

**MASINDE MULIRO UNIVERSITY OF SCIENCE AND  
TECHNOLOGY(MMUST)**

**UNIVERSITY EXAMINATIONS**

**2013/2014 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER EXAMINATIONS  
FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL AND  
STRUCTURAL ENGINEERING**

**COURSE CODE: CSE 313**

**COURSE TITLE: STRUCTURAL MASONRY DESIGN**

**DATE:**

**DURATION: 3HOURS**

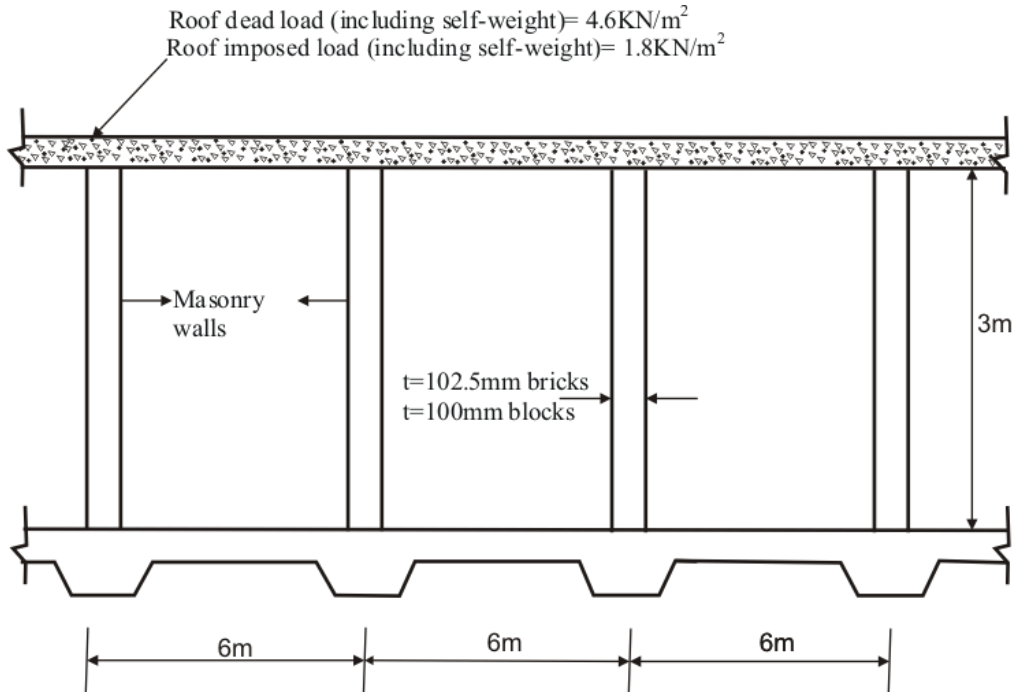
**Instructions to candidates**

Answer question five and any three of the four of the remaining questions. Marks for each question are indicated in the parenthesis.

Marks for each question will be awarded for procedures of design, illustrations and correct answer.

Relevant standard codes applicable are allowed

1. a) Explain in general terms, the concept of limit state design. (3 marks)
- b) Masinde Muliro University of Science and Technology administration is planning to build modern student center. A single leaf wall is to be used as shown in figure 1. Using mortar designation (iii) and standard bricks for scenario 1 and solid concrete blocks of length 440, height 140mm and thickness 100mm for scenario 2. Assuming that the manufacturing and construction control are normal design the wall for the two scenarios.



**Fig.1**

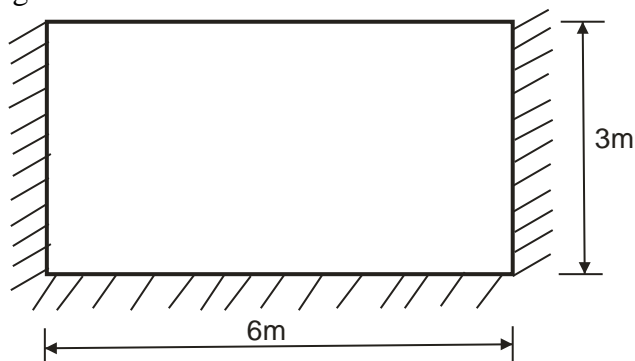
(11 marks)

2. a) Differentiate between simple and enhanced resistance and sketch typical construction details showing examples of both types of restraint. (3 marks)

b) A two way spanning cavity wall shown in figure 2 is to be used in the construction of engineering complex of MMUST. Determine the maximum wind pressure  $W_k$  which can be resisted by the wall if the details are as follows:

- Outer leaf: clay bricks having water absorption of 7%-12% laid in mortar designation (i).
- Inner leaf: solid concrete blocks of compressive strength  $3.5\text{ Nmm}^{-2}$  and length 390mm, height 190mm, thickness 100mm also laid in mortar designation (iii).

