NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF THE BUILT ENVIRONMENT

DEPARTMENT OF ARCHITECTURE
BACHELOR OF ARCHITECTURAL STUDIES (HONOURS) DEGREE

PART II – END OF SECOND SEMESTER EXAMINATIONS – MAY 2007
AAR 2205 – STRUCTURAL DESIGN II

**Instructions**   _**Time**_ : **3 Hours**
Answer four (4) questions
Each Question carries (25) twenty five marks.

Question 1

        Show that:

a)   Modular ratio in a reinforced concrete beam is given by

$$m = \frac{E_s}{E_c}$$

Where m is the modular ratio
        E_s is the modular of electricity of Steel
        E_c is the modulus of elasticity of concrete.

(12½)

b)   Equivalent areas of composite section of concrete and steel in terms of concrete is given by $A_c = a_c + mA_s$

Where mA_s is the equivalent area of concrete that is replacing area of steel A_s

(12½)

Question 2

        For a balanced rectangular section (b x d) of a singly reinforced beam, determine
        (i)   Depth of neutral axis
        (ii)   Moment of resistance
        (iii)   Percentage of steel using m15 concrete and Fe 415 steel.

        Take width (b) as 200mm and depth (d) as 300mm.

        Use table 1 provided for the necessary information needed for this question

(25)

Question 3

A rectangular, singly reinforced beam 300mm wide and 500 mm effective depth is used as a simply supported beam over an effective span of 6m. The reinforcement consists of 4 bars of 20mm diameter. If the beam carries a load of 12kN/m, inclusive of the self-weight, determine the stresses developed in concrete and steel. Take m = 19.

(25)

Question 4

(a)   Define bearing capacity of the soil.

(b)   Give the equation used in determining the bearing capacity of the soil in foundation design.

(c)   Design an unreinforced concrete wall footing for a wall 500mm thick carrying a load of 400kN per meter run. The bearing capacity of the soil is 200kN per metre^2.

(25)

Question 5

(a)   Define the following in riveting and bolting connections:-

(i)   Single shear
(ii)   Double shear
(iii)   Failure in bearing.

(b)   Calculate the safe load W on the lap joint shown in fig 1 below:

Four 25mm diameter power riverts.

(25)