Assignment Title:	Assignment 2 – Yield Line/Slab Design
Assignment Type:	Summative
Assignment Weighting	25% of Module
Word Limit	No limits
Set Date	17th February, 2026
Submission Date:	1 ^{h} March, 2026**
Submission Method:	Gradescope
Feedback Date:	21st, April, 2026**
Type of Feedback:	General/Individual Written feedback

Rationale

Coursework 2 relates to the design of a Reinforced Concrete 2-way flat slab design. The coursework enables you to practice the Yield Line theory taught in the module as well other topics, such as Deflection. Coursework 2 again contains a self-taught exercise in the form of the FE analysis. Finally, the coursework aims to build / refresh your basic RC design knowledge.

Learning outcomes being assessed

Select and apply appropriate computational and analytical techniques to model complex reinforced concrete flat slab design problems and discuss the limitations of these techniques.

Evaluate the environmental and societal impact of solutions to complex design problems, optimising the design solutions to minimise these adverse impacts.

Apply a comprehensive knowledge of mathematics, materials and their behaviour, and engineering principles to the solution of complex reinforced concrete design and analysis problems.

Formulate and analyse complex structural engineering design problems to reach substantiated conclusions. This will involve evaluating available data using fundamental engineering principles and judgment (both existing and new) to work with information that may be uncertain or incomplete and discussing the limitations of the techniques employed.

Assignment Guidance

- Coursework 2 is a MAJOR item of coursework and must be submitted to the School in the usual way on or before **TBC**. (Note: any special arrangements for the submission of coursework previously agreed with part-time students will also apply to this work).

- Assessment No.2 is on R.C Column Design to EC2. This is worth up to 25% of the total mark awarded for Advanced Concrete Design.

- **Each Coursework must be submitted separately** with the School's standard cover sheet for a MAJOR item of coursework. This coursework sheet must also be included as part of the submission.

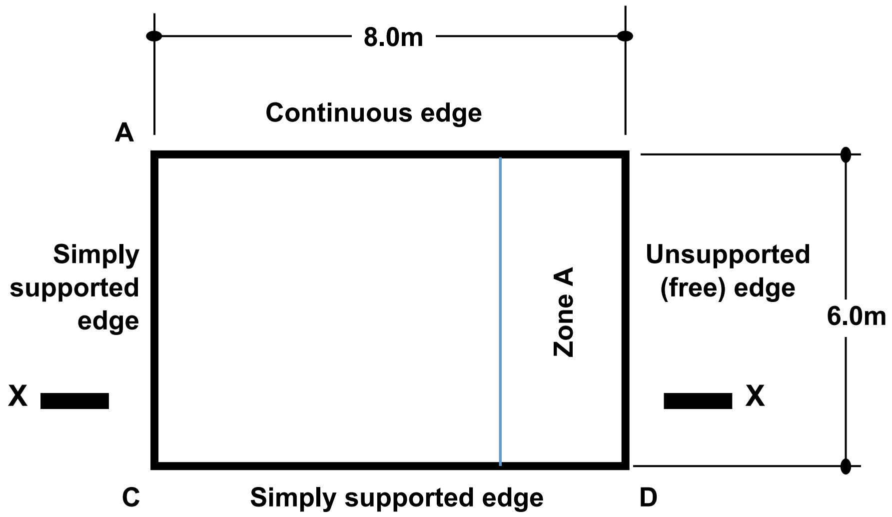
- Feedback on your performance will be given in the form of brief general comments to the cohort plus a mark for each item of work. These will be issued on **TBC**.

Assessment Criteria and process

Yield Line Analysis of an R.C. Slab

You are required to design the reinforcement for the 8m x 6m concrete slab shown in plan below. The slab is to be 200mm thick and is to carry finishes (1.0 kN/m^2) plus a variable (imposed) loading of 7.5 kN/m^2.

You may assume that the unit weight of reinforced concrete is 25 kN/m^3 and that the design ultimate load may be taken as 1.35 (Permanent Load + Finishes) + 1.5 (Variable Load).



You are required to present the following calculations:

a). Determine the design ultimate UDL for the slab.

b). Assume that the reinforcement provided across the longer span of the slab has a moment capacity = 0.7 ‘m’ and that provided across the shorter span has a moment capacity = ‘m’. Select what you consider to be a realistic pattern of yield lines for the slab. Then, from first principles (i.e. do not use any standard formulae), use a yield line analysis to determine a value for m.

c). Repeat the process for two additional yield line patterns and, from the 3 results, determine a value of m that you will then use in the design of the reinforcing steel (in c, below).

d). Provide confirmation of your chosen yield line pattern using computer software (i.e. Abaqus, Oasys-GSA etc) and comment/explain any differences between the computer output and your chosen yield line pattern.

e). Using the design guidance in EC2, apply a partial safety factor of 1.1 to the moment calculated from your yield line analysis and determine the area of steel reinforcement required for the long and the short spans of the slab. As part of this design, you should, where possible, consider all SLS and ULS design checks.

f). The client has informed you that there is a potential requirement for the variable load to be increased in Zone 1 from 7.5 to 10 kN/m^2; Zone A is 6m x 2m. What effect would this have on the design of your steel reinforcement?

g). Consider the materials used for the slab; comment on whether the sustainability of the slab could be improved by considering a different strength of concrete or a different type of concrete.

h). Draw a number of cross sections (i.e. section X-X - see above – could be one of these) showing both layers of steel reinforcement that you have designed and any other reinforcement you consider to be appropriate (i.e. at the supports). (Note: **neat**, clear, accurate hand drawings for the sections will be acceptable; otherwise use Autocad or the like).

