7ENT2033: Design of Steel and Composite Structures

Coursework 1 Brief

2024-2025 Academic Year

(Semester B)

Table of Contents

List of Figures

List of Tables

1 Overview

Your consultancy company is to **technically assist** an architect in the ***Development of a Composite Framed Multi-storey Office Building*** on the outskirts of London, England (UK). You are to complete two main tasks as shown in Table 1-1.

Table 1-1: Project tasks

Task	Details
Coursework 1	develop **conceptual structural design options**, and then propose a single concept

Important notes:

(i) Key dimensional information about this building is given in Figure 1-2 and Figure 1-4 as well as in Table 1-2. The number of storeys and plan dimensions are to be derived from this data.

(ii) The building has a flat roof and a ground bearing reinforced concrete slab with *Continuous Flight Auger* (CFA) piles. The architect does not require advice on the ground floor and foundations other than column loads at foundation level.

(iii) The structural system consists of a steel frame acting compositely with a reinforced concrete slab.

(iv) The slab acts compositely with its metal decking.

(v) It is important for constructability that neither the slabs nor the beams require temporary propping during construction.

(vi) Details of the floor system are shown in Figure 1-1 to Figure 1-4. The chosen metal decking should be chosen from the information in the brochure listed in the bibliography.

Each student is expected to spend **at least 50 hours** working on this assignment.

This project assignment assesses the following module *Learning Outcomes* (from Definitive Module Document):

(i) Demonstrate a comprehensive knowledge of mathematics, statistics, and engineering principles to the solution of complex problems design problems in the area of steel and composite structures.

(ii) Design solutions for complex problems in the area of steel and composite structures that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate.

(iii) Function effectively as an individual, and as a member or leader of a team.

(iv) Evaluate effectiveness of own and/or team performance.

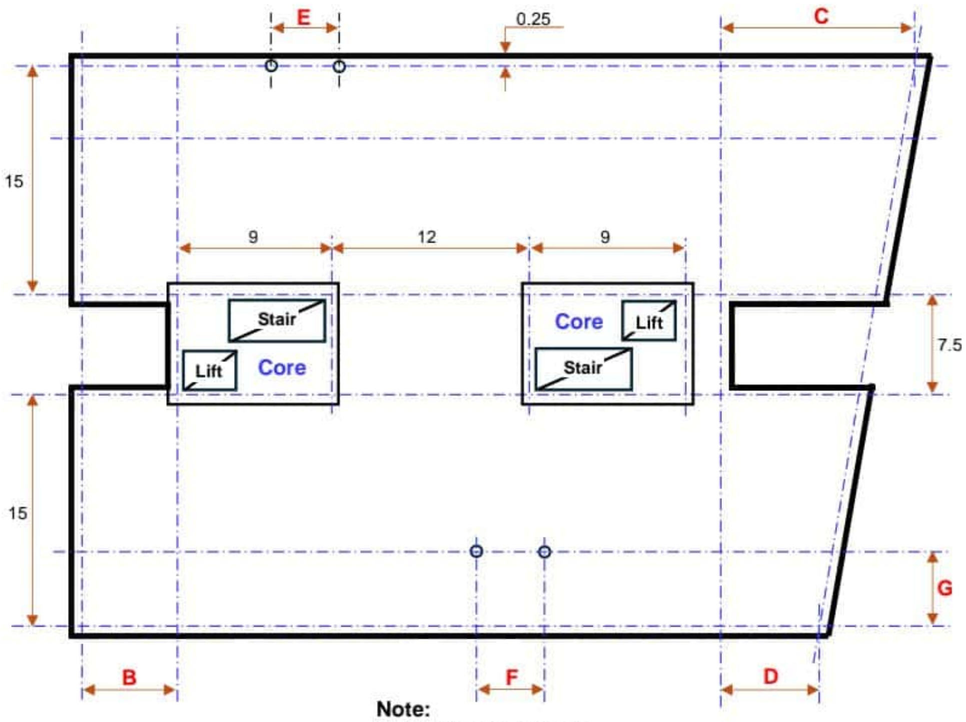
(v) Formulate and analyze complex steel and composite structures problems to reach substantiated conclusions.

