UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ADVANCED STRUCTURAL TIMBER DESIGN
COURSE CODE	:	BFK 40303
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS OPEN BOOK EXAMINATION

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

Q1 **Figure Q1** shows a factory plan at first floor level. The purposes at this level include office and production area.

The location of this building is in northern Australia where the temperature ranges between 24°C to 32°C and the average annual relative humidity is 56% with the highest record past 80%. The Service Class used for the following design exercises shall be decided based of these given conditions.

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.

Your answering attempt must follow the sequence of the question number as the data required for subsequent questions may depend on the previous question. Please read every question carefully.

This question specifically refers to the design of structural member D-E/5 which carries the load of the perimeter wall of the building (see **Figure Q1**).

(a) Calculate the ULS and SLS load demand in kN/m.

(8 marks)

(b) Calculate and sketch the bending moment and shear force diagrams in kNm and kN, respectively.

(6 marks)

(c) Perform a ULS design check. Determine the smallest possible LVL member size base on strength capacity (bending and shear only).

(11 marks)

Q2 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 of this TCC floor with sufficient drawing. The drawing must be well labeled and well illustrated. Comment how your proposal differs from Detail A in **Figure Q1** and **Figure Q2**.

(9 marks)

(b) Calculate the ULS and SLS load demand in kN/m for the proposed TCC joist based on your answer in Q2(a).

(9 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.

(7 marks)

Q3 This question continues from **Q2** 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) Calculate the SLS gamma coefficient, γ_1 and effective bending stiffness, EI_{eff} values for the TCC floor.

(9 marks)

(c) Interpret the meaning of the values gamma coefficients, γ_1 that have been calculated in (a) and (b). Explain the relationship of these values to the degree of composite action. Comment on how to better enhance the composite action of your proposed TCC floor.

(7 marks)

Q4 This question specifically refers to the design of structural member D/4-6 in **Figure Q1**. Some important information will be required from your answers of **Q2.** Such information will help you to solve this question. Note that there is a full opening of 3 m length along grid-line D/5-6 for the purpose of loading and unloading of production stocks.

(a) Calculate the ULS and SLS load demand in kN/m and produce a free body diagram for each of the load demand.

(8 marks)

(b) Make a first size estimation base on strength capacity.

(6 marks)

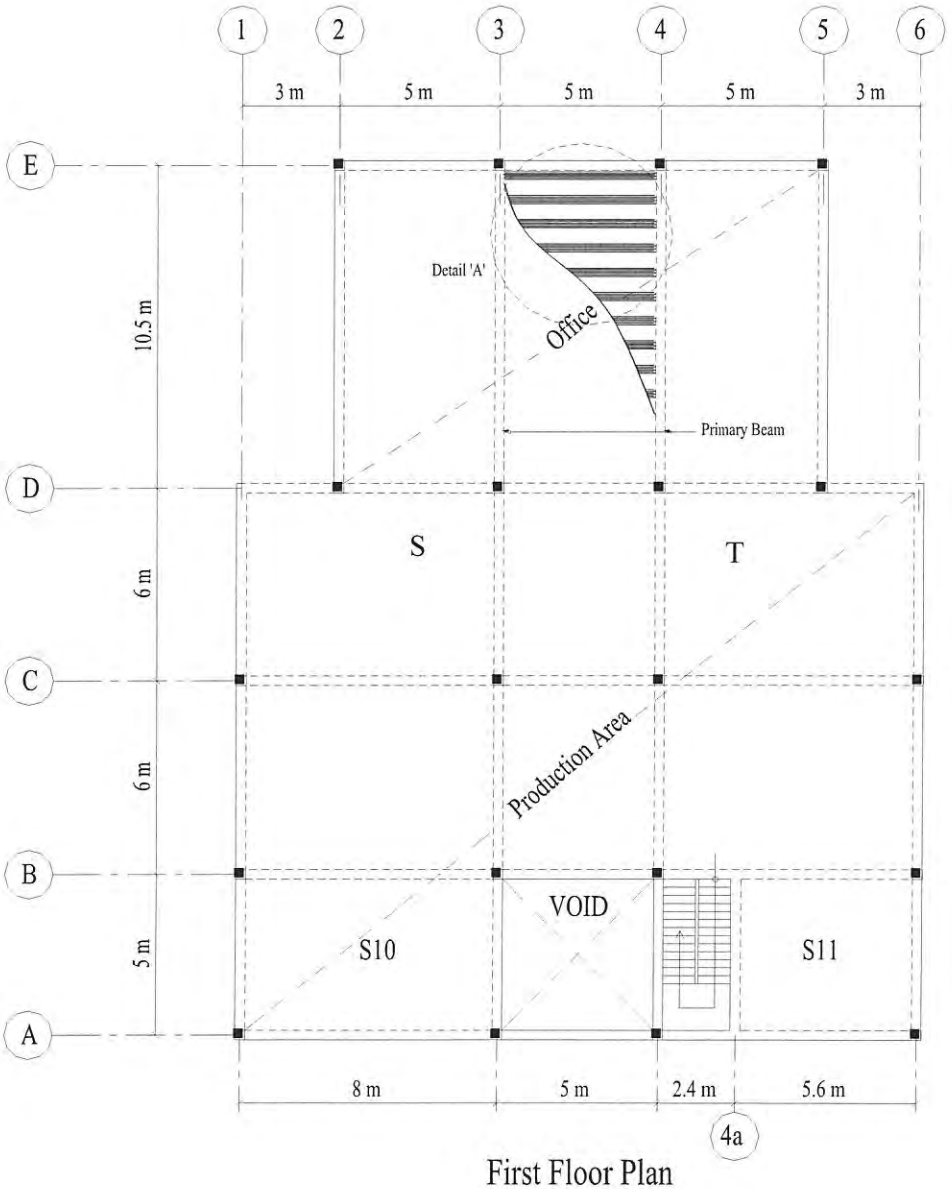
(c) Using the answer in (b), check the maximum short-term deflection at the end of overhang and between supports.

