MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2014/2015

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING

BCE CD 204: THEORY OF STRUCTURES I

Date: 7/4/2015 **Time: 8:30 -10:30 am**

Instructions:

- *This paper comprises five questions*
- *Question **one** is **compulsory** and carries 30 marks*
- *All other questions carry 20 marks each*
- *Answer question **one** and any other **two** questions*

1.

a) A 400 X 250mm column supports a vertical load P of 150kN at an eccentricity of 40mm to the X-X axis as shown in figure 1.
   i) Calculate the maximum and minimum stresses developed in the section
   ii) Determine the maximum eccentricity of the load from the X-X axis if no tensile stresses are allowed to develop anywhere in the section.

(10 marks)

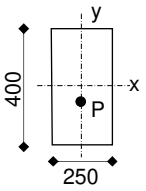

Fig. 1

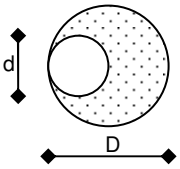

Fig. 2

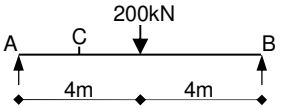

Fig. 3

b) Determine the position of the centroid of the shaded portion shown in figure 2 (5 marks)

c) Figure 3 shows a simply supported beam carrying a concentrated load at mid span.
   i) Using Macaulay's method, determine the maximum deflection
   ii) Using Mohr's theorems determine the slope and deflection at the quarter span point marked C (15 marks)

2. Using Macaulay's method, calculate the deflection under each of the point loads acting on the beam shown in figure 3. EI = 15 X 10^3 kNm^2

(20 marks)

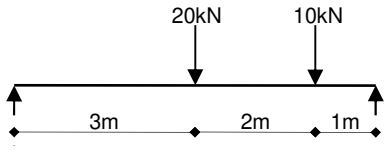

Fig. 3

3. Figure 4 shows a zed purlin.
   a) Determine the position of the centroid
   b) Calculate the values I_{xx} and I_{yy}
   c) Calculate the values r_{xx} and r_{yy} (20 marks)

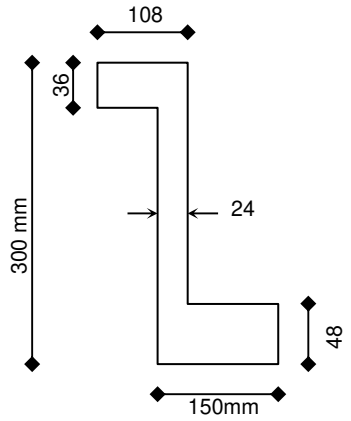

Fig. 4

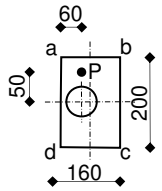

Fig. 5

4. A short column has a rectangular section 200 X 160mm with a circular hole of 80mm diameter as shown in figure 5. It carries an eccentric load P of 100kN located as shown in the figure. Calculate the stresses at the four corners of the section.

(20 marks)

5.
   a) State **five** assumptions that are made in the analysis of pin-jointed columns and struts

(5 marks)

   b) With the aid of a sketch, show that for a pin-ended strut the Euler critical load is:

$$P = \pi^2 \frac{EI}{L^2}$$

(15 marks)