1.1 Project information

Student-specific project details are to be obtained from the MS Excel spreadsheet downloadable here. Additional key project information is provided in Table 1-2.

Table 1-2: Selected project design specifications / information

Finishes in the core areas:	– there are no floor finishes in the stairs and plant areas – there are 50 mm of solid finishes (screed and tiles) in the bathrooms
Assumptions:	– slabs are of lightweight concrete – assume that the loading is for 4.0 kPa live load plus 1.0 kPa for partitions – use S275 steel grade as per Cobb (2014) **Note:** State appropriate assumptions for any missing information



Note:
(a) Drawing Not to Scale
(b) All dimensions in meters (m)

Figure 1-1: Building plan

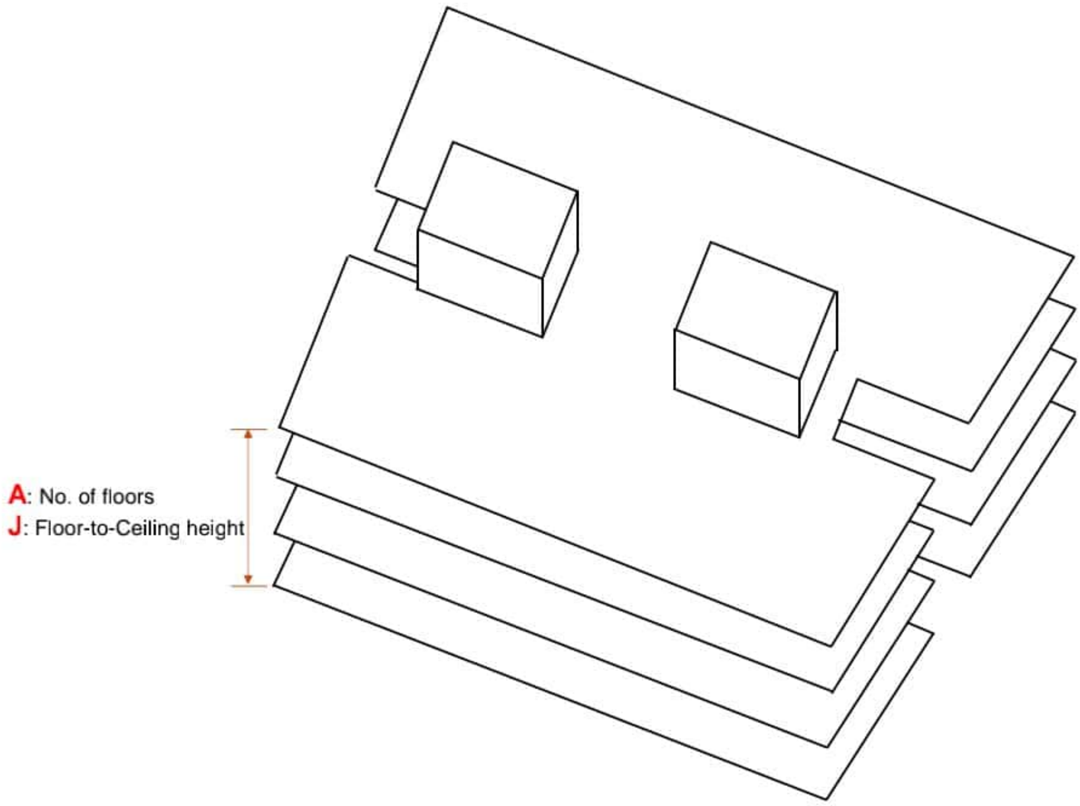


Figure 1-2: Building 3-D projection sketch

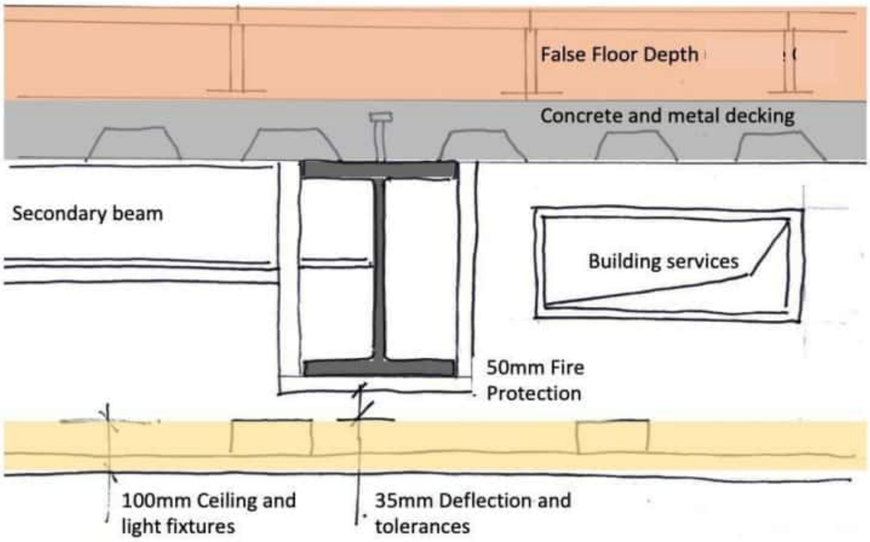


Figure 1-3: Sectional information – floor solution

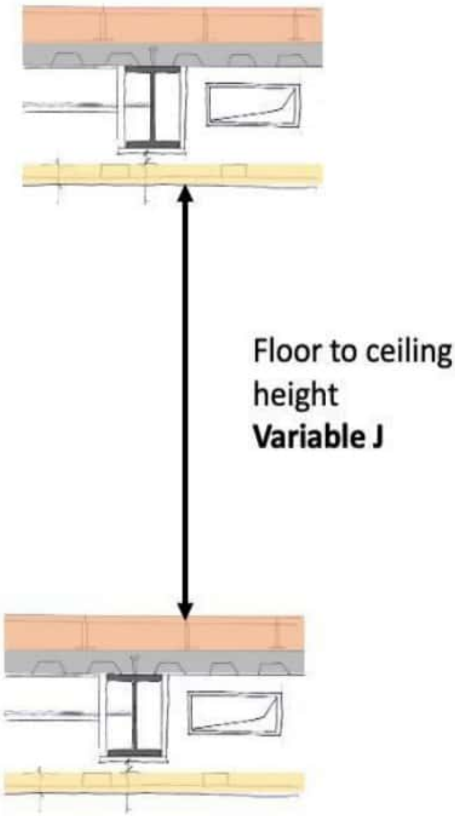


Figure 1-4: Sectional information – floor-to-ceiling dimension

1.2 Assessment weighting

	Weighting	Details
Coursework 1	50%	See assessment rubric on pp. 8 for details

2 Coursework 1: Conceptual Structural Design Options for a Composite Framed Multi-storey Building

2.1 Sub-tasks (required steps)

2.1.1 In your assigned Project Group (see here), discuss the project in order to develop a clear understanding of its scope, and client requirements and tasks. Note the following:

