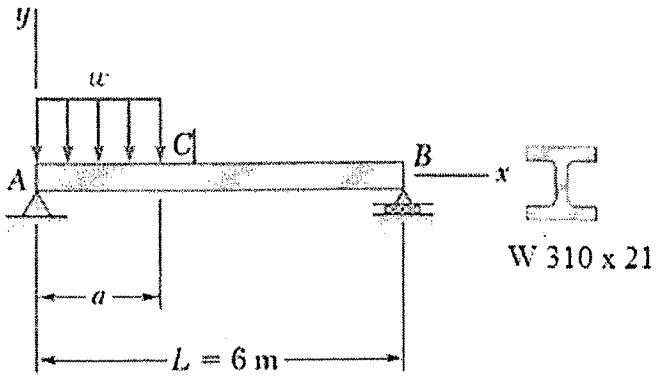

Figure 6