Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	STRUCTURAL STEEL AND TIMBER DESIGN
COURSE CODE	:	BFC43003
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS IN **PART A** AND **TWO (2)** QUESTIONS IN **PART B** 2. OPEN BOOK EXAMINATION

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

PART A: ANSWER **ALL** QUESTIONS

Q1 (a) Explain the classifications of cross sections. Draw the curvature for the classification of cross sections.

(5 marks)

(b) Describe the lateral buckling of beam.

(5 marks)

(c) A simply supported steel joist with a 4.0 m effective span carries a uniformly distributed load of 40 kN/m over its span inclusive of self-weight. The depth of the joist is restricted to 250 mm and laterally unsupported. Take f_y = 275 N/mm^2, E = 2.1 x 10^5 N/mm^2 and G = 81000 N/mm^2.

(i) Propose a size for the steel joist

(2 marks)

(ii) Check for the lateral torsional buckling of the joist.

(13 marks)

Q2 (a) List down the checking for axial and moment loaded column.

(5 marks)

(b) A 406 x 178 x 85 UB grade S275 column is used to sustain axial load of 2500 kN. The column is pinned at the top and connected rigidly at the base. Intermediate beams that provide lateral restrain at y axis are located 4.5 m from column base as shown in **Figure Q2.**

(i) Classify the column.

(3 marks)

(ii) Check the cross-section compression resistance of the column.

(3 marks)

(iii) Check the column buckling resistance in both axis.

(10 marks)

(c) Under certain circumstances, UB section is suitable to be used as column compared to normal UC section. Simply explain **ONE (1)** of the circumstances.

(4 marks)

PART B: ANSWER **TWO** QUESTIONS ONLY

Q3 (a) State **ONE (1)** similarity and **TWO (2)** differences between struts and columns.

(5 marks)

(b) A truss member of 150 x 150 x 75 of steel grade S275 with length 5 m is connected to a gussett plate of 15 mm thickness by a staggered bolt connecetion as shown in **Figure Q3**. All bolts are 20 mm in diamater. Determine the followings;

(i) Tension resistance, $N_{t,Rd}$ of the truss member

(10 marks)

(ii) The buckling resistance of the truss member by assuming out-of-plane of the truss governs.

(10 marks)

Q4 **Figure Q4(a)** shows beam-column connection of an office building designed using STAAD-Pro software. Detail A is referred.

(a) Draw typical beam end connection design for

(i) Beam to column flange with cleats
(ii) Beam to column web with fin plate
(iii) Beam to beam endplate

(3 marks)

(b) Check the suitability of bolts location of the suggested connection as detailed in **Figure Q4(b)**.

(10 marks)

(c) Verify the suggested connection from **Q4(b)** if the connection is subjected to the shear force, F_y of 82.2 kN and the tension force, F_x of 20.3 kN. Use bolt diameter of 16 mm with Grade 4.6 and steel plate of Grade S275.

(12 marks)

Q5 (a) A timber beam is used as a lintel for a 4-panel window opening. The opening is 2.4 m wide. The beam carries a wall load above it. The timber used is SG2 Standard Grade, Dry, Sawn, Double 100 mm × 200 mm. Calculate the maximum wall load in kN/m which the beam can carry. Ignore the selfweight of the beam in your calculation.

(14 marks)

(b) Consider a timber column of SG1 timber, Dry and from Select grade. The proposed size is a 200 × 200 nominal size (finished size 194 × 194). The height of the column is 4 m and pin-ended. The column is restrained at mid height on one face while the other face do not have any restrain. The column supports a floor load above it. Using Permissible Stress Design method recommended in MS544 Part 2, attempt the following questions.

(i) Calculate the k_8 factor for the proposed column.

(5 marks)

(ii) Check whether the proposed column is adequate to sustain 1000 kN axial load demand.

(6 marks)

– END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER/SESSION	: SEMESTER II / 2018/2019	PROGRAMME CODE	: 4 BFF
COURSE NAME	: STRUCTURAL STEEL AND TIMBER DESIGN	COURSE CODE	: BFC43003

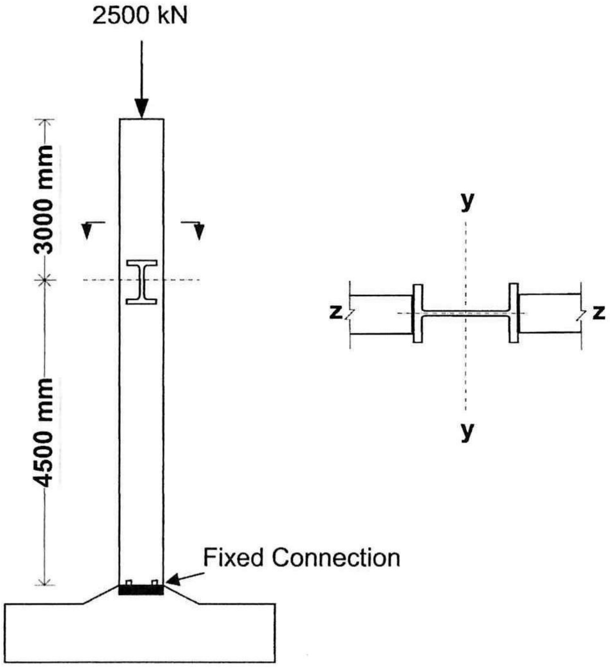
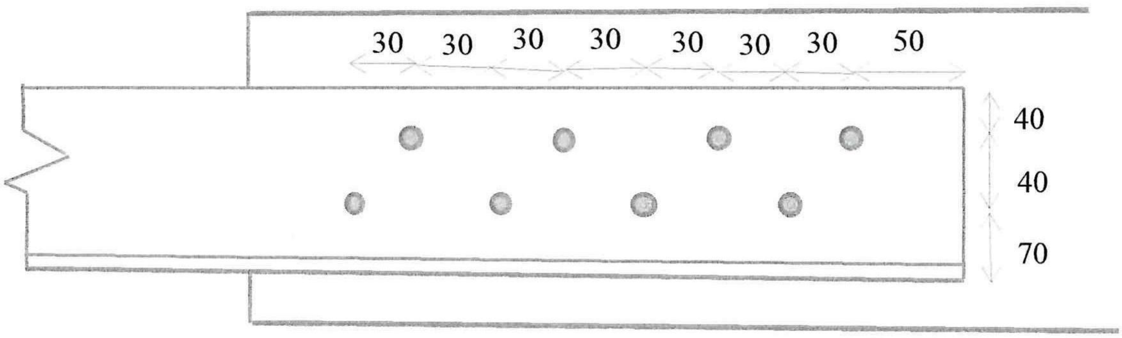