(i) All meeting/s to discuss the project should preferably be held in person, but online (Zoom or MS Teams) meetings are acceptable;

(ii) The 10-15-minute meeting must be video-recorded, with each student introducing themselves by name and SRN before the meeting starts;

(iii) The recorded file;

- must be audible and clearly show each student's face throughout the meeting, and
- are to be uploaded onto StudyNet by **Friday 21 February 2025 at 23h59**.

(iv) Following the group discussion, explain in your own words your understanding of the coursework briefing. **Note:** Word limit is 400 words max. This should form part of your individual submission (see Section 2.2 (pp. 6) of this brief).

2.1.2 **Develop three conceptual structural design options for the steel beam layouts for a typical floorplate:**

(i) Produce three hand-drawn A3 sketch plans at an appropriate scale.

(ii) Use two different line thicknesses for secondary/tertiary beams (thinner) and primary/transfer beams (thicker).

(iii) Show slab edges and holes/openings.

(iv) Do not calculate beams sizes at this stage.

(v) Choose the slab and metal decking specification needed to minimize material use.

(vi) Identify beams that may require web openings for building services.

(vii) State your opinion of the advantages and disadvantages of each layout on its sketch.

(viii) Select one option to develop further and state your reason for this selection on its sheet. **Your chosen option should have a suitably numbered grid**.

