



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING

ECE 2415: STRUCTURAL DESIGN II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1 (30 marks)

- a) Fig Q 1 (a) shows the plan of an eight-storey reinforced concrete building frame 26m long by 7m wide. The length is divided into four equal bays as shown. Using the design information given, design the required stability ties for the building.

Fig Q1 (a)

Design information:

- Clear storey height under beams = 2.9m
- Floor to ceiling heights = 3.4m
- Dead load (g_k) = 6kN/m²
- Imposed load (q_k) = 3kN/m²
- Strength of reinforcement = 460N/mm²

Assume any information not given and state it clearly

(15 marks)

- b) A simply supported reinforced beam whose overall span is 7.15m carries characteristic dead (excluding self weight) and imposed loads of 12kN/m and 8kN/m respectively. The beam cross-section is 450mm effective depth and 275mm width. It is supported on 150mm thick brickwalls. The concrete and steel strengths are 30N/mm² and 460N/mm² respectively. Design the required reinforcement for bending and shear. Do not consider deflection. Take cover to reinforcement as 20mm. Assume any information not given and state it clearly. (15 marks)

SECTION B (Answer any TWO questions from this section)

Question 2 (20 marks)

- a) With the aid of labeled sketches, outline the types of reinforced concrete slabs. (5 marks)
- b) A reinforced concrete floor slab whose overall width is 4.2m and length is 12.2m is simply supported on 200mm thick concrete block walls along the two longer sides. It is subjected to an imposed load of 2kN/m². Design a suitable section for the slab assuming the following material strengths: concrete grade 30 and steel grade 460. Take cover to reinforcement as 20mm. show the arrangement of reinforcement bars in plan only. Assume any information not given and state it clearly. (15 marks)

Question 3 (20 marks)

- a) Outline the main types of concrete foundations stating the situations where they may be used to advantage (5 marks)

- b) A 400mm square column carries a dead load of 1000kN and an imposed load of 250kN. The safe bearing capacity of the soil is 160kN/m². Design a square pad footing to resist the applied loads assuming the following design information: concrete strength = 30N/mm², steel reinforcement strength = 460N/mm² and cover to reinforcement = 50mm. Show the arrangement of reinforcement bars in plan and section. (15 marks)

Question 4 (20 marks)

- a) Outline the various requirements that a reinforced concrete beam should possess in order to perform its functions adequately and safely (4 marks)
- b) It has been observed that reinforced concrete beams fail mainly by bending and/or shear. Discuss these modes of failure and outline appropriate measures that should be taken to ensure that failure does not occur (16 marks)

Question Five (20 marks)

- a) What is prestressed concrete? With the aid of sketches, outline **TWO** methods of prestressing concrete beams (8 marks)
- b) State the main merits and limitations of prestressed concrete compared with in-situ reinforced concrete (2 marks)
- c) A rectangular prestressed concrete beam 600mm wide and 1200mm deep is simply supported over an effective span of 8m. It is subjected to a dead load of 25kN/m (excluding self weight) and an imposed load of 30kN/m. Determine the minimum prestressing force and its position from the bottom of the beam if all the tensile stresses are to be eliminated and straight cables are to be used. Sketch the final stress distribution at mid span. (10 marks)