

UNIVERSITY OF BOLTON
FACULTY OF ADVANCED ENGINEERING AND
SCIENCES

BSc(HONS) CIVIL ENGINEERING
SEMESTER ONE EXAMINATION 2011/2012

STRUCTURAL PLANNING

MODULE NO: BLT3020

Date: Friday 20 January 2012

Time: 10.00 am – 12.00 noon

INSTRUCTIONS TO CANDIDATES:

This is an OPEN BOOK examination.
You may bring your own notes and documents into the examination room.

Sketches should be neat and approximately to scale.

There are FOUR questions. Marks for each question are shown.

Attempt only THREE questions.
Answer Question 1 and Question 2.
Answer Question 3 or Question 4.

Graph paper is provided.

All answers are to be written in the answer book or on the graph paper provided. Pre-prepared material will not be accepted.

Total 100 marks for the paper.

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Background information

1. Refer to the sketches (Figures 1 and 2) and structural information provided. It is proposed to construct a four storey healthcare building with a footprint of 36m x 60m.
2. The upper storeys of the proposed building will comprise a structural frame of either steel or concrete. The developer wants to investigate both options. For the purposes of this exam you must only consider either steel or concrete. The choice is yours. Do not consider both steel and concrete.
3. At ground level there is internal car parking. The approximate location of the access to the car park is shown in Figure 1. The developer requires that the car park be designed to provide the maximum possible number of parking bays. There are no restrictions on column locations at ground level.
4. At 1st floor level and 2nd floor level, the architect has decided on the setting out of the columns within the offices/consulting rooms. The columns are to be positioned at approximately 6.0m centres both longitudinally and transversely.
5. At 3rd floor level it is proposed to construct a sports hall. At this level, there must be a clear uninterrupted space and no internal columns. External columns may be spaced to suit the structural framing. The outline of the roof structure has not yet been decided and so you are free to propose to the architect a flat, sloping or any other shaped roof.
6. The perimeter cladding of the whole building is non-structural and so the structure will need to extend its support to the edges of the building. The final choice of cladding has not been made. It will be either non-structural masonry or a "rainscreen system". For the purposes of this exam you must only consider either non-structural masonry or a "rainscreen system". The choice is yours. Do not consider both types of cladding.
7. The location of the services and stair/lift zone has not yet been decided. This will be confirmed at a later date and should not be considered at this stage. The perimeter bracing/shear walls can be located to suit your structural requirements. The bracing/shear walls must provide overall lateral stability for the building in all directions.
8. The maximum wind force acting on the building, in any direction, is 1.2 kN/m² (this force includes both pressure and suction).
9. All other forces, loads etc acting on the building must be calculated or estimated.

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Answer Question 1 and Question 2

Question 1

Produce preliminary general arrangement sketches (i.e. annotated stick drawings) showing the following:

(a) A plan of the building at 2nd floor level showing the structural layout of beams, internal and external columns and floor slab or decking etc. (15 marks)

(b) A plan of the building at 1st floor level showing the structural layout of beams, transfer beams, internal and external columns and floor slab or decking etc (make it clear in your plan which beams are transfer beams). (15 marks)

(c) A transverse section through the building showing the arrangement of the columns, beams and transfer beams etc. At roof level, indicate the chosen structural form and its structural layout but do not provide structural calculations for the roof structure. (15 marks)

(d) Justify the section sizes chosen for the main structural elements at 2nd floor level (shown in part (a) above) making use of “rule of thumb” or very brief preliminary calculations. There is no need to provide calculations relating to the bracing. (20 marks)

Total 65 marks

Question 2

Produce a preliminary sketch layout plan at ground floor level showing your proposed access arrangements for the car park and the car park layout. Show the locations of structural columns, vertical bracing/shear walls and car parking bays and state clearly the maximum number of spaces that your scheme provides.

20 marks

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Answer Question 3 or Question 4

Question 3

Present **two** options for the construction of the **roof structure** using notes and freehand sketches (ie do not use your ruler). The sketches should show the sizes of the main structural elements in the roof. Do not do calculations but include approximate dimensions in your sketches. Show the location of bracing or shear walls but there is no need to provide calculations relating to the bracing.

15 marks

Question 4

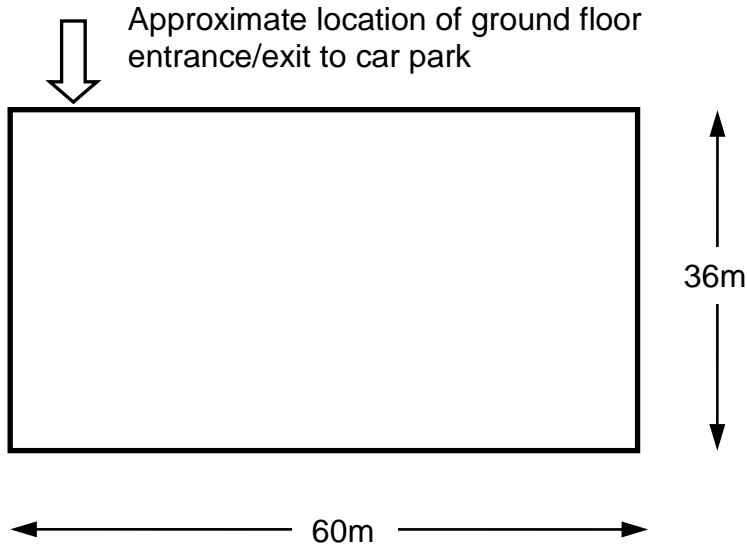
Show how the whole building structure (including the roof) will sustain the applied wind loads using notes and freehand sketches (ie do not use your ruler). Do not carry out calculations. Ignore the design of the foundations for any shear walls or bracing.

15 marks

END OF QUESTIONS

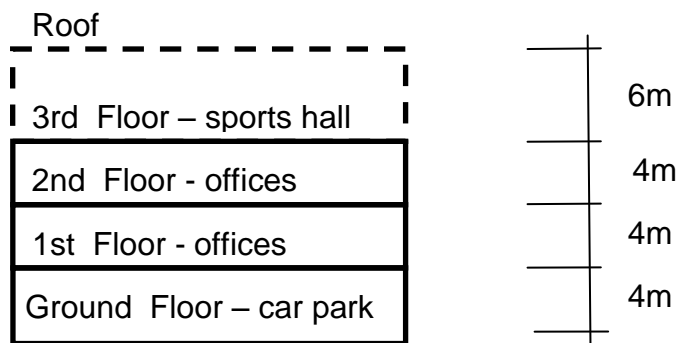
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Plan showing the footprint of the proposed 4 storey building

Figure 1



Sectional elevation showing the 4 storey building

Figure 2

END OF PAPER