2.1.3 **Develop minimum weight and minimum depth floorplate versions for your chosen option:**

(i) Using the design tables in Cobb (2014) develop two versions of your chosen option for beam size and slab thicknesses (a minimum steel weight and minimum steel depth).

(ii) Noting that the tables in the reference are only for primary and secondary beams in internal building bays, develop a justified approach to estimating edge and other special case beams sizes based on these.

(iii) Calculate the total steel weight for the beams in each of the two floorplate options, adding 5% as an allowance for the weight of connections.

(iv) Define the overall floor depth (i.e., Soffit of ceiling up to Finished Floor Level) and use that to calculate the required Floor to Floor height.

(v) Show all this information on annotated A3 hand-drawings for each option.

2.1.4 **Develop typical column designs:**

(i) Identify at which level the columns will be spliced and explain why.

(ii) Assess the key design load for each column for a typical internal, typical perimeter and typical corner case. State the required steel size for all these cases.

2.1.5 **Develop a sketch showing beam layouts for the required core layout:**

(i) Identify which beams are composite and which are non-composite.

(ii) Identify the changes of floor level required.

(iii) Indicate potential beam sizes and justify your choices.

(iv) Identify the location of vertical steel braced bays for horizontal stability.

(v) Tabulate the key staircase dimensional information for your design.

(vi) Show all this information on an annotated A3 hand-drawing.

2.1.6 **Develop a design for the required vertical bracing using hand calculations:**

Indicate the bracing member sizes on an annotated A3 hand drawing with a supporting calculation.

2.2 Submission Requirements and Deadlines

2.2.1 Your individual **single pdf file report** must respond, in sequence, to the entire briefing as follows:

(i) Clear and legible handwritten/hand drafted answers for each step of the briefing, ideally using a calculation paper and sketching paper template. These will need to be scanned and incorporated in the PDF file.

- Responses to the briefing must be clearly presented in detail in a logical sequence, including references.
- Each step must be clearly identified in the calculation notes.
- Assumptions must be clearly justified with an appropriate reference.

(ii) The PDFs should use 11pt Arial font with 1.5 line spacing (i.e. Paragraph → Line Spacing → 1.5 lines).

(iii) UH regulations governing assessment offences including Plagiarism and Collusion (UPR AS14) are available from here.

(iv) UH guidance on avoiding plagiarism can be found here (see the Referencing section).

2.2.2 The submission deadlines for this assignment are available on StudyNet:

Late submission (submission after the 'Due date' but before the 'Until date') receives penalties as clearly explained below:

For postgraduate modules, late submission of any item of coursework for each day or part thereof (or for hard copy submission only, working day or part thereof) for up to five days after the published deadline, coursework relating to modules at Level 7 submitted late (including deferred coursework, but with the exception of referred coursework), will have the numeric grade reduced by 10 grade points until or unless the numeric grade reaches or is 50. Where the numeric grade awarded for the assessment is less than 50, no lateness penalty will be applied.

2.2.3 Your individual **single pdf file report** must be uploaded onto the module site on StudyNet.

2.3 Assessment Criteria

2.3.1 A score of **at least 50%** represents a pass mark.

2.3.2 Your work will be marked against the grading criteria given in the rubric.

2.3.3 The mark will be based on the quality of the work submitted and will be moderated according to standard procedures. **Note that the criteria must be attended <u>in its entirety</u> to be awarded the corresponding grade.**

2.4 Grading Rubric and Feedback

2.4.1 See Appendix A (pp. 8) for the grading rubric.

2.4.2 Formative feedback can be given during practical sessions on request.

2.4.3 Summative feedback will be given to all submitted reports.

2.5 Bibliography

Publications are available on StudyNet → "Online Library" → "A-Z list of search sources" → "British Standards Online" or "Construction Information Service".