(11 marks)

- END OF QUESTIONS-

FINAL EXAMINATION

SEMESTER/SESSION : SEMESTER II / 2020/2021 PROGRAMME CODE : BFF
COURSE NAME : ADVANCED STRUCTURAL TIMBER DESIGN COURSE CODE : BFK 40303

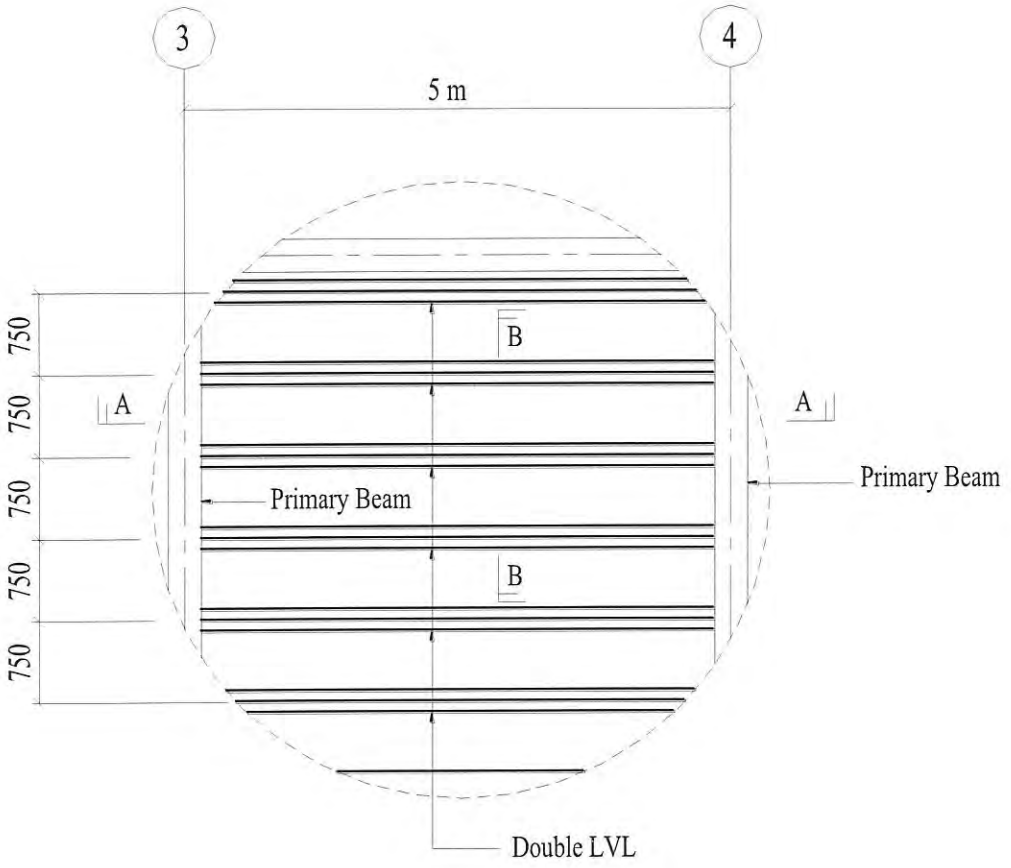


First Floor Plan

FIGURE Q1

FINAL EXAMINATION

SEMESTER/SESSION : SEMESTER II / 2020/2021 PROGRAMME CODE : BFF
COURSE NAME : ADVANCED STRUCTURAL TIMBER DESIGN COURSE CODE : BFK 40303



Detail 'A'

FIGURE Q2