

UNIVERSITY OF BOLTON

SCHOOL OF ENGINEERING

BEng (Hons) CIVIL ENGINEERING

SEMESTER ONE EXAMINATIONS 2018/2019

STRUCTURAL PLANNING

MODULE NO: CIE6010

Date: Friday 18th January 2019

Time: 10:00 – 13:00

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 **THREE** questions. Marks for each question are shown.

Attempt **ALL** questions

A3 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 – School building

1. A two storey school building is required for a new town. See Figure Q1.
2. The school building is to provide 24 classrooms located on two levels, equally divided either side of a hall and administration facilities. The classrooms are to be accessed from a central corridor at each level.
3. Columns are only permitted around the perimeter of the building and on the wall lines of the central corridor.
4. The internal clear floor height to all areas, except the hall, is to be 2.8m with a 200mm clear service zone under the structure.
5. An external enclosed staircase is required at each end of the central corridor.
6. The building is to be clad in a flat composite cladding system and the roof is clad with composite profile sheeting.

The structure supporting the floors and roof 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.

Imposed loading (unfactored)

Roof 0.75 kN/m²
Floors 3.00 kN/m²

A horizontal wind force of 1.2 kN/m² acts on the building

Site conditions

7. The site is level and located on the outskirts of the new town.
8. Ground Conditions:

Ground – 1.0m	Top soil and fill
1.0m – 2.0m	Soft clay
2.0m – 6.0m	Stiff clay

No ground water was encountered.

Omit from consideration

Detail design of the external staircases as they do not contribute to the overall stability.
Design of foundations.

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Question 1.

Prepare a design appraisal with appropriate sketches indicating a viable structural solution for the proposed scheme. Indicate clearly the functional framing, load transfer and stability aspects of the scheme.

For the purposes of this question, you must only consider either steel or concrete for the main structural frames. Do not consider both steel and concrete.

Justify the reasons for the solution.

(30 marks)

Question 2.

For the design solution recommended in Question 1:

- a) Prepare sufficient preliminary design calculations to establish the form and size of the principal structural elements (at least one beam, one column, and one slab).

For this question, omit the design of foundations.

(20 marks)

- b) Prepare general arrangement plans, at least two sections and two elevation to show the dimensions, layout and disposition of the structural elements for estimating purposes. Prepare clearly annotated sketches to illustrate details of:

- (i) The roof at eaves level
(ii) A perimeter column at ground floor level.

(30 marks)

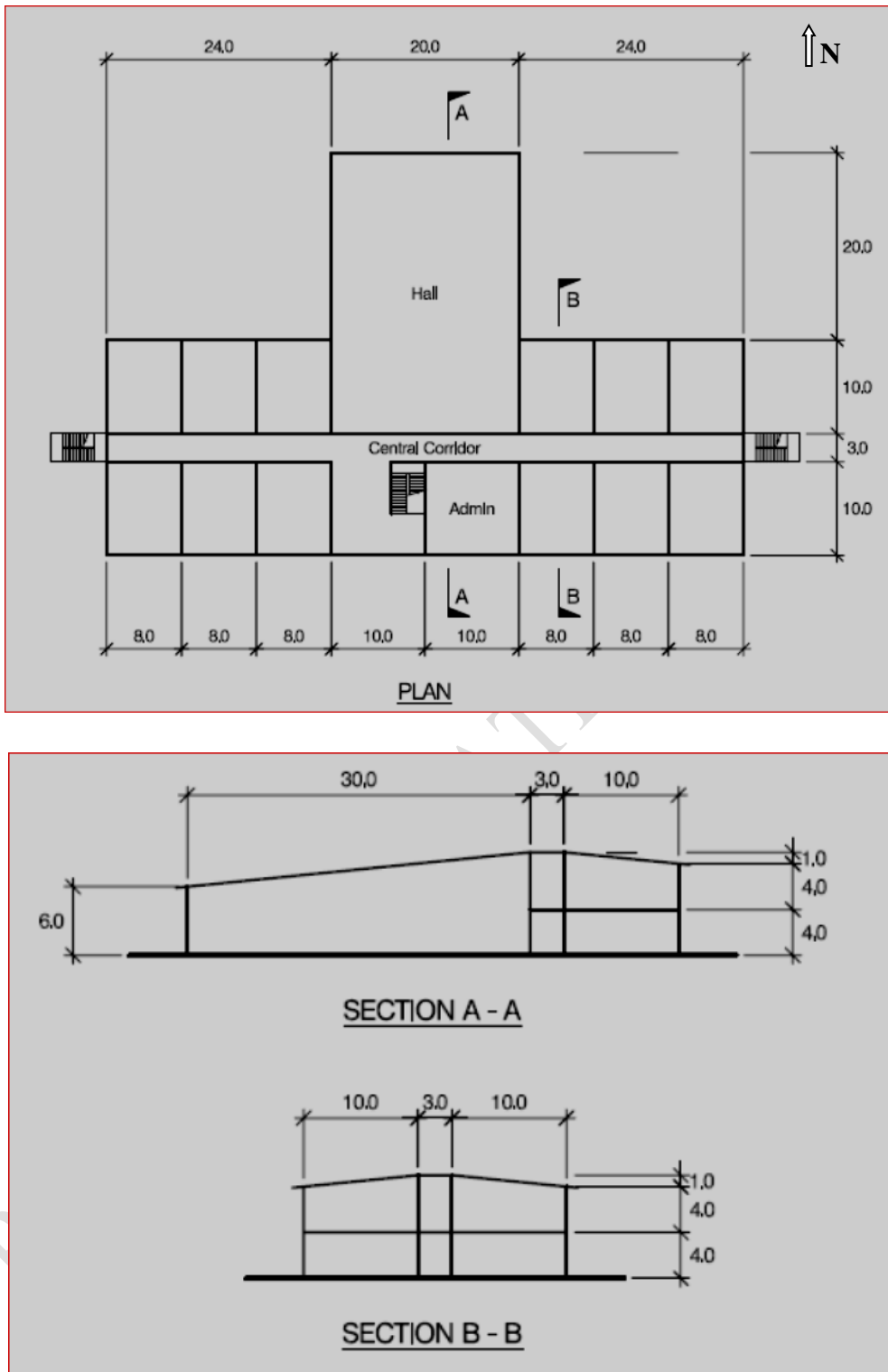
Question 3

Using notes, calculations and sketches, show how the structure will sustain the wind loads on the building in the North direction. 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 shear walls or bracing, etc.

(20 marks)

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NOTE: All dimensions are in metres

Figure Q1

END OF QUESTION