Notes

1. The cover to the reinforcement across the shorter span = 30mm,
2. The characteristic compressive strength of the concrete is 35 MPa.
3. The characteristic tensile strength of the steel reinforcement is 500 MPa.
4. Perform any other design checks you deem necessary.

Coursework Assessment Grid – Assignment 2 (Slab Design using Yield Line Analysis)					
Criteria	<39%	40 to 49%	50 to 59%	60 to 69%	>70%
Technical Knowledge and Understanding of the Analysis method		Some understanding and knowledge of relevant subject matter; incomplete or missing consideration of the required analysis technique.	Basic understanding and knowledge of relevant subject matter. Able to estimate errors/accuracy of methods used. Can evaluate and derive information from data to produce coherent solutions. Incomplete consideration of the required analysis technique / incorrect Yield Line (although supported by acceptable reasoning).	Good understanding of the essence of the problem, its relevance and its context. Able to estimate errors and validate accuracy of the results produced. Can critically evaluate and interpret the results and relate them to published evidence to draw robust solutions.	Comprehensive and detailed understanding of the problem. Able to frame this in a novel or innovative way based on past work in the field. Able to clearly estimate errors and clearly validate accuracy of the results using appropriate methods. Can critically evaluate methodology used, interpret the results and relate them to published evidence and consider the results in a broader context to draw robust solutions. A compete and correctly optimised Yield Line analysis.
Design Methodology (Methods / Techniques)		Used a basic and familiar approach for the project leading to a routine solution which was partially incomplete or incorrect. (Decisions were not supported by acceptable reasoning.)	Used a basic and familiar approach for the project leading to a routine solution (correct but partially incomplete). Able to conduct a prescribed approach to the problem. The methods / techniques adopted were appropriate	Can develop and clearly justify a scheme for solving unfamiliar engineering problems. Able to select an appropriate approach to solve the problem. The methods / techniques were both appropriate, of an advanced level and complete.	Can develop and clearly justify innovative scheme for complex engineering problems. Able to both select and adapt an appropriate approach to the problem. There is a high level of confidence in the potential to obtain quality results. The methods / techniques were detailed, appropriate and sophisticated.

Alternative Designs		Basic consideration of alternative designs using only 1 parameter.	Good consideration of the problem (sustainability, constructability etc) within the field of reinforced concrete design.	Very good consideration of the problem within the field of reinforced concrete design.	Excellent consideration of the problem within the field of reinforced concrete design, with the alternative designs based on extensive, relevant and industry recognised parameters.
Independently Search for and Evaluate Published Sources of Information		Can search for both academic and other information relevant to the problem, however, the search is incomplete/a minimum.	Can search for both academic and other information relevant to the problem, with some evidence of critical engagement.	Can search for both academic and other information relevant to the problem, independently evaluate it in a critical fashion and identify knowledge gaps.	Can initiate and undertake searches for both academic and other information relevant to the problem. From a critical evaluation of this material can recommend actions based on knowledge gaps.
Layout and Presentation		The problem was communicated, however, the clarity of some areas of the communication were questionable.	Able to clearly communicate the problem in an effectively structured written technical format using appropriate IT techniques. Appropriate use of figures. Avoids plagiarism.	Able to clearly communicate the problem in an effectively structured written technical format using appropriate IT techniques and correct formatting of calculations. Appropriate use of figures. Avoids plagiarism.	Able to communicate the problem in a targeted, focused manner, using appropriate IT techniques and correct formatting of calculations. Figures clearly selected to enhance the arguments. Avoids plagiarism.
Drawings		Engineering drawings were incomplete/incorrect – insufficient sections were provided. Sketches within the calculations were incomplete/incorrect. Problems were observed re scales, line thicknesses etc.	A basic set of engineering drawings were provided, however, the drawings suggested an inability to communicate the design with sufficient detail.	All drawings correctly supported the design calculations. Drawings consisted of sketches within the calculations and a set of engineering drawings (hand or computer) which cross-referenced themselves and were referenced within the calculations. Minimum errors.	All drawings correctly supported the design calculations. Drawings consisted of sketches within the calculations and a set of engineering drawings (hand or computer) which cross-referenced themselves and were referenced within the calculations. The set of

					engineering drawings were of a professional level.

Academic misconduct and plagiarism

students are part of an academic community that shares ideas and develops new ones. You need to learn how to work with others, how to interpret and present other people's ideas, and how to produce your own independent academic work.

It is essential that you can distinguish between other people's work and your own, and correctly acknowledge other people's work.

All students new to the University are expected to complete an online Academic Integrity tutorial and test, and all students should ensure that they are aware of the principles of Academic integrity.

When you submit work for assessment it is expected that it will meet the University’s academic integrity standards.