

Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 level 1st Semester Examination – June / July 2017
SCT 365-1 Engineering Design



Instructions to candidates:

Duration: Two (02) hours

Number of questions: Four (04)

Answer all questions

Mark allocation: 100

1)

- a. What is bearing stress? Explain how it leads to failures in structures. (6 Marks)
- b. In figure 1, it shows that 20mm diameter revert joining two plates that are 100mm wide. Applied load $P=200\text{kN}$. The allowable stress for bearing in plate material is 120MPa and allowable shear stress for revert material is 600MPa. Find the followings. (10 Marks)
- The minimum thickness of each plate. (9 Marks)
 - Largest average tensile stress in the plates. (9 Marks)

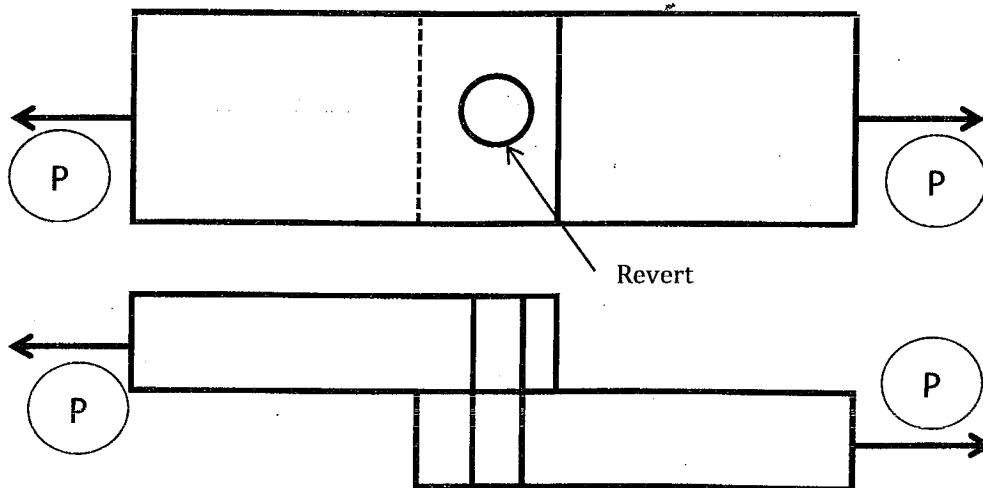


Figure 1



2)

(3 Marks)

a. What is buckling?

(3 Marks)

b. Explain the transitional zone in buckling.

c. Given an Aluminum ($E=80\text{GPa}$) column built in the ground has length, $L=3.2\text{m}$ and is under axial compressive load, P as shown in figure 2. The dimension of cross section area, $b=200\text{mm}$ and $d=250\text{mm}$.

(5 Marks)

i. The critical load to buckle the column.

ii. If the allowable compressive stress of Aluminum is 240MPa , is the column like to buckle or yield?
(9Marks)

iii. If the factor of safety is 1.65, what is the allowable buckling load?

(4 Marks)

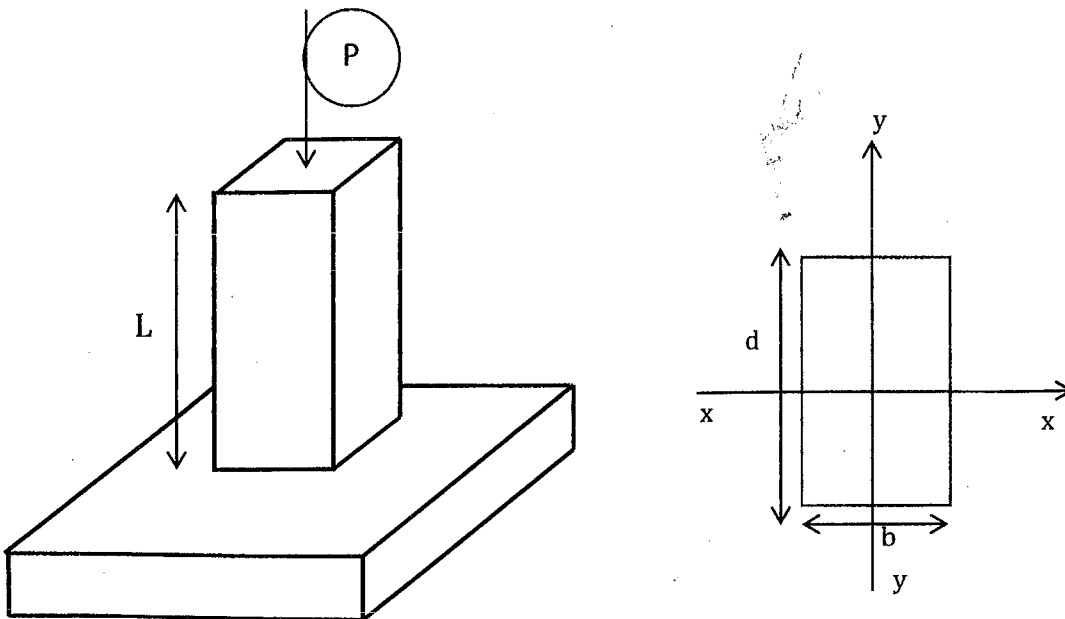


Figure 2

Note: The moment of inertia for a rectangular cross section is $I_{xx} = \frac{bh^3}{12}$ and $I_{yy} = \frac{hb^3}{12}$ where b is width and h is height respectively.

