TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

EBC 2209 : REINFORCED CONCRETE AND MASONRY DESIGN

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: Pick Date Dec 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

- Pocket calculator

-Bs 8110: Structural use of concrete, part 1.

This paper consists of **FIVE** questions. Attempt any THREE questions.

Do not write on the question paper.

Mobile phones are not allowed in the examination room.

1. a) List four factors governing structural design? (4 marks)

   (b) A simple supported slab of clear span 3.5 m rests on 200 mm thick wall on both two sides. It is loaded with additional dead and live loads of 1.6Kn/m^2 and 3.0 kn/m^2 respectively.

   Using the following material strength, design the slab and show the reinforcement arrangement?

   F_{cu} =25 N/mm2

   F_y= 425 N/mm2

   Take Cover to main reinforcements= 20 mm (16 marks)

2. A reinforced rectangular concrete beam spans over three supports spaced at 5.0 m apart. The beam carries dead load (including self-weight) and imposed load of 12 Kn/m and 9 Kn/m respectively. Given the following information design the beam for bending and shear.
   h= 450 mm
   b=250 mm
   F_{cu} =25 N/mm^2
   F_y= 460 N/mm^2
   F_{yy}= 250 N/mm^2
   Take Cover to main reinforcements= 20 mm (20 marks)

3. An internal column of a multi-storey building is supporting a symmetrical arrangement of beams and carries characteristic dead and imposed load of 750Kn and550 Kn respectively. The storey height = 3.5m. Assuming effective height facto=0.85 and the column is square, short and braced.
   Take F_{cu} =30 N/mm^2
   F_y= 460 N/mm^2

   Design.

   (i) Suitable cross section of the column.
   (ii) The size of longitudinal reinforcements.
   (iii) The size and spacing of links.
   Hence sketch the reinforcement details. (20 marks)

4. Design a square pad resisting characteristic dead load of 800 Kn and Imposed load of 450 Kn from 400 mm square column. The safe bearing pressure of soil 350 Kn/m^2.
   Assume the following material strength.
   F_{cu} =30 N/mm^2
   F_y= 460 N/mm^2
   Hence sketch the pad details. (20 marks)

5. (a) Define the two types of limit states under which a structure may become unfit for its intended use. (4 marks)

(b) The figure below shows a cross section of a stairs slab monolithically casted with edge beam. Using the following information, design the stair slab and show the reinforcement arrangement.
Risers, 9 no@ 150 mm
Treads, 8no @ 250 mm
F_{cu} =25N/mm^2
F_y= 460 N/mm^2
Cover to main reinforcement= 20 mm (16 marks)

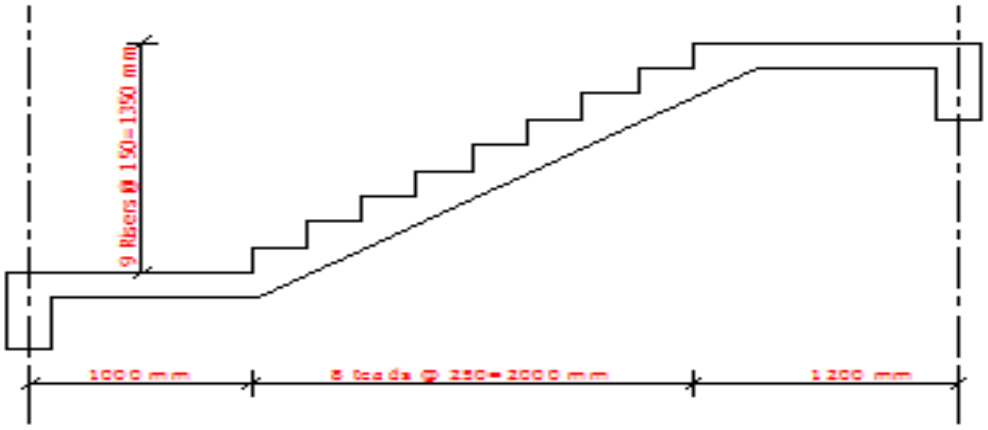

Table 1: Values of A_{sv}/S_v

Diameter of links (mm)	Spacing of links(mm)										
	85	90	100	125	150	175	200	225	250	275	300
8	1.183	1.118	1.006	0.805	0.671	0.575	0.503	0.447	0.402	0.336	0.335
10	1.847	1.744	1.57	1.256	1.047	0.897	0.785	0.698	0.628	0.571	0.523
12	2.659	2.511	2.26	1.808	1.507	1.291	1.13	1.004	0.904	0.822	0.753
16	4.729	4.467	4.02	3.216	2.68	2.297	2.01	1.787	1.608	1.462	1.34

Table 2: Cross-sectional area per metre width for various bar spacing (mm^2)

Bar Size (mm)	50	75	100	125	150	175	200	250	300
6	566	377	283	226	189	162	142	113	94.3
8	1010	671	503	402	335	287	252	201	168
10	1570	1050	785	628	523	449	393	314	262
12	2260	1510	1130	905	754	646	566	452	377
16	4020	2680	2010	1610	1340	1150	1010	804	670
20	6280	4190	3140	2510	2090	1800	1570	1260	1050
25	9820	6550	4910	3930	3270	2810	2450	1960	1640
32	16100	10700	8040	6430	5360	4600	4020	3220	2680
40	25100	16800	12600	10100	8380	7180	6280	5030	4190

Table 3: Cross-sectional areas of groups of bars (mm^2)

Bar Size (mm)	Number of bars									
	1	2	3	4	5	6	7	8	9	10
6	28.3	56.6	84.9	113	142	170	198	226	255	283
8	50.3	101	151	201	252	302	352	402	453	503
10	78.5	157	236	314	393	471	550	628	707	785
12	113	226	339	452	566	679	792	905	1020	1130
16	201	402	603	804	1010	1210	1410	1610	1810	2010
20	314	628	943	1260	1570	1890	2200	2510	2830	3140
25	491	982	1470	1960	2450	2950	3440	3930	4420	4910
32	804	1610	2410	3220	4020	4830	5630	6430	7240	8040
40	1260	2510	3770	5030	6280	7540	8800	10100	11300	12600