Cobb (2014), Structural Engineer's Pocket Book: Eurocodes, Taylor & Francis Group

BCSA (2023), National Structural Steelwork Specification for Building Construction: 7th Edition, 1st Revision: BCSA publication number 68/23, BCSA

Online manufacturer's steel section information for the UK can be obtained from: https://www.steelforlifebluebook.co.uk

Online information on UK's industry's standard approaches to connection design can be obtained from: https://www.steelconstruction.info/The_Green_Books

Metal decking should be from Tata's ComFlor range. Information can be obtained from the manufacturer's online brochure at: https://www.tatasteeleurope.com/construction/products/flooring/composite-floor-deck

Staircase requirements should be based on Approved Document K of the UK Building Regulations: Protection from falling collision and impact, available online at: https://assets.publishing.service.gov.uk/media/5a79b642e5274a684690b8f0/2077370.pdf

Appendix A: Grading rubric for Coursework 1

		Points (score)										
Criterion (sub-task)		**100 to >95 Pts**	**95 to >85 Pts**	**85 to > 75 Pts**	**75 to >65 Pts**	**65 to >55 Pts**	**55 to >45 Pts**	**45 to >35 Pts**	**35 to >25 Pts**	**25 to >10 Pts**	**10 to >0 Pts**	**0 Pts**
Summarized understanding of the coursework briefing and based on the group meeting discussion/s with a word limit of 400 words	**15**	Student's summary reflects a comprehensive understanding of the project, and reflects clearly the group discussion technical outcomes, with critical specificity relevant to the project. The student attended the group meeting and contributed significantly to the technical discussions as evidensed by the recorded video file submission.	Student's summary reflects a comprehensive understanding of the project Tasks 1 and 2, and reflects clearly the group discussion outcomes. The student attended the group meeting and contributed a lot to the technical discussions as evidensed by the recorded video file submission.	Student's summary reflects a excellent understanding of the project Tasks 1 and 2, and reflects clearly the group technical discussion outcomes. The student attended and contributed to the group meeting as evidensed by the recorded video file submission.	Student's summary reflects a very good understanding of the project Tasks 1 and 2, and reflects clearly the group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	Student's summary reflects a good understanding of the project Tasks 1 and 2, and reflects the group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	Student's summary reflects a general understanding of the project Tasks 1 and 2, and reflects the general group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	Student's summary reflects a little understanding of the project Tasks 1 and 2, and reflects the little group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	Student's summary reflects a marginal understanding of the project Tasks 1 and 2, and reflects the marginal group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	Student's summary reflects little to no understanding of the project Tasks 1 and 2, and reflects little to no group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	Student's summary reflects very little understanding of the project Tasks 1 and 2, and reflects very little group technical discussion outcomes. The student attended and contributed to the group meeting as evidenced by the recorded video file submission.	No marks
Conceptual structural design options for the steel beam layouts for a typical floorplate	**25**	The student has shown exceptional understanding of the three conceptual design concepts, clearly listing the advantages and disadvantages thereof. Student has demonstrated a high level of innovation in their conceptual design options. The sketches show outstanding skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is carefully done and justified to minimize material use. All the beams that may require web openings for building services have been clearly identified. The student has presented a very strong and clear justification for the selected design option that is presented in a clearly numbered grid.	The student has shown outstanding understanding of the three conceptual design concepts, clearly lsting the advantages and disadvantages thereof. Student has demonstrated innovation in their conceptual design options. The sketches show outstanding skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done and justified to minimize material use. All the beams that may require web openings for building services have been clearly identified. The student has presented a strong and clear justification for the selected design option that is presented in a clearly numbered grid.	The student has shown excellent understanding of the three conceptual design concepts, clearly listing the advantages and disadvantages thereof. Student has demonstrated some level of innovation in their conceptual design options. The sketches show excellent skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done and justified to minimize material use. All the beams that may require web openings for building services have been identified. The student has presented a clear justification for the selected design option that is presented in a clearly numbered grid.	The student has shown very good understanding of the three conceptual design concepts, clearly listing the advantages and disadvantages thereof. Student has shown moderate innovation in their conceptual design options. The sketches show very good skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done and moderately justified to minimize material use. Some of the beams that may require web openings for building services have been identified. The student has presented a moderate justification for the selected design option that is presented in a clearly numbered grid.	The student has shown good understanding of the three conceptual design concepts, clearly listing some of the advantages and disadvantages thereof. Student has shown some innovation in their conceptual design options. The sketches show good skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done and justified to minimize material use. Beams that may require web openings for building services have been identified. The student has presented a moderate justification for the selected design option that is presented in a clearly numbered grid.	The student has shown marginal understanding of the three conceptual design concepts, with some listing the advantages and disadvantages thereof. Student has shown marginal innovation in some of their conceptual design options. The sketches show good skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done and marginally justified to minimize material use. Some beams that may require web openings for building services have been identified. The student has presented a moderate justification for the selected design option that is presented in a clearly numbered grid.	