



**UTHM**  
Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER II  
SESSION 2020/2021**

COURSE NAME : STRUCTURAL STEEL AND  
TIMBER DESIGN

COURSE CODE : BFC 43003

PROGRAMME CODE : BFF

EXAMINATION DATE : JULY 2021

DURATION : 3 HOURS

INSTRUCTIONS : 1. OPEN BOOK EXAMINATION  
2. ANSWER **ALL** QUESTIONS IN  
**PART A AND TWO (2)**  
QUESTIONS IN **PART B**

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THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

**PART A**

**Q1** (a) Perform the cross-section classification for a steel beam with the size of 356 x 171 x 57 UKB grade S275. (5 marks)

(b) Check the design resistance of the section in **Q1 (a)** where the design moment,  $M_{Ed} = 250$  kNm and shear force,  $V_{Ed} = 170$  kN. The beam is laterally fully restrained throughout the entire 7.0 metres span. Use  $Q_k = 50$  kN/m. (20 marks)

**Q2** (a) Explain briefly flexural buckling mode, torsional buckling mode and flexural-torsional buckling mode. (3 marks)

(b) A 305 x 305 x 198 UKC column which effectively held in position but not restrained in direction extends through a height of 4.0 metres. By using simple construction approach, check whether this section is suitable to support a design axial load of 550 kN, a major axis bending moment of 250 kNm and minor axis design moment of 110 kNm at the top of the member. Use steel grade S355.

Use elastic critical moment,  $M_{cr} = \text{*****} \times 10^4$  Nmm.

\*\*\*\*\* is your matrix card number. For example, your matrix card number is AF 170051. Therefore  $M_{cr} = 170051 \times 10^4$  Nmm.

(22 marks)

**PART B**

**Q3** (a) With the aid of a sketch, explain the analysis of a truss where the purlins are not positioned at the nodes. (5 marks)

(b) A truss is subjected to a permanent action of 0.5 kN/m<sup>2</sup> (on slope) and variable action of 0.75 kN/m<sup>2</sup> (on slope). Design the purlins using single angle sections by both empirical and beam method for the following given data:

Roof slope = 20.3 degree

Spacing between purlins = 2.0 m

Spacing between trusses = 7.0 m

(12 marks)

- (c) A tension member consists of a 150 x 90 x 12 single unequal angle connected through a gusset plate by the larger leg by a single row of four 20 mm bolts at 50 mm centres. Check for the design tension resistance if the angle is of S275 steel.  
(8 marks)
- Q4** (a) Determine the suitability of the bolt arrangement for the connection shown in **Figure Q4(a)**.  
(8 marks)
- (b) Calculate the shear and bearing resistance of the bolt group as in **Figure Q4 (a)**. The plates are made of S355 steel and connected using non-preloaded bolts of diameter 22 mm and class 5.6.  
(17 marks)
- Q5** (a) A timber floor joist is subjected to a uniformly distributed load of 3.5 kN/m (dead load plus imposed load). The joists are spaced 400 mm centres with the effective span of 4.0 metres. Suggest a suitable size of standard grade Chengal at 18% moisture content.  
(11 marks)
- (b) For the timber joists as in **Q5(a)** above, conduct all the necessary checking.  
(14 marks)

- END OF QUESTIONS -

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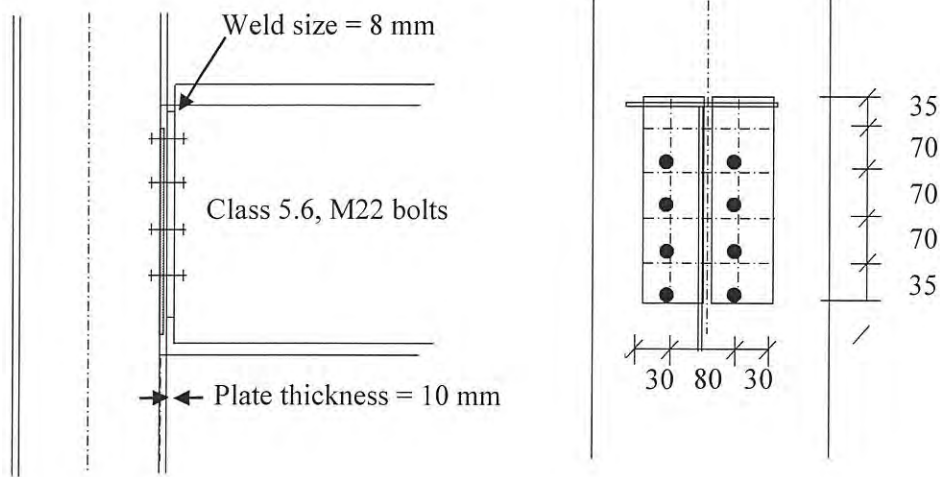


Figure Q4 (a) : Bolted connection (All unit in mm)

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