NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF ARCHITECTURE AND QUANTITY SURVEYING

DEPARTMENT OF ARCHITECTURE
BACHELOR OF ARCHITECTURAL STUDIES (HONOURS) DEGREE

PART II SUPPLEMENTARY EXAMINATIONS – JULY 2003
AAR 2105 – STRUCTURAL DESIGN I

Instructions   *Time* : 3 Hours

1.   *Answer any four questions*

QUESTION 1

a)   Discuss loads considered during structural design.   [8]

b)   Beams can be defined by the way they are supported. With the aid of sketches discuss
        the three common types of beams and explain their behaviour under vertical loads.

c)   I)   Differentiate permissible stress design and limit state design.   [2]

        ii)   A short brick column is to support a 750kN load of a hostel with a live load of
                 390kN. Determine the required cross – sectional area of the column if the design
                 is based on limit. State principle when design strength of the column is 6 Nmm^2
                 and permissible stress principal when permissible basic stress of column is 3,3
                 N/mm^2.   [7]

Question 2

a)   Explain the importance of drawing shearing forces and bending moments diagrams
        structural beams.   [8]

b)   Fig. I below shows the detail of a loaded beam ABCDE carrying a uniformly distributed
        load of 8 kN/m over BC, plus a point load 25kN at D. Draw the shearing force and
        bending moment diagrams for the beam indicating all significant values.   [17]

Question 3

a)   A timber beam of rectangular cross section is 200 mm wide and allowable bending stress
        in tension and compression must not exceed 8 N/mm^2. What maximum bending moment
        in Nmm can the beam safely carry.   [10]

b)   Determine the position of centre of area of the shape shown and calculate the values of its Ixx and Iyy.

Question 4

a)   List two types of foundation you can possibly use on a weak soil where a residential building is to be constructed. Give reasons for your choice.   [6]

b)   Discuss factors that control the depth of foundations   [9]

c)   A cavity wall for a domestic building has an overall thickness of 275 mm. It supports a total factored load from the roof, floors and its own weight of 62 kN/m. The soil at foundation level is firm clay with permissible bearing pressure of $100kN/m^{2.}$. Determine the width of a suitable strip foundation.   [10]

Question 5

a)   Define the following terms

        i)   stress
        ii)   strain
        iii)   modulus of elasticity   [6]

b)   A bar of steel 2000 mm2 in cross – sectional area is being pulled with an axial force of 180 kN. Find the stress in the steel.   [8]

c)   A post of timber similar to that used in the above test is 150 mm square and 4 mm high. How much will the post shorten when an axial load of 108 kN is applied.   [11]