The student has shown little understanding of the three conceptual design concepts, with some listing the advantages and disadvantages thereof. Student has shown little innovation in their conceptual design options. The sketches show little skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done and marginally justified to minimize material use. Beams that may require web openings for building services have not been clearly identified. The student has presented a little justification for the selected design option that is presented in a clearly numbered grid.	The student has shown marginal understanding of the three conceptual design concepts, with no listing the advantages and disadvantages thereof. Student has shown marginal innovation in their conceptual design options. The sketches show marginal skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done but barely justified to minimize material use. Some beams that may require web openings for building services have not been clearly identified. The student has presented a marginal justification for the selected design option that is presented in a clearly numbered grid.	The student has little to no understanding of the three conceptual design concepts, with no listing the advantages and disadvantages thereof. Student has shown very little innovation in their conceptual design options. The sketches show very little skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done but barely justified to minimize material use. Some beams that may require web openings for building services have not been clearly identified. The student has presented a very little justification for the selected design option that is presented in a clearly numbered grid.	The student has very little to no understanding of the three conceptual design concepts, with no listing the advantages and disadvantages thereof. Student has shown very little to no innovation in their conceptual design options. The sketches show very little to no skill in the production of engineering sketch drawings, including the use of appropriate scale, line thicknesses for secondary (thinner) and primary (thicker) beams, and showing slab edges and holes/openings. The selection of the slab and metal decking specification is done but barely justified to minimize material use. Some beams that may require web openings for building services have not been clearly identified. The student has presented very little to no justification for the selected design option that is presented in a clearly numbered grid.	No marks
Development of minimum weight and minimum depth floorplate versions for the chosen option	**20**	The student has developed at least two exceptional design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with an exceptional technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are very well defined and quantified. All the design information (beams, slab and column) is very clearly presented in A3 hand-drawings for each option. All the relevant sections are also shown in the drawing/s.	The student has developed at least two outstanding design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with an outstanding technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are very well defined and quantified. All the design information (beams, slab and column) is clearly presented in A3 hand-drawings for each option. All the relevant sections are also shown in the drawing/s.	The student has developed at least two excellent design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with an excellent technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are well defined and quantified. All the design information (beams, slab and column) is clearly presented in A3 hand-drawings for each option. All the relevant sections are also shown in the drawing/s.	The student has developed at least two very good design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with an very good technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are well defined and quantified. All the design information (beams, slab and column) is clearly presented in A3 hand-drawings for each option. All the relevant sections are also shown in the drawing/s.	The student has developed at least two good design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with an good technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are defined and quantified. Some of the design information (beams, slab and column) is clearly presented in A3 hand-drawings for each option. Some relevant sections are also shown in the drawing/s.	The student has developed at least two marginal design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with a marginal technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are neither well defined nor quantified. Some of the design information (beams, slab and column) is not clearly presented in A3 hand-drawings for each option. Some relevant sections are also shown in the drawing/s.	The student has developed only one design option for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with a marginal technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are neither well defined nor quantified. Design information (beams, slab and column) is not clearly presented in A3 hand-drawings for the one option. Some relevant sections are also shown in the drawing/s.	The student has developed incomplete design options for the beam sizes and slab thicknesses while minimizing the slab and beam depths and ensuring that serviceability is not compromised. The student has come up with a marginal technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are neither well defined nor quantified. Some design information (beams, slab and column) is not clearly presented in A3 hand-drawings. Some relevant sections are shown in the drawing/s.	The student has developed incomplete design options for the beam sizes and slab thicknesses. Slab and beam depths not minimized. The student has come up with a poor and/or non-technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are neither well defined nor quantified. Some design information (beams, slab and column) is not presented in A3 hand-drawings. Relevant sections are not shown in the drawing/s.	The student has not developed design options for the beam sizes and slab thicknesses. Slab and beam depths not minimized the and ensuring that serviceability is not compromised. The student has not come up with a poor and/or non-technical / engineering method to estimate the required beam sizes. The required overall floor depth (i.e. soffit of ceiling up to finished floor level) and the required floor-to-floor height are not defined. Design information (beams, slab and column) is not presented in hand-drawings.	No marks