Assuming that the top edge of the wall is unsupported, but the base and vertical edges are simply supported. The manufacturing and construction control are both assumed to be special.



**Fig. 2**

(11 marks)

3. a) (i) Enumerate functions of mortar in masonry construction. (2marks)  
(ii) Differentiate between diaphragm wall and fin wall (3 marks)

b) A 3.2m m high wall show in figure 3 is constructed from clay bricks having a compressive strength of  $20 \text{ Nmm}^{-2}$  laid in a 1:1:6 mortar. Calculate the design load resistance of the wall assuming the partial safety factor for materials is 3.5 (i) resistance to lateral loading is simple, (i) resistance to lateral loading is enhanced.

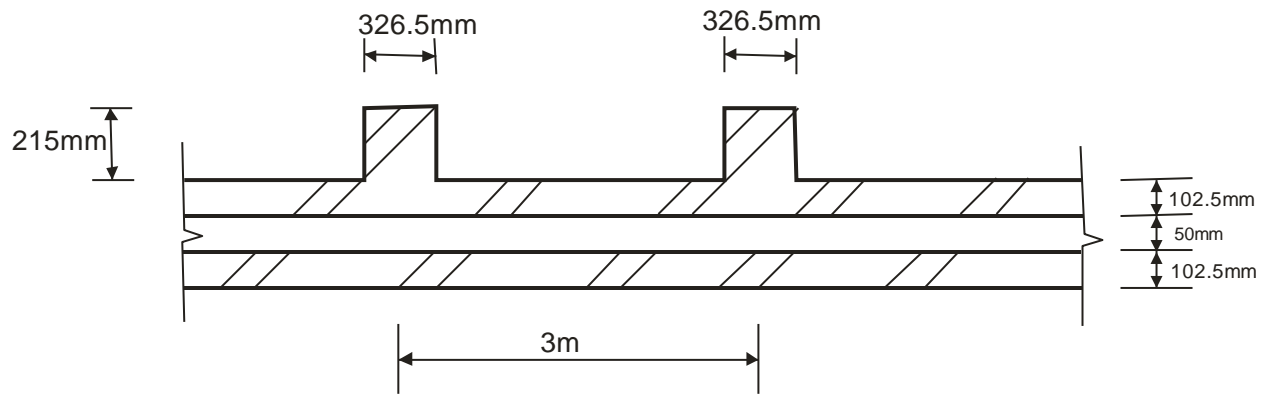


Fig. 3

4. a) Identify six factors which influence compressive strength of masonry structures. (9 marks)  
(3 marks)

b) A three story low cost classrooms are to be constructed in MMUST. A ground floor wall supports loads indicated in figure 4. Choose suitable bricks and mortar for the wall. Partial safety factors are given as follows;  $\gamma_m = 2.8$ ; for dead loads;  $\gamma_f = 1.4$ ; for imposed loads  $\gamma_f = 1.6$ .

The manufacturing control is to be normal and construction control is to be special

