UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	ADVANCED STRUCTURAL TIMBER DESIGN
COURSE CODE	:	BFK 40303
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTIONS	:1.	ANSWER ALL QUESTIONS
	2.	THIS FINAL EXAMINATION IS AN **ONLINE ASSESSMENT** AND CONDUCTED VIA **OPEN BOOK**
	3.	DESIGN SHOULD BE BASED ON BS EN 1995 1-1 AND SPECIFIC ENGINEERING DESIGN FOR ENGINEERED TIMBER

TERBUKA

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1   **Figure Q1** shows a first floor level plan of a special purpose built light commercial building. The purposes at this level include office and production area. The location of this building is in Johor Bahru. The Service Class used for the following design exercises shall be decided based on the location of the building and the purposes.

You are the principal design engineer for this project.

All design in this question and subsequent questions are to be in accordance to BS EN 1995-1-1. Relevant Eurocodes for actions and relevant specific engineering design guides can be used.

Data for design such as values of actions, structural member types and geometry are to be proposed by you with correct engineering judgement and reasoning. Such engineering judgement and reasoning must be written clearly in your answer script. Marks will be given based on the suitability of your reasons and decisions. This applies to **ALL** questions in this Final Examination.

This question specifically refers to the design of floor panel D-C/4-6 indicated as T in **Figure Q1**. This floor panel is built from timber-concrete composite (TCC) construction.

    (a)   Propose the layout and orientation of this TCC floor with sufficient sketches / drawings. The drawing must be well labeled for the different important components of the TCC floor.

                                          (6 marks)

    (b)   Calculate the ULS and SLS load demand in kN/m for the proposed TCC joist based on your answer in **Q1(a)**.

                                          (10 marks)

    (c)   Propose the connection system and spacing to be used in the design and construction of the TCC floor in panel T. Your proposal must include explanation to the choice of connection and spacing given. Clear drawing and design values of the connection are required in your proposal.

                                          (9 marks)

Q2   This question continues from **Q1** and it concerns the design of timber-concrete composite (TCC) floor panel T as shown in **Figure Q1**.

    (a)   Calculate the ULS gamma coefficient, γ_1 and effective bending stiffness, EI_{eff} values for the TCC floor.

                                          (9 marks)

    (b)   Interpret the meaning of the value gamma coefficient, γ_1 that has been calculated in **Q2(a)**. Explain the relationship of this value to the degree of composite action. Comment on how to better enhance the composite action of your proposed TCC floor.

                                          (10 marks)

(c)   If the TCC joist is doubled in span, would you be able to maintain the same gamma coefficient value, γ_1 that you have obtained in **Q2(a)**? Explain your answer. If you require changes to your solution for this doubled span, what are the changes?

(6 marks)

Q3   This question concerns the design of an intermediate Column A/3 from GF to 1F as shown in **Figure Q1**. All beam-column connections are of simple construction.

(a)   Calculate the axial demand in kN for Column A/3.

(5 marks)

(b)   Make a first estimation of size for Column A/3. Give reasons for the starting size you have proposed.

(5 marks)

(c)   Perform a full design check for Column A/3. Make a summary comment regarding your first size estimation and the outcome of your full design.

(15 marks)

Q4   This question relates to a shade for communal area to be suggested at the frontage of the office along grid line E in **Figure Q1** for a 15 m length. A steel solution for this shade is given in **Figure Q2**. The client would like to explore a timber solution. You are the structural design engineer appointed to counter propose a design for the main structural member ABC with a timber solution. Member ABC is spaced every 5m distance to support a lightweight prefabricated roofing aluminium panel. The unit weight of the prefabricated roofing aluminium panel is 30 kg/m^2. The ULS and SLS loads used in the steel solution for member ABC is 12 kN/m and 8.75 kN/m. Present your counter proposal in the following order.

(a)   ULS structural analysis.

(8 marks)

(b)   Beam type and size estimation based on deflection.

(8 marks)

