MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2013/2014

SCHOOL OF ENGINEERING

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN BUILDING TECHNOLOGY
DIPLOMA IN CIVIL ENGINEERING

STRUCTURES III

Date: 17/7/2014 **Time:** 8:30-11:30am

INSTRUCTIONS TO CANDIDATES

*Answer any **FIVE** of the following **EIGHT** questions*
All questions carry equal marks
Candidates to have relevant design manuals

1.
a) State ***Six*** assumptions that are made in the design of riveted joints (6 marks)
b) A single riveted lap joint connects two plates of 15mm thickness
i. Design the lap joint
ii. Determine the efficiency of the joint
Take: Shear stress = 80N/mm^2, bearing stress = 150N/mm^2, tearing stress = 100N/mm^2 (14 marks)

2.
a) Explain ***Four*** modes of failure that occur in riveted joints (8 marks)
b) A double riveted double cover butt joint is provided with 12mm thick cover plates, 15mm thick main plate and 20mm nominal diameter rivets as shown in figure 1. Determine:
i. The safe load that the connection can carry
ii. The efficiency of the joint
Take: Shear stress = 70N/mm^2, bearing stress = 180N/mm^2, tearing stress = 90N/mm^2 (12 marks)

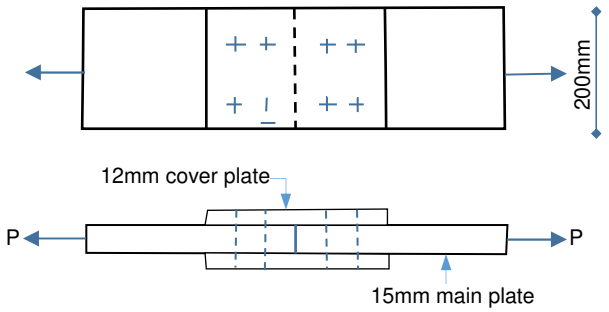

Figure 1

3. A timber beam of overall span 3.0m supports a uniformly distributed design load of 10kN/m inclusive of self-weight. The ends of the beam are held in position and the compression edge is held in line.
   Select a suitable section for the beam using timber of strength class C16
   Check for bending, deflection, lateral buckling and bearing
   K_3=1.00, K_7=1.02, l_b=200mm (20 marks)

4.
   a) State ***Six*** advantages of welded connections over riveted connections (6 marks)
   b) A tie bar in a truss consisting of a double angle section 100 X 65 X 10mm is subjected to a load of 250kN and is welded to a gusset plate as shown in figure 2.
   Design the joint with 8mm fillet weld. Permissible stress in weld is 100N/mm^2 (14 marks)

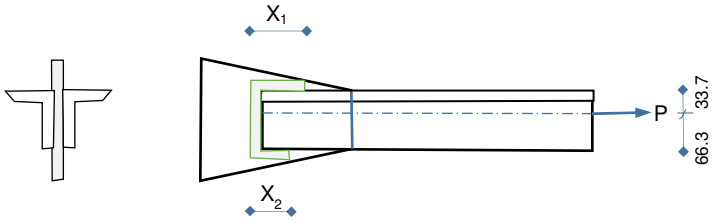

Figure 2

5. A nailed timber joint is required to sustain a long term axial load of 4kN. The timber is a softwood of strength class C16 and of section size 150X50mm. design the joint if 4.2mm diameter, 90mm long round wire nails are used.
   Sketch the joint details
   Assume long term loading and service class 2 exposure conditions (20 marks)

6. Figure 3 shows a simply supported beam. Using equilibrium conditions, draw the influence line diagrams for the following response functions:
   a) Shear at point C
   b) Shear at point B
   c) Bending moment at point C
   d) Moment at point B (20 marks)

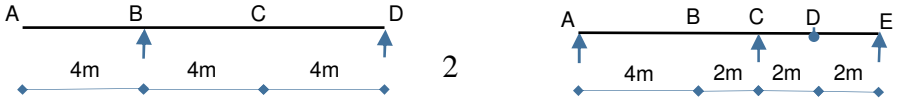

Figure 3 Figure 4

7. Figure 4 shows a simply supported beam with a hinge at point D.
   a) Sketch the influence line diagrams for the following load components
      i. Reaction at A
      ii. Shear at D
      iii. Bending moment at D (12 marks)
   b) If the beam is subjected to a single concentrated load of 10kN and a uniform load of 4kN/m over the entire span, determine the following:
      i. Maximum shear at A
      ii. Maximum shear at point D
      iii. Maximum positive bending moment at point D (8 marks)

8. A suspended timber floor has members as shown in figure 5. Using timber of strength class C16, design the timber floor joists given the following data:
   Effective span of floor = 4.0m
   Self-weight of floor deck = 0.1kN/m^2
   Self-weight of ceiling = 0.2kN/m^2 (20 marks)

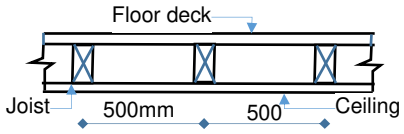

Figure 5