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

DEPARTMENT OF ARCHITECTURE
BACHELOR OF ARCHITECTURE (HONOURS) DEGREE

PART I SECOND SEMESTER EXAMINATIONS – MAY 2002
AAR1206 – APPLIED STRUCTURAL STATICS AND DYNAMICS

Instructions ***Time 2 hours***
Answer Question 1 and any two others
Question 1 carries 40 marks; others each carry 30 marks.

Question 1 - Compulsory

Give a detailed outline of the structural design process for a building, from the Client's brief through to preparation of drawings. [40]

Question 2

a) For the structures illustrated in Fig 1.1a) below determine all the reactions at the supports.

b) For Fig 1.1a) i) above, what does the reaction at 'A' signify?

c) Fig 1.2b) shows a system of loads applied at a point in a structure. Determine the horizontal and vertical components of the loads and hence fully describe the resultant force.

d) Illustrate simple structures that represent the following;

i) a determinate structure.
ii) an indeterminate structure.
iii) an unstable structure. [30]

Question 3

a) i) Name two types of floor loads, giving two examples of each.

ii) Give three factors that affect the wind load on a building.
Briefly explain how each affects the wind load.

b) The following characteristic loads are anticipated in a column for a proposed building;
dead load = 230kN
imposed load = 180kN

i) What is the design load for serviceability limit state?
ii) What is the design load for ultimate limit state? [30]

b) A mass of soil retained by a reinforced concrete retaining wall to a height z(m) will exert lateral earth pressure onto the wall. A liquid retained in the same manner to the same depth also exerts lateral hydrostatic pressure on the wall. Discuss the distribution of the pressure for each case, describing the major difference between them.

c) A reinforced concrete wall retains the following

i) 2.4m high earth backfill. Soil density = 1900kg/m^3, active pressure coefficient = 0.35
ii) 3.2m deep wastewater with density 1090kg/m^3.

For the above cases, illustrate the pressure distribution, showing the equivalent resultant pressure. [30]

Question 4

a) What do you understand by;
   i) Serviceability limit state
   ii) ultimate limit state

With a reference to a structure. Give an example of each.

b) Briefly describe what you understand by;

   i) analysis of a structural system
   ii) structural design

c) Define i) stress
   ii) strain

How are stress and strain related?

c) A plain concrete stub column carries the following loads;

Dead load - 460KN
Imposed load - 350KN

Determine suitable dimensions for the column based on;

i) Permissible stress design
Permissible stress of concrete = $19N/mm^2$

ii) Limit state design
Design strength of concrete = $25N/mm^2$ [30]

Question 5

a) Tensile members are widely used for their high strength/weight ratio. Illustrate 3 examples of structures employing tensile structures, indicating the members in tension.

b) i) A mild steel flat bar is used as a tension member in a truss. Analysis of the truss shows that the tensile axial force in the bar is 160kN. If the strength of mild steel is $275N/mm^2$, determine the minimum width of the bar if it is 6mm thick.

   ii) If at one end, a 14mm diameter hole is drilled for bolting, what thickness of the bar would be required to carry the same load if the width is maintained?

c) What are the two principal modes of failure of members with axial compressive loads?

d) i) Illustrate four sections commonly used as columns, labelling their distinct features where applicable.
   ii) What is the principal difference between short and slender columns? Briefly describe their behaviour when loaded with concentric axial loads. [30]

THE END

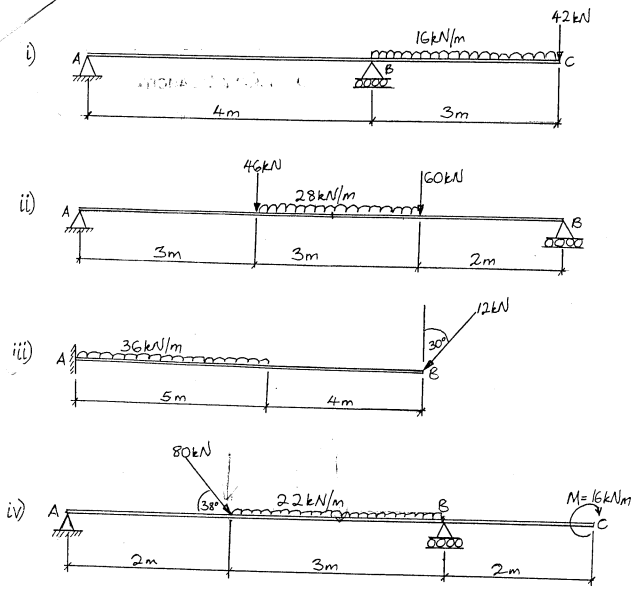

Fig 1.1a

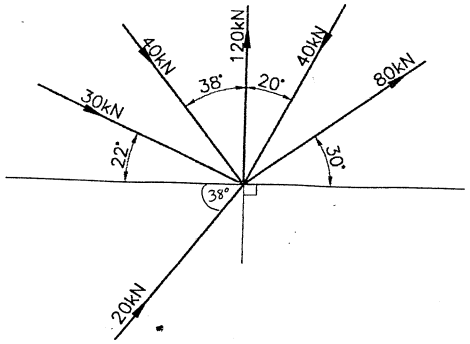

FIG. 1.2b