(c)   If the mounting of cable tie at B is moved to position C, explain how will this change your answer in **Q4(b)** and explain how this change will affect the cable tie.
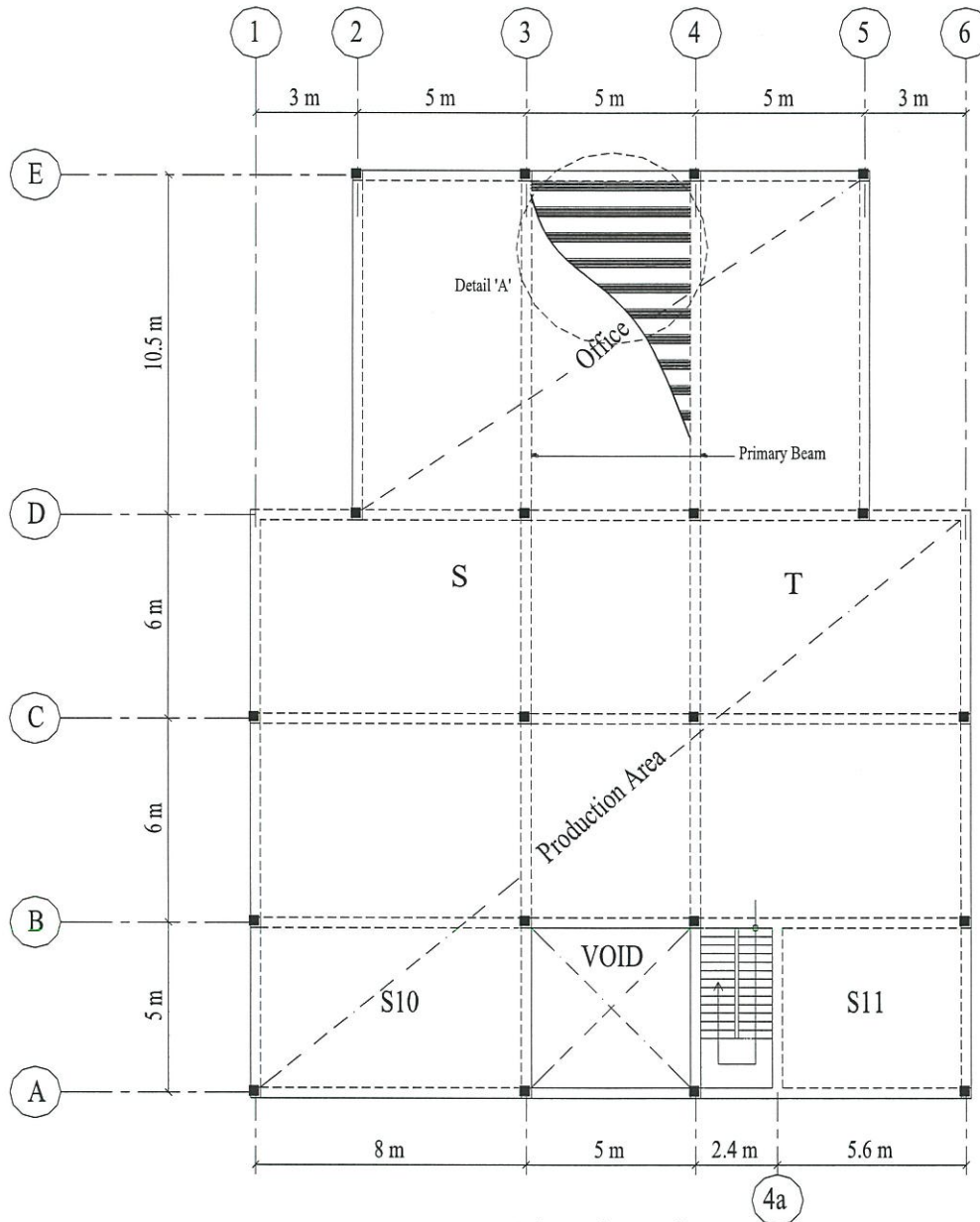
(9 marks)

- END OF QUESTIONS-

First Floor Plan

FIGURE Q1

FINAL EXAMINATION

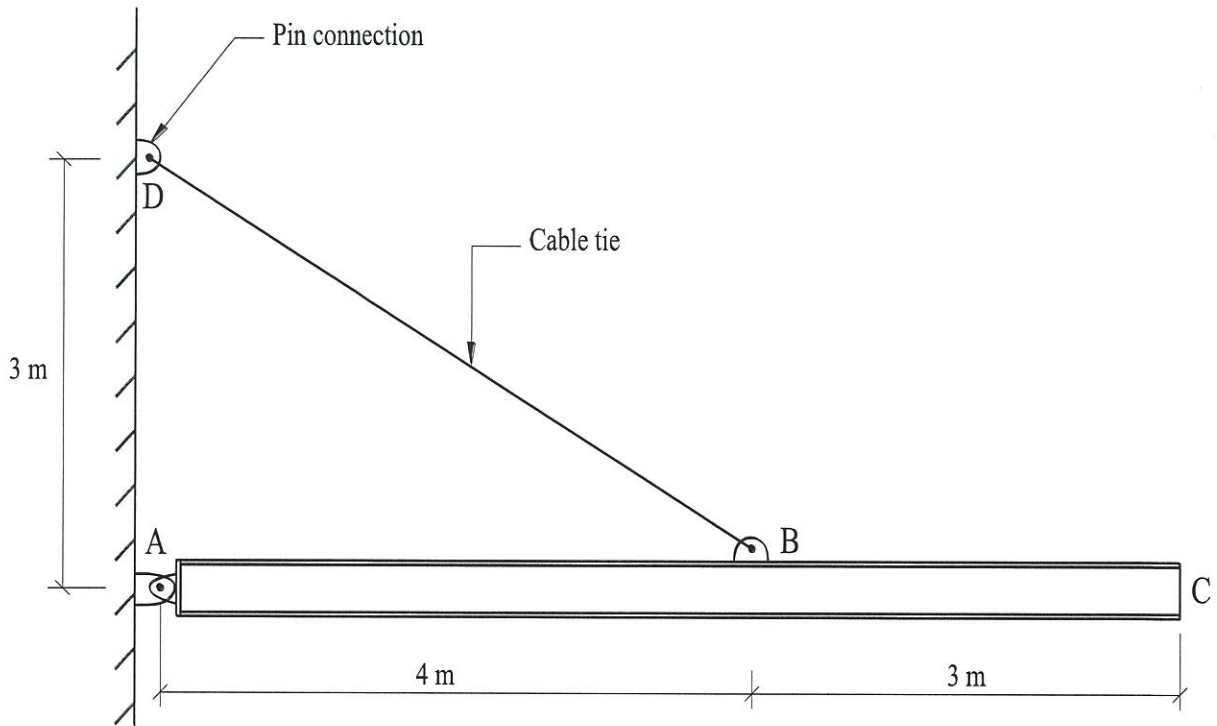|		
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FIGURE Q2