



Machakos University College

(A Constituent College of Kenyatta University)

University Examinations 2013/2014

SCHOOL OF ENGINEERING

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

Diploma in Building
Diploma in Civil Engineering

Year 3

STRUCTURES III

Date:

Time:

Instructions

1. Answer any five questions of the Eight Questions
2. All questions carry equal marks

SECTION A: BUILDING TECHNOLOGY

1. A simply supported beam carries uniformly distributed characteristic dead and imposed loads and Km/m each as well as a characteristic imposed point load of $30k/n$ at mid-span as shown in figure 1.

Select a suitable section in grade 5275 steel to satisfy bending and shear considerations

2. Figure 2 shows the plan of a loaded column of actual length 3.7m carrying loads from three beams. It is fixed in position and direction at both ends. Select a suitable uc section for the column in grade S275 steel and check its adequacy. (20 marks)
3. A universal beam of effective span 6 m is loaded with design loads as shown in figure 3. Select a suitable UB section in grade S275 steel and check for bending, shear and bearing. Assume bearing length of 200mm. (20 marks)
4. Figure 4 shows a loaded strapping of section 305 * 305 * 118 kg/m uc. Check the adequacy of the return when caused in accordance with BS 5950 if the column has an actual length of 4.5 and is fixed at one end and pinned at the other. (20 marks)

5. (a) With the aid of sketches, explain five failure mechanisms that are likely to occur to occur in fixated joints. (10 marks)

(b) Two plates 10 mm thick are joined by a double fixated lap joint. The pitch of each of rivets is 50mm. The rivets have 200mm nominal diameter and the permissible stresses are:

$$\text{Shearing of rivets} = 70\text{N/MM}^2$$

$$\text{Bearing of rivets} = 160\text{N/MM}^2$$

$$\text{Tearing of plate} = 100\text{N/MM}^2$$

Determine the maximum tensile force on the joint and efficiency of the joint.

(10 marks)

6. (a) State 5 advantages of welded joints over riveted joints. (5 marks)

(b) Sketch five types of rivet heads. (5 marks)

(c) A tie bar in a buff consisting of a double angle section. 100 mm * 65mm * 10mm is subject to a load of 250kN and is welded to a gusset plate as shown in figure 5. Design the joint with 8mm fillet weld. Take allowable stresses in the weld as 100 N/mm² (10 marks)

7. A timber joint is required to carry a long term axial load of 4kN

The timber is softwood of strength class SC3 and sized 50 * 150mm

(a) Determine the number of nails and their spacing of 4.2 mm diameter, 90mm long wire nails are used

(b) Detail the joint (20 marks)

8. A Timber beam of overall span 3m supports a uniformly distributed 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.

Assume a bearing length of 200mm

(a) a suitable section for the beam using timber of strength class SC3

(b) for bending, deflection, Lateral buckling and bearing

Take $K_G = 1.0$, $K_{3b} = 1.0$ (20 marks)