3)

(3 Marks)

a. What is factor of safety?

(3 Marks)

b. What is shear stress?

c. A short post connected from a hollow circular tube of Aluminum supports a compressive load of 250kN as shown in figure 3. The inner and outside diameters of the tube are $d_1=9\text{cm}$ and $d_2=13\text{cm}$ respectively and its length is 100cm. The shortening of the post due to the load is measured as 0.5mm. Find the followings of the post by clearly including the assumptions you made.

i. Compressive stress

ii. Strain

(19 Marks)

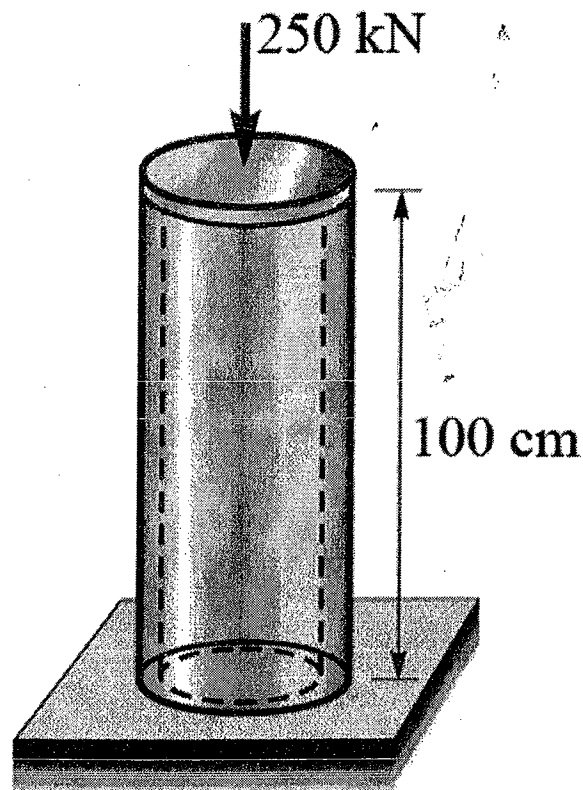
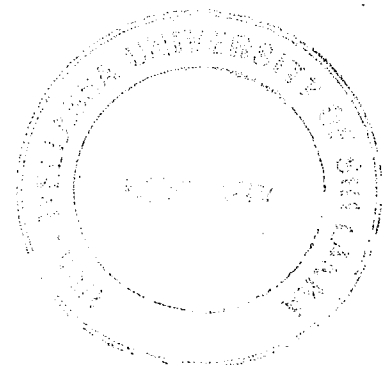


Figure 3



4)

- a. A punch for making holes in steel plates is shown in figure 4. Assume that the punch has a diameter of 19mm is used to punch a hole in a 6mm plate as shown in the cross sectional view. If a force $P=125\text{kN}$ is required what is the average shear stress in the plate and average compressive stress in the plate.

(10 Marks)

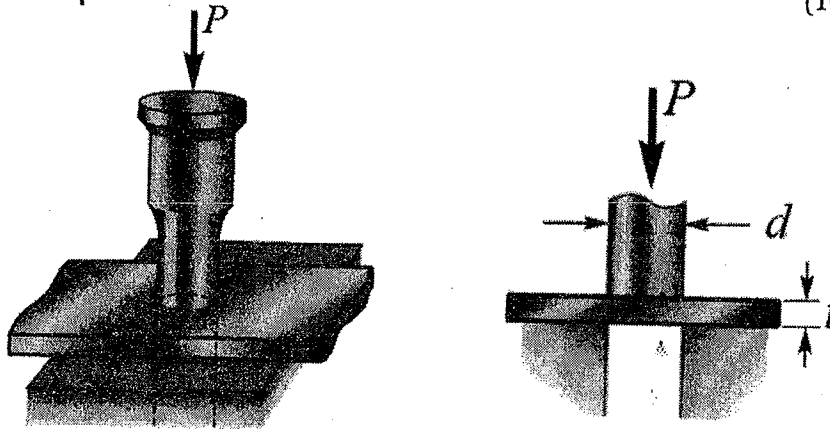


Figure 4

- b. The bell crank mechanism shown in figure is in equilibrium. Determine,

- i. The normal stress in connecting rod CD (3 Marks)
- ii. The shearing stress in the 8mm diameter pin at B (3 Marks)
- iii. The bearing stress in bracket supports at B (4Marks)
- iv. The bearing stress at crank B point (5Marks)

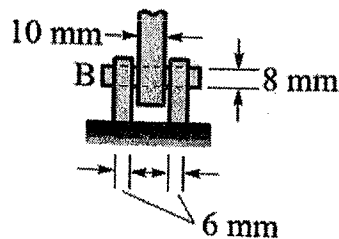
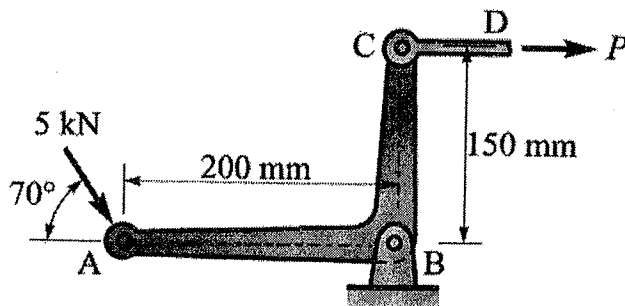


Figure 4