

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART III FIRST SEMESTER EXAMINATION- DECEMBER 2005
DESIGN OF STRUCTURES I- TCW 3103

INSTRUCTION

Answer All Question

Time: Four hours

Total Marks : **100**

Open Book Examination.

QUESTION ONE

A floor plan of a building is shown in Figure 1.0. The loading on the slab is as follows

Screed, Finish, Partitions 2.0 kN/mm²

Imposed load 3.0 kN/mm²

The characteristic material strengths are $f_{cu} = 30\text{N/mm}^2$; $f_y = 460\text{N/mm}^2$

Take density of reinforced concrete as 24.0 kN/m³

Assume soil bearing pressure as 150 kN/mm²

Design the following elements:

- (a) The slab
- (b) Beam B/1-2
- (c) Column B/1
- (d) Foundation for column B/1

Show complete reinforcement details of any one element.

40 Marks

QUESTION TWO

A simply supported steel beam of 6.0m span is required to carry a uniform dead load of 40 kN/m and an imposed load of 20 kN/m. The floor slab system provides full restraint of the beam

If a 457x151xUB60 of Grade 43 steel is available for this purpose, check its adequacy in terms of bending, shear and deflection.

Take Modulus of Elasticity $E = 205\text{ kN/mm}^2$

Section properties are

$S_x = 1284\text{ cm}^3$; $Z_x = 1120\text{ cm}^3$; $I_x = 25464\text{ cm}^4$

20 Marks

QUESTION THREE

A Grade 43 steel column having 6.0m effective length for both axes is to carry pure axial loads from the floor above. If a 254 x 254 UC 73 is available, check the ultimate load that can be imposed on the column. The self weight of the column may be neglected.

Section properties are

$$A = 92.9 \text{ cm}^2 ; r = 6.46 \text{ cm}$$

20 Marks

QUESTION FOUR

Design the joists of a timber floor carrying the following loads

(a) Flooring is tongue and groove	0.11 kN/m ²
(b) Ceiling	0.20 kN/m ²
(c) Self weight of joist	0.12 kN/m ²
Imposed load	1.5 kN/m ²

Assume the following

Strength Class of timber SC 3

For SC 3 Grade

Bending stress parallel to grain	= 5.3 N/mm ²
Shear stress parallel to grain	= 0.67 N/mm ²
Modulus of Elasticity E	= 8800 N/mm ²
Long term loading	

Modification Factors:

K3, duration of loading	1.0
K8 Load sharing system	1.1
K7 Depth factor	
for d = 225	1.032
for d = 200	1.046

Span of Joist = 4.0m

Spacing of joists = 400 mm c/c

20 Marks

