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

DEPARTMENT OF ARCHITECTURE
BACHELOR OF ARCHITECTURE (HONOURS) DEGREE

PART II SECOND SEMESTER EXAMINATIONS – MAY 2002
AAR 2205 – STRUCTURAL DESIGN II

Instructions   *Time: 3 hours*
Answer any four questions
Each question carries 25 marks

Question 1

a) Given a Client's brief to design a high-rise office complex, a number of structural materials/systems are available to the designer. Discuss three (3) structural materials/systems that may be considered, highlighting the advantages and disadvantages for various situations in each case.   [15]

b) Discuss the factors that may affect the form/layout of a proposed building, given the building use and site.   [10]

Question 2

There are numerous suspended floor systems available for consideration in the design of multi-storey buildings. With the aid of diagrams, discuss five (5) floor systems, giving details of their applications, advantages and disadvantages.   [25]

Question 3

a) Roof structures range from simple rafters to very complex structures. Discuss three (3) different roof structures, giving details of where they are most suited, and their advantages and disadvantages.   [13]

b) Illustrate three (3) common types of roof trusses. Give their advantages, and disadvantages, and the situations where they are most suited.   [12]

Question 4

a) With the aid of diagrams, describe two (2) applications of retaining walls.   [6]

b) Retaining walls have two principal modes of failure. Name them and describe what precautions are taken to avert the respective failure modes.   [6]

c)	i)	A reinforced concrete wall is used to form a loading bay at a warehouse, Fig. 4.1 Determine the distribution of lateral earth pressure and the equivalent resultant pressure on the wall. Density of soil = 1900kg/m^3, K_a = 0.33 [5]
	ii)	A major oil spill causes the earth-fill to be saturated to half the height of the platform. Determine the distribution of the resultant lateral pressure. Density of oil = 1100kg/m^3 [8]

Question 5

a)	i)	List three (3) types of defects that may occur in welds. [3]
	ii)	A 6mm fillet weld is used to connect a strut to a truss chord. The axial force in the strut is 250kN. Determine a suitable length of weld if; Structural steel grade – 43, electrode strength E43. [3]
b)	i)	Fig. 5.1 below shows a bolted splice of a tensile member. Determine the capacity of the splice if 20mm diameter ordinary bolts are used. [10]
c)	i)	What is the principal difference between ordinary and high strength friction grip (HSFG) bolts? Which situations are HSFG bolts more suitable than the former. [3]
	ii)	If HSFG bolts of the same size were used in the splice in Fig. 5.1, what would the capacity of the splice then be? [2]

Table 5a Strength of Ordinary Bolts and Bearing Strengths of Bolts and connected elements (N/mm^2)

Strength of Bolts (N/mm^2)	Bolt Grade	
	4.6	**8.8**
Shear Strength p_s	160	375
Bearing Stregth p_{bb}	435	970

Bearing strength of Connected elements	Steel Grade		
	43	**50**	**55**
Bearing Strength p_{bs}	460	550	650

Table 5b Proof Loads of High Strength Friction Grip Bolts

Nominal Bolt Diameter	Proof Load (kN)
M12	49.4
M16	92.1
M20	120.0
M22	177.0
M24	201.0

d) When bolts are used to connect structural elements, minimum distances are specified from the bolt to the edge of the connected element. Illustrate two (2) possible failure modes of the connection if the minimum distances are violated.
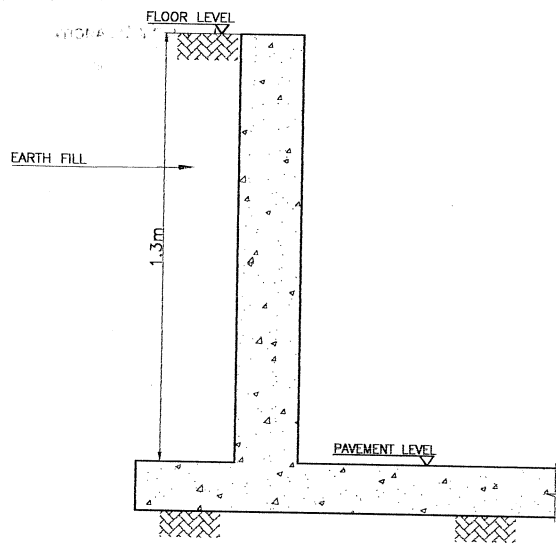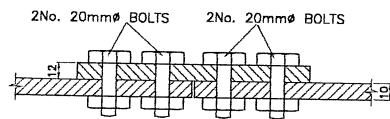
[4]

THE END

FLOOR LEVEL

EARTH FILL

1.3m

PAVEMENT LEVEL

FIG. 4.1

2No. 20mmø BOLTS   2No. 20mmø BOLTS

12

10

FIG. 5.1