(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

THIRD YEAR SEMESTER ONE EXAMINATIONS

FOR THE
DIPLOMA
IN

CIVIL ENGINEERING

COURSE CODE: DCE 087

COURSE TITLE: REINFORCED CONCRETE AND MASONRY DESIGN

DATE: TUESDAY 26TH APRIL 2022 TIME: 8.00AM- 10.00AM

INSTRUCTIONS:

1. This paper contains FIVE questions
2. QUESTION ONE IS COMPULSORY
3. Attempt any other TWO questions
4. Marks for each question are indicated in the parenthesis.
5. Examination duration is 2 Hour

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE - COMPULSORY (10 MARKS)

a) Explain the difference between columns which are short and slender and those which are braced and unbraced.
b) Explain the difference between M and Mu
c) Explain what you understand by the term 'under-reinforced' and why concrete beams are normally designed in this way.
d) Discuss how shear failure can arise in reinforced concrete members and how such failures can be avoided.
e) Describe the measures proposed in BS 8110 to achieve durable concrete structures.

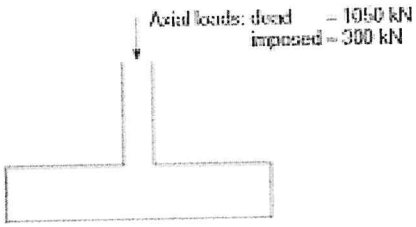
QUESTION TWO (20 MARKS)

An internal column in a multi-storey building supporting an approximately symmetrical arrangement of beams carries an ultimate load of 2,000 kN. The storey height is 5.2 m and the effective height factor is 0.85, fcu = 35 N/mm^2 and fy = 500 N/mm^2. Assuming that the column is square, short and braced, calculate:

i. A suitable cross-section for the column
ii. The area of the longitudinal reinforcement
iii. The size and spacing of the links. Sketch the reinforcement detail in cross-section.

QUESTION THREE (20 MARKS)

A 400 mm square column shown below carries a dead load (Gk) of 1050 kN and imposed load (Qk) of 300 kN. The safe bearing capacity of the soil is 170 kNm^{-2}. Design a square pad footing to resist the loads assuming the following material strengths: fcu = 35 Nmm^{-2} fy = 500 Nmm^{-2}



QUESTION FOUR (20 MARKS)

Design the bending and shear reinforcement for the beam in Fig. Q3 using the following information fcu = 30 N/mm2 fy = 500 N/mm2 fyv = 250 N/mm b = 300 mm

Span/depth ratio = 12

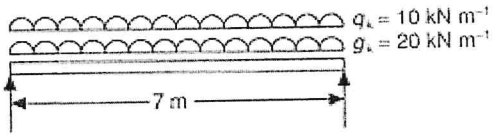
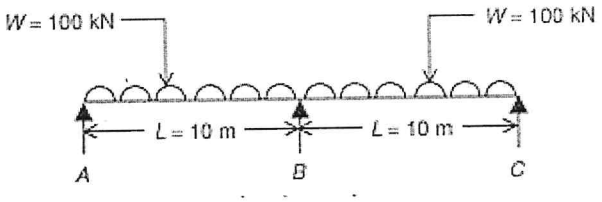


Fig. Q3

QUESTION FIVE (20 MARKS)

Evaluate the critical moments and shear forces in the beam shown below assuming that it is of constant section and the supports provide no restraint to rotation.



TABLES

Table 3.10 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

Table 3.22 Cross-sectional area per metre width for various bar spacing (mm^2)

Bar size (mm)	*Spacing of bars*								
	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