TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2515: STRUCTURAL DESIGN IV

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2013
TIME ALLOWED: 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)** and any **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FIVE** printed pages

Question One (Compulsory)

Figure Q1 shows a sub-frame where the beams are loaded with characteristic loads dead load (including self-weight of Gk = 25KN/m and imposed load Qk = 10KN/m uniformly distributed along the beam. The

frame is braced and carries vertical loads only. Show the three loading cases and by the moment distribution method, determine the design moments at A, B, C and D for the first loading case. Sketch the bending moment diagram for the first loading case only.

Question Two

A continuous beam is 300mm wide by 660mm deep with three equal 5.0m spans. In the transverse direction the beams are at 4.m centres with a 180mm thick slab as shown in figure Q2. The imposed load on the beam is 50KN/m and the deal load (including self-weight) is 85KN/m. The characteristic material strengths are f_{cu} = 30N/mm^2, f_y = 460N/mm^2 for the main reinforcement and f_{yv} = 250N/mm^2 for the links. Cover to reinforcement is 25mm. Design the required reinforcement for the beam.

Show arrangement of reinforcement for the end span only.

Question Three

a) Design a waffle slab for an internal panel of a floor system, each panel spanning 6.0m in each direction. The characteristic material strengths are fcu = 30N/mm^2 and fy = 460N/mm^2. The section as shown in figure 3(a) is to be tried with characteristic dead load including self weight of 6.0KN/m2 and characteristic imposed load of 2.5KN/m^2

b) Figure Q3 (b) shows the elevation of a stair slab spanning longitudinally and supported on two beams. The effective span is 3.0m and the rise is 1.5m with 260mm treads and 150mm risers. The imposed load is 3.0KN/m^2 and the characteristic material strengths are f_{cu} = 30N/mm^2 and f_y = 250N/mm^2. Design the suitable reinforcement for the stair slab. Try a 125mm waist and effective depth d = 90mm **(10 marks)**

Question Four

Figure 4 shows the elevation and plan of a plane reinforced concrete frame of a four-story building which is symmetric and regular. Using the information given, determine the lateral forces due to earthquake loading and sketch the shear force diagram at various floor levels. **(20 marks)**

Floor heigh = 3.5m
Longitudinal walls = 250mm thick (brick)
Traverse wall = 150mm thick
Imposed load = 3.5KN/m^2
Materials Concrete grade 20
Reinforcement grade 460
Columns 250 x 450mm
Beams 250 x 400mm
Slabs 100mm thick
Unit weight of concrete = 25KN/m^3
Frame type: Reinforced concrete moment resisting frame
Unit weight of brick masonry = 20KN/m^3
Seismic intensity is severe, Z = 0.24
Importance factor I = 10
Lateral load resisting system: special R = 5
Show the distribution of forces at various floor levels.

Question Five

Design a strip footing to carry 400mm square columns equally spaced at 3.5m centres. On each column the characteristic loads are 100KN dead and 350KN imposed. The safe bearing pressure is 200KN/m^2 and the characteristic material strengths are fcu = 35KN/mm^2 and fy = 460N/mm^2. Show arrangement of reinforcement. **(20 marks)**

Discuss the graph theory and clearly explain how it is applied in the transport action network system. **(6 marks)**