Grading rubric for Coursework 1 (continued)

		Points (score)										
Criterion (sub-task)		**100 to >95 Pts**	**95 to >85 Pts**	**85 to > 75 Pts**	**75 to >65 Pts**	**65 to >55 Pts**	**55 to >45 Pts**	**45 to >35 Pts**	**35 to >25 Pts**	**25 to >10 Pts**	**10 to >0 Pts**	**0 Pts**
Development of typical column designs	**10**	The student has developed exceptional structurally proficient column designs, referencing relevant standard/s. All column splicing locations/levels have been correctly identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been clearly and sequentially presented. All relevant checks are implemented in the design - durability, deflection, fire resistance, etc. The required optimal sizes for the three (internal, corner and perimeter) columns are clearly presented and duly justified.	The student has developed outstanding structurally proficient column designs, referencing relevant standard/s. Most of column splicing locations/levels have been correctly identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been sequentially presented. All relevant serviceability checks are implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are clearly presented and justified.	The student has developed excellent structurally proficient column designs, referencing relevant standard/s. Most of column splicing locations/levels have been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been sequentially presented. Most of the relevant serviceability checks are implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are clearly presented and justified.	The student has developed very good structurally proficient column designs, referencing relevant standard/s. Most of column splicing locations/levels have been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been sequentially presented. Most of the relevant serviceability checks are implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are presented and justified.	The student has developed good structurally proficient column designs, referencing relevant standard/s. Some column splicing locations/levels have been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been sequentially presented. Some of the relevant serviceability checks are implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are presented but not well justified.	The student has developed marginally structurally proficient column designs, referencing relevant standard/s. Some column splicing locations/levels have been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been sequentially presented. Some of the relevant serviceability checks are implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are presented but not well justified.	The student has developed marginally structurally proficient column designs, referencing relevant standard/s. Some column splicing locations/levels have been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have been sequentially presented. Some of the relevant serviceability checks are implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are presented but not well justified.	The student has developed non-structurally proficient column designs, with limited referencing of relevant standard/s. Many column splicing locations/levels have not been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have not been sequentially presented. Some of the relevant serviceability checks are not implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are presented but not justified.	The student has developed non-structurally proficient column designs, with limited referencing of relevant standard/s. Many column splicing locations/levels have not been identified and justified. The key design load for typical internal, typical perimeter and typical corner column cases have not been presented. Relevant serviceability checks are not implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are not presented.	The student has not developed structurally proficient column designs. No referencing of relevant standard/s. Column splicing missing. The key design load for typical internal, typical perimeter and typical corner column cases have not been presented. Relevant serviceability checks are not implemented in the design - durability, deflection, fire resistance, etc. The required sizes for the three (internal, corner and perimeter) columns are not justified.	No marks
Sketch showing beam layouts for the required core layout	**20**	The student has, for the selected option, developed an exceptionally comprehensive engineering A3-paper size drawing / sketch identifying all the composite and non-composite beams (primary and secondary). All the changes to the floor level have been identified. The potential beam sizes have been identified. All the steel bays to be braced for horizontal stability have been clearly identified. A comprehensive table of key staircase dimensions have been provided. The scale used is perfect for showing all the key details.	The student has, for the selected option, developed a comprehensive engineering A3-paper size drawing / sketch identifying all the composite and non-composite beams (primary and secondary). All the changes to the floor level have been identified. The potential beam sizes have been identified. All the steel bays to be braced for horizontal stability have been clearly identified. A complete table of key staircase dimensions have been provided. The scale used is appropriate for showing all the key details.	The student has, for the selected option, developed a well-detailed engineering A3-paper size drawing / sketch identifying all the composite and non-composite beams (primary and secondary). Changes to the floor level have been identified. The potential beam sizes have been identified. Most of the steel bays that require bracing for horizontal stability have been clearly identified. A complete table of key staircase dimensions have been provided. The scale used is suitable for showing all the key details.	