

**UNIVERSITY OF BOLTON**  
**SCHOOL OF THE BUILT ENVIRONMENT &  
ENGINEERING – RAK CAMPUS**  
**BSc(HONS) CIVIL ENGINEERING**  
**SEMESTER THREE EXAMINATION 2010/2011**  
**STRUCTURAL PLANNING**  
**MODULE NO: BLT3020**

Date: Thursday 1 September 2011

Time: 1.00 pm – 3.00 pm

---

**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.

---

School of the Built Environment & Engineering – RAK Campus  
BSc(Hons) Civil Engineering  
Semester Three Examination 2010/2011  
Structural Planning  
Module No. BLT3020

### Background information

1. Refer to the sketches (Figures 1 and 2) and structural information provided. It is proposed to construct a commercial building with a footprint of 36m x 36m. All floors will be occupied by offices apart from the ground floor which will provide 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 number of parking bays.
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. The architect has decided on the setting out of the *upper* columns (above 2<sup>nd</sup> floor level). These are to be provided at 6.0m centres both longitudinally and transversely. The lower columns (below 2<sup>nd</sup> floor level) at ground floor and 1st floor levels must be at 9.0m centres. The setting out of the upper columns therefore differs from the setting out of the lower columns of the building. A transfer deck will be needed at 2<sup>nd</sup> floor level.
4. The perimeter cladding of the 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.
5. 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. Perimeter bracing/shear walls must provide overall lateral stability for the building in all directions. The bracing/shear walls can be located to suit your structural requirements.
6. A wind force of 0.9 kN/m<sup>2</sup> acts on the building (this force includes both pressure and suction).
7. All other forces, loads etc acting on the building must be calculated or estimated.

**Please turn the page**

School of the Built Environment & Engineering – RAK Campus  
BSc(Hons) Civil Engineering  
Semester Three Examination 2010/2011  
Structural Planning  
Module No. BLT3020

**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 3<sup>rd</sup> floor level showing the structural layout of beams, internal and external columns and floor slab or decking etc.
- (b) A plan of the building at 2<sup>nd</sup> 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).
- (c) A transverse section through the building showing the arrangement of the columns, beams and transfer beams

Justify the section sizes chosen for the main structural elements at 3<sup>rd</sup> floor level (shown in part (a) above) making use of “rule of thumb” or brief preliminary calculations. Show the location of bracing/shear walls but, for this question, there is no need to provide calculations.

**50 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**

**Answer Question 3 or Question 4**

**Question 3**

Draw a neat, true-to-scale, annotated section drawing (1:10) showing the perimeter structure at a location at 3<sup>rd</sup> floor level and its interaction with the cladding. Show all elements of the building fabric and structure. Your drawing should include, as necessary:

- columns
- perimeter wall/cladding
- 3<sup>rd</sup> floor edge beam
- 3<sup>rd</sup> floor slab

**30 marks**

**Please turn the page**

School of the Built Environment & Engineering – RAK Campus  
BSc(Hons) Civil Engineering  
Semester Three Examination 2010/2011  
Structural Planning  
Module No. BLT3020

**Question 4**

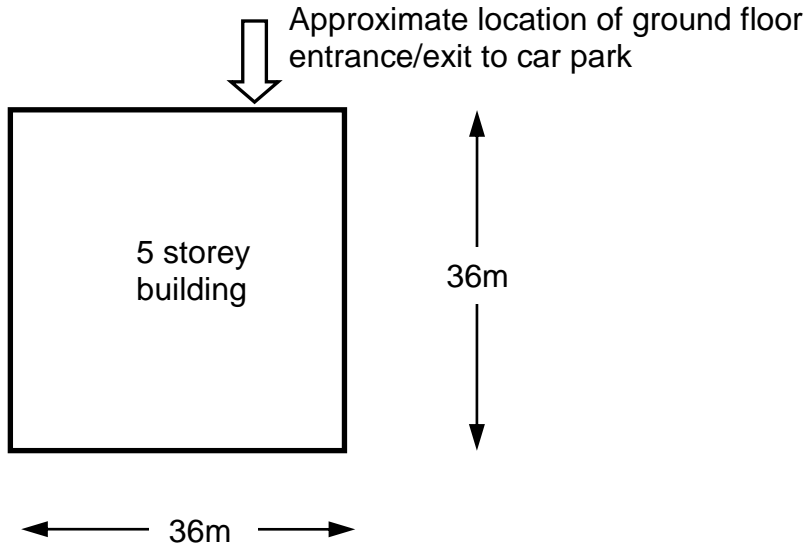
Using notes, calculations and sketches, show how the whole building structure (including the roof) will sustain the applied wind loads. Include calculations to justify the size of the member that carries the greatest wind-induced force or bending moment. Ignore the design of the foundations for the shear wall/bracing.

**30 marks**

**END OF QUESTIONS**

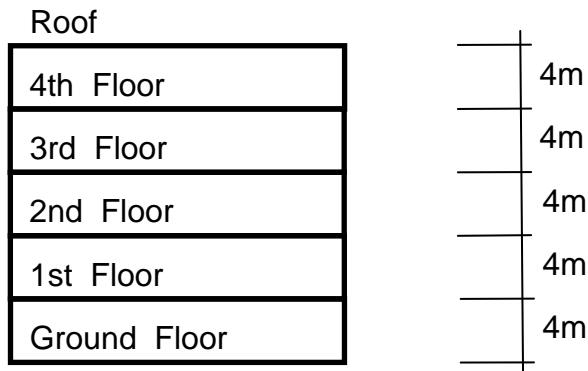
**Please turn the page**

School of the Built Environment & Engineering – RAK Campus  
BSc(Hons) Civil Engineering  
Semester Three Examination 2010/2011  
Structural Planning  
Module No. BLT3020



Plan showing the footprint of the proposed 5 storey building

**Figure 1**



Sectional elevation showing the 5 storey building

**Figure 2**

**END OF PAPER**