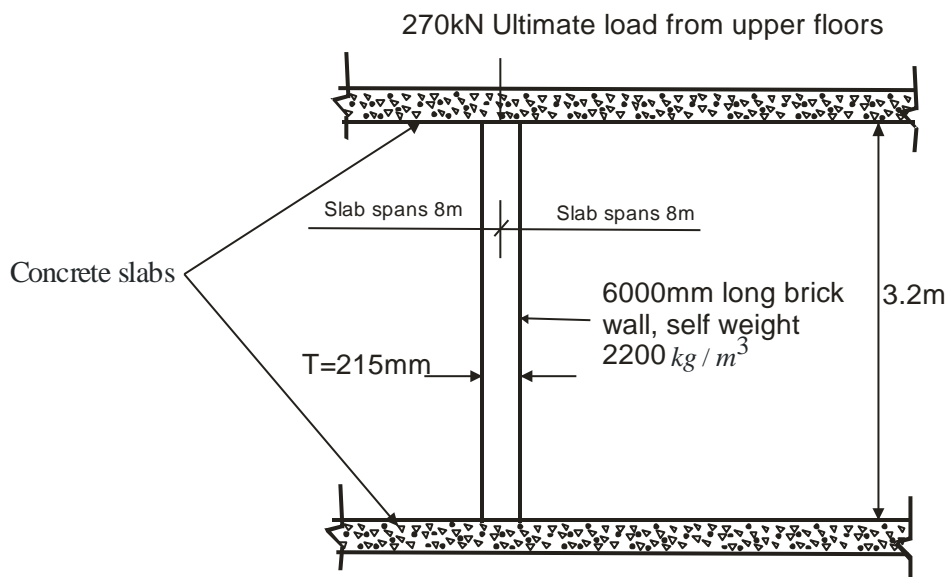


Fig.4

5. a) Define the following terminologies as applied in masonry design.  
- Masonry

- Double leaf wall
- Pier
- Load bearing walls

(4 marks)

b) Illustrate the following bonds used in masonry structures.

- Flemish bond
- English garden-wall bond
- Heading bond
- Quetta bond

(5 marks)

c) Briefly explain the advantages and disadvantages of structural masonry.

(21marks)

**Table 2.1** Schedule of unit masses of building materials (based on BS 648)

<b>Asphalt</b>		<b>Plaster</b>	
Roofing 2 layers, 19 mm thick	42 kg m <sup>-2</sup>	Two coats gypsum, 13 mm thick	22 kg m <sup>-2</sup>
Damp-proofing, 19 mm thick	41 kg m <sup>-2</sup>	<b>Plastics sheeting (corrugated)</b>	4.5 kg m <sup>-2</sup>
Roads and footpaths, 19 mm thick	44 kg m <sup>-2</sup>	<b>Plywood</b>	
<b>Bitumen roofing felts</b>		per mm thick	0.7 kg m <sup>-2</sup>
Mineral surfaced bitumen	3.5 kg m <sup>-2</sup>	<b>Reinforced concrete</b>	2400 kg m <sup>-3</sup>
<b>Blockwork</b>		<b>Rendering</b>	
Solid per 25 mm thick, stone aggregate	55 kg m <sup>-2</sup>	Cement: sand (1:3), 13 mm thick	30 kg m <sup>-2</sup>
Aerated per 25 mm thick	15 kg m <sup>-2</sup>	<b>Screeding</b>	
<b>Board</b>		Cement: sand (1:3), 13 mm thick	30 kg m <sup>-2</sup>
Blockboard per 25 mm thick	12.5 kg m <sup>-2</sup>	<b>Slate tiles</b>	
<b>Brickwork</b>		(depending upon thickness and source)	24–78 kg m <sup>-3</sup>
Clay, solid per 25 mm thick medium density	55 kg m <sup>-2</sup>	<b>Steel</b>	
Concrete, solid per 25 mm thick	59 kg m <sup>-2</sup>	Solid (mild)	7850 kg m <sup>-3</sup>
<b>Cast stone</b>	2250 kg m <sup>-3</sup>	Corrugated roofing sheets, per mm thick	10 kg m <sup>-2</sup>
<b>Concrete</b>		<b>Tarmacadam</b>	
Natural aggregates	2400 kg m <sup>-3</sup>	25 mm thick	60 kg m <sup>-2</sup>
Lightweight aggregates (structural)	1760 + 240/ -160 kg m <sup>-3</sup>	<b>Terrazzo</b>	
<b>Flagstones</b>		25 mm thick	54 kg m <sup>-2</sup>
Concrete, 50 mm thick	120 kg m <sup>-2</sup>	<b>Tiling, roof</b>	
<b>Glass fibre</b>		Clay	70 kg m <sup>-2</sup>
Slab, per 25 mm thick	2.0–5.0 kg m <sup>-2</sup>	<b>Timber</b>	
<b>Gypsum panels and partitions</b>		Softwood	590 kg m <sup>-3</sup>
Building panels 75 mm thick	44 kg m <sup>-2</sup>	Hardwood	1250 kg m <sup>-3</sup>
<b>Lead</b>		<b>Water</b>	1000 kg m <sup>-3</sup>
Sheet, 2.5 mm thick	30 kg m <sup>-2</sup>	<b>Woodwool</b>	
<b>Linoleum</b>		Slabs, 25 mm thick	15 kg m <sup>-2</sup>
3 mm thick	6 kg m <sup>-2</sup>		