Section A – Reinforced Concrete

The attached drawing, FigQA, details the structural framing arrangement of a two storey building of in-situ reinforced concrete construction. Single pad footing foundations are provided to each individual column.

The ground floor will comprise ground bearing concrete slab construction and no loading from this level will be carried by the structural framing.

Lateral stability of the building will be provided independently of the main beam and column framing shown.

A1. Column B3 and associated pad footing:

(i) Design column B3 (225x225) and its pad footing from roof to formation level. (26 marks)

(ii) Detail the column and pad footing designed in A1.(i) above. (15 marks)

(iii) Prepare a bar bending schedule for the column detailed in A1.(ii) above. Include the completed schedule with your Answer Book. (4 marks)

(Total QA1. 45 marks)
A2. Solid Slab between grid lines 2 & 5 (1st floor level)

(i) Design the slab between grid lines 2 & 5 at first floor level. The slab is continuous over beam supports along grid lines 3 & 4 and should be designed as simply supported along grid lines 2 & 5. (15 marks)

(ii) Detail the slab designed in A2.(i) above. (10 marks)

(Total QA2. 25 marks)

Design Information:

Durability and Fire:
Exposure: Substructure – moderate superstructure – mild
Fire: 1 hour

Loading: (Characteristic Values)
Dead Loading: Specific weight of reinforced concrete = 24 kN/m³
Weight of suspended ceiling & services, floor finishes etc: allow 2.0kN/m² (all levels)

Imposed Loading: Apply uniformly distributed loadings of Table 1, BS6399-1:1996
Reading rooms / Libraries: Activity/Occupancy Category E
1st floor: Weight of removable partitions/fittings: allow 1.5kN/m²
Roof: Allow 1.5 kN/m² for maintenance access

Materials:
Concrete : Grade 35 (maximum aggregate size 20mm)
Reinforcement: Main – high yield steel, f_y = 460 N/mm²
Links – mild steel, f_y = 250 N/mm²

Soil Conditions:
Safe bearing capacity of soil at formation level = 180 kN/m²
Section B – Masonry

Design is to conform to IS 325:Part 1 and/or BS 5628:Part 1

B1. Fig.QB1 gives details of two masonry walls which support a reinforced concrete slab as shown.
Design the wall using 440mm x 215mm x 100mm solid concrete blocks
Note that the bearing length of the slab on each wall is to be 0.9 x wall thickness
(Assume that the horizontal cross-sectional area of each of the walls is greater than 0.2m²)

Design Data:
Characteristic dead load from concrete slab (including slab self weight) = 8.5 kN/m²
Characteristic imposed load from concrete slab = 11.5 kN/m²
W_{Blockwork} (Characteristic) = 18.0 kN/m³
Manufacturing/construction control = Normal/Normal

(18 Marks)

B2. Fig.QB2 gives details of two masonry walls which support a small fuel tank.
The single-skin walls comprise 440mm x 215mm x 190mm solid concrete blocks as shown.
The load from the tank is distributed through timber beams and may be considered to be concentrically applied to each wall.
Determine a suitable blockwork/mortar combination which may be used for the walls.

Design Data:
Ultimate Design Load of the tank = 200kN
W_{Blockwork} (Characteristic) = 18.0 kN/m³
Manufacturing/construction control = Normal/Normal

(12 Marks)
PLAN

NOTES:
1. - Column position
   All columns are 225 x 225
2. All dimensions in mm U.K.
3. Scale: 1/200

ELEVATION

Cork Institute of Technology
Spring Examination 2000
Bachelor of Engineering (Ord.) in Civil Engineering
Structural Design I
(Concrete & Masonry)

Fig. QA
<table>
<thead>
<tr>
<th>Member</th>
<th>Bar Mark</th>
<th>Type and size</th>
<th>No. of bars in each</th>
<th>Total no.</th>
<th>Length of each bar</th>
<th>Shape code</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E/F (mm)</th>
</tr>
</thead>
</table>

This schedule complies with the requirements of BS 8110:1985

* Specified in multiples of 5 mm.
* Specified in multiples of 25 mm

Q1.1 (b) Please return with answer book

STUDENT NAME: ___ ___ ___

STRUCTURAL DESIGN 1 (CONCRETE A bb10000)