Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	STRUCTURAL STEEL DESIGN
COURSE CODE	:	BFC 44903
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. OPEN BOOK EXAMINATION

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 A 406 x 178 x 54 UB of grade S275 and span 6.5 m is used to support a timber floor. The form of connection between column and the beam is flexible end plate. Based on these information,

(a) Determine whether flexible end-plate is categorized as a simple connection type? (1 mark)

(b) Based on your understanding of simple connection, specify the type of checks NOT to be performed for the above beam design case (1 mark)

(c) Classify the respective I-section beam in accordance with BS EN 1993-1-1 (3 marks)

(d) Determine the critical length, L_{cr} of the beam. (1 mark)

(e) Determine the moment buckling resistant, $M_{b,Rd}$. (14 marks)

(f) Calculate the maximum design load in kN/m that the beam can safely carry by assuming the moment buckling resistant, $M_{b,Rd}$ governing the structure design.
Remarks: The beam is simply supported beam and loaded with uniform distributed load from timber floor. (5 marks)

Q2 **Figure Q2** shows a 254 x 254 x 73 UC with the grade S355 steel section under combined bending and compression. The column is pinned at both ends and the material resistance factor γ_{M0} and γ_{M1} are 1.0. Check the adequacy for;

(a) Compressional resistance. (6 marks)

(b) Bending moment resistance. (4 marks)

(c) Buckling resistance. (15 marks)

Q3 A strut member of a truss with length of 25 m is subjected to a combined axial and bending moment of 251 kN and 1.05 kNm respectively. Use 100 x 50 x 8 RHS section with steel grade S355.

(a) Perform section classification of RHS section used. (5 marks)

(b) Calculate compression resistance of the cross-section. (4 marks)

(c) Compute the buckling resistance with combination of axial compression and bending moment. No bending about the major axis. Use simple construction approach. (16 marks)

Q4 As an engineer, you have been assigned to design a mini stadium hall as shown in **Figure Q4(a)**. An analysis of frame has been done as shown in **Figure Q4(b)** and the data is given in **Table Q4**.

Specification:

Building area = 28.36 m x 40.50 m
Spacing of frame = 4.05 m
Structurl steel grade : S275

Loading:

Purlin + Sheeting = 0.75 kN/m^2
Insulation = 0.05 kN/m^2
Ceiling + Finishes + ME = 1.0 kN/m^2
Variable action = 0.25 kN/m^2 (inaccessible roof except for maintenance)
Wind load = 0.65 kN/m^2 (inward)

(a) Determine the plastic modulus required for column and rafter. (9 marks)

(b) Check the cross-section resistance for column. (9 marks)

(c) Propose with the aid of sketches the position of lateral restraint for the column 1 (take C_1 =1.0). (7 marks)

– END OF QUESTIONS –

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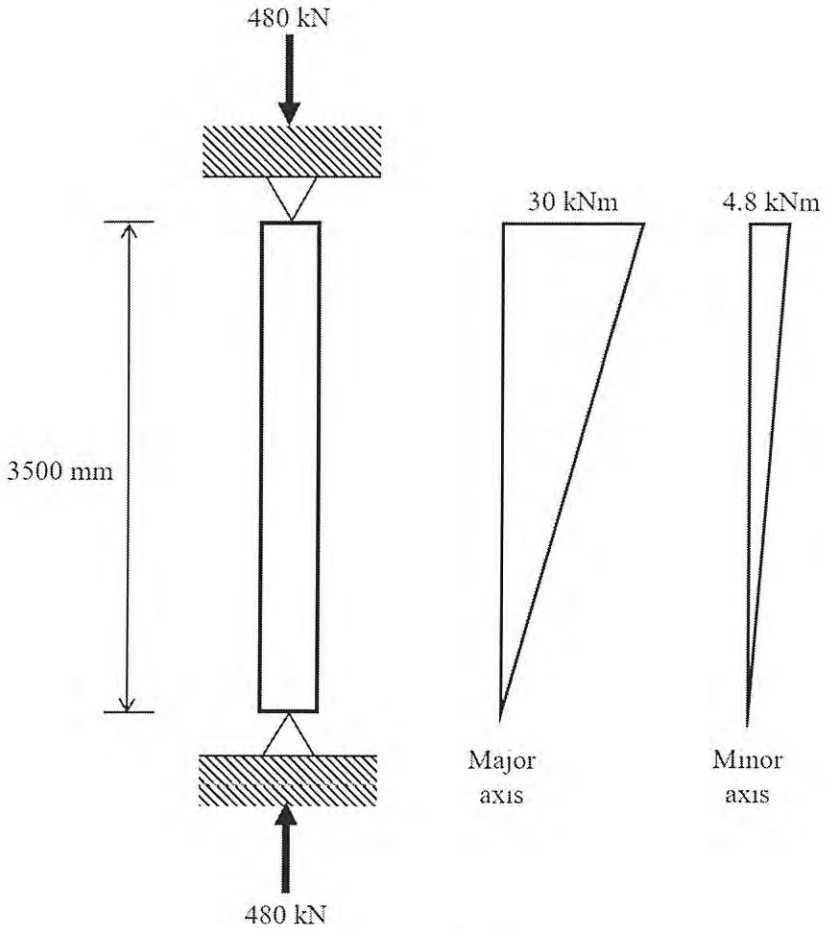

FIGURE Q2

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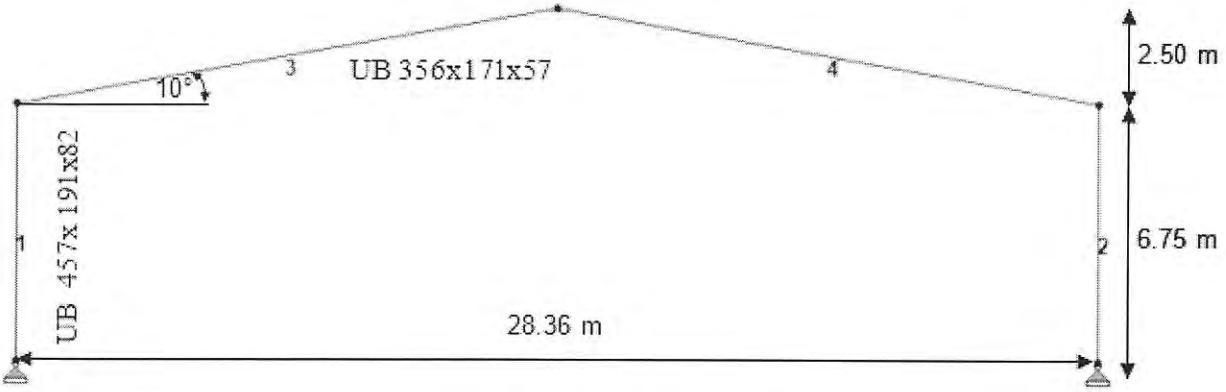

FIGURE Q4 (a)