FIGURE Q2



All units in mm

FIGURE Q3

FINAL EXAMINATION

SEMESTER/SESSION : SEMESTER II / 2018/2019
KOD PROGRAM : 4 BFF
NAMA KURSUS : STRUCTURAL STEEL AND TIMBER DESIGN
COURSE CODE : BFC43003

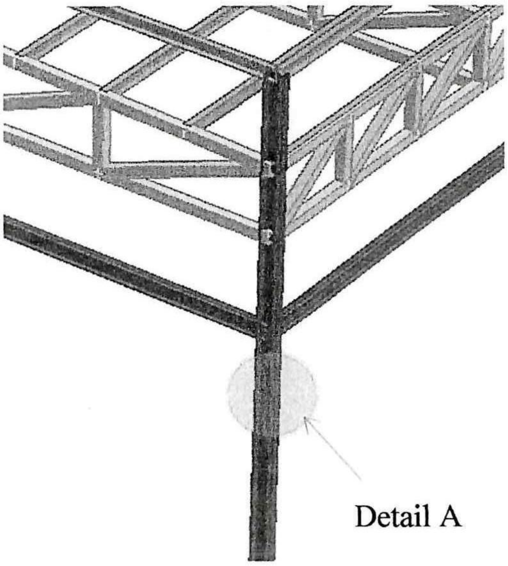


FIGURE Q4(a)

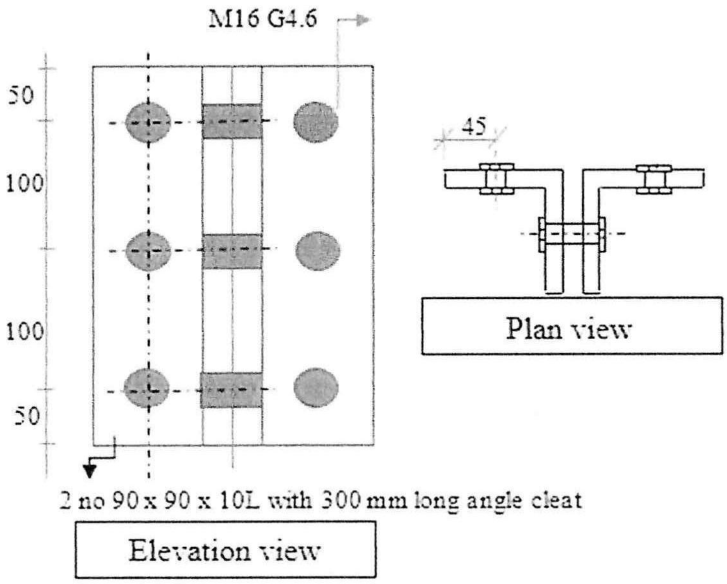


FIGURE Q4(b)

FINAL EXAMINATION

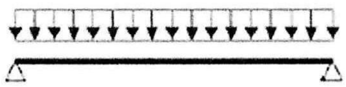
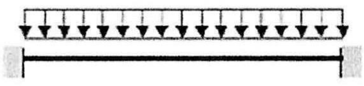
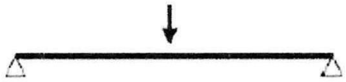
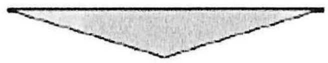
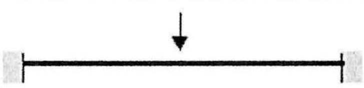
SEMESTER/SESSION	: SEMESTER II / 2018/2019	KOD PROGRAM	: 4 BFF
NAMA KURSUS	: STRUCTURAL STEEL AND TIMBER DESIGN	COURSE CODE	: BFC43003

APPENDIX

$$M_{cr} = C_1 \frac{\pi^2 E I_z}{(kL)^2} \left\{ \sqrt{\left(\frac{k}{k_w}\right)^2 \frac{I_w}{I_z} + \frac{(kL)^2 G I_t}{\pi^2 E I_z} + (C_2 z_g)^2} - C_2 z_g \right\}$$

where; $k = k_w = 1.0$ and $z_g = \frac{h}{2}$

Table 3.2 Values of factors C_1 and C_2 for cases with transverse loading (for $k = 1$)

Loading and support conditions	Bending moment diagram	C_1	C_2
		1,127	0,454
		2,578	1,554
		1,348	0,630
		1,683	1,645

Note : the critical moment M_{cr} is calculated for the section with the maximal moment along the member