The student has, for the selected option, developed very good engineering A3-paper size drawing / sketch identifying the composite and non-composite beams (primary and secondary). Changes to the floor level have been identified. The potential sizes for most of the beams have been identified. Most of the steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions have been provided. The scale used is suitable for showing all the key details.	The student has, for the selected option, developed good engineering A3-paper size drawing / sketch identifying the composite and non-composite beams (primary and secondary). Changes to the floor level have been identified. The potential sizes for most of the beams have been identified. Most of the steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions have been provided. The scale used is good for showing all the key details.	The student has, for the selected option, developed a conventional engineering A3-paper size drawing / sketch identifying the composite and non-composite beams (primary and secondary). Some changes to the floor level have been identified. The potential sizes for some of the beams have been identified. Some of the steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions have been provided. The scale used is good for showing all the key details.	The student has, for the selected option, developed a basic engineering A3-paper size drawing / sketch identifying some composite and non-composite beams (primary and secondary). Some changes to the floor level have not been identified. The potential sizes for some of the beams have been identified. Some of the steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions have been provided. The scale used is not good for showing all the key details.	The student has, for the selected option, developed a poor engineering A3-paper size drawing / sketch identifying some composite and non-composite beams (primary and secondary). Changes to the floor level have not been identified. The potential sizes for some of the beams have not been identified. Some of the steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions has not been provided. The scale used is not good for showing all the key details.	The student has, for the selected option, developed a very poor engineering A3-paper size drawing / sketch identifying some composite and non-composite beams (primary and secondary). Changes to the floor level have not been identified. The potential sizes for some of the beams have not been identified. Some of the steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions has not been provided. No scale is indicated.	The student has, for the selected option, developed a non-engineering A3-paper size drawing / sketch identifying some composite and non-composite beams (primary and secondary). Changes to the floor level have not been identified. The potential sizes for the beams have not been identified. Steel bays that require bracing for horizontal stability have been clearly identified. A table of key staircase dimensions has not been provided. No scale is indicated.	No marks
Design for the required vertical bracing using hand calculations and A3 hand-drawing with a supporting calculations showing the bracing member sizes	**10**	The student has produced comprehensive designs for the vertical bracings, and a comprehensive well-scaled A3-hand drawing for the same. Referencing of appropriate clauses in the relevant standards is complete. Clear and comprehensive hand calculations are presented.	The student has produced excellent designs for the vertical bracings, and a complete well-scaled A3-hand drawing for the same. Very good referencing of appropriate clauses in the relevant standards is complete. Very good hand calculations are presented.	The student has produced excellent designs for most of the vertical bracings, and a complete scaled A3-hand drawing for the same. Excellent referencing of appropriate clauses in the relevant standards. Excellent hand calculations are presented.	The student has produced very good designs for most of the vertical bracings, and a complete scaled A3-hand drawing for the same. Very good referencing of appropriate clauses in the relevant standards. Very good hand calculations are presented.	The student has produced very good designs for most of the vertical bracings, and a complete scaled A3-hand drawing for the same. Good referencing of appropriate clauses in the relevant standards. Good hand calculations are presented.	The student has produced marginal designs for most of the vertical bracings, and a complete scaled A3-hand drawing for the same. Marginal referencing of appropriate clauses in the relevant standards. Good hand calculations are presented.	The student has produced poor designs for most of the vertical bracings, and a poorly scaled A3-hand drawing for the same. Poor referencing of appropriate clauses in the relevant standards. Poor hand calculations are presented.	The student has produced very poor designs for most of the vertical bracings, and a very poorly scaled A3-hand drawing for the same. Very poor referencing of appropriate clauses in the relevant standards. Very poor hand calculations are presented.	The student has produced little to no designs for most of the vertical bracings, and an incomplete scaled A3-hand drawing for the same. Little to no referencing of appropriate clauses in the relevant standards. Little to no hand calculations are presented.	The student has not produced designs for the vertical bracings, and/or not produced an A3-hand drawing for the same. No referencing of appropriate clauses in the relevant standards. No hand calculations are presented.	No marks