NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ARCHITECTURE AND QUANTITY SURVEYING

DEPARTMENT OF ARCHITECTURE
BACHELOR OF ARCHITECTURAL STUDIES (HONOURS) DEGREE

PART II FIRST SEMESTER EXAMINATIONS DECEMBER 2001

AAR 2105 STRUCTURAL DESIGN I

Instructions   3 hours

Answer any four questions
Each question carries 25 marks.

QUESTIONS

1. For each of the structures illustrated in Fig1 below, draw the bending moment and shear force diagrams, indicating the signs and magnitudes of the peak values.

2. Site geotechnical investigations are conducted to determine the characteristics of the soils and suitability of the site prior to the construction of a building. Give four site properties that may be established during such investigations, describing how each of them could affect the design of foundations.
    (b) The behaviour of volumetrically active soils under varying physical conditions can be a source of problems in building structures. Give details of how such soils affect buildings.
    (c) Give a brief account of why made up ground may not be suitable as a foundation stratum.

3. (a) Different materials are used in various construction methods in the form of beams. For each of the following beam types, use illustrations to describe the circumstances in which they are best suited, giving their advantages over other types of beams;
        (i) steel box girder
        (ii) rolled mild steel universal beam
        (iii) laminated timber beam
        (iv) solid timber section

4. (a) Illustrate four types of foundations, briefly describing the circumstances in which they are employed in buildings.
    (b) i. What do you understand by the "safe bearing capacity of soil"?
        ii. A pad footing is used as a foundation for a column carrying the following loads;
        * Dead load   - 172kN
        * Live load   - 90kN
    If the bearing capacity of the soil is 180kN/m2, determine suitable plan dimensions for the foundation. Factor of safety 1.25.
        iii. For the pad footing determine in ii above, what is the earth pressure at ultimate limit stress.

2. (a) Briefly describe five factors that affect the load bearing capacity of a masonry wall.

(b) The effective height and length of a wall depends on the support conditions at its ends. Illustrate the following end conditions;

    i. vertical lateral support capable of providing enhance resistance.
    ii. horizontal lateral support capable of providing simple resistance.

(c) The vertical design strength per meter length of masonry wall $= \hat{a} t f_k / \hat{a}_m$

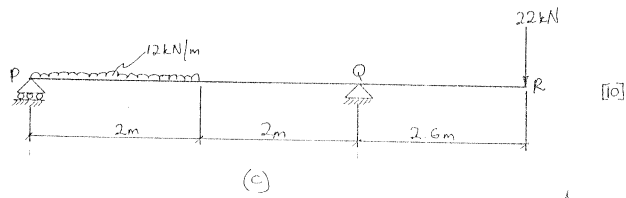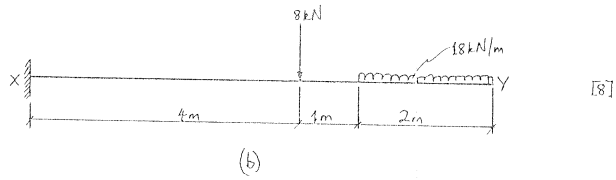Which parameters in the above equation are determined by the properties of the masonry units an/or manufacture?
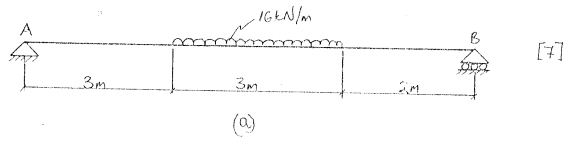
16 kN/m

A ——————————————————————— B   [7]

| 3m | 3m | 2m |

(a)

8 kN

18 kN/m

X ——————————————————————— Y   [8]

| 4m | 1m | 2m |

(b)

22 kN

12 kN/m

P ———————————— Q ————————— R   [10]

| 2m | 2m | 2.6m |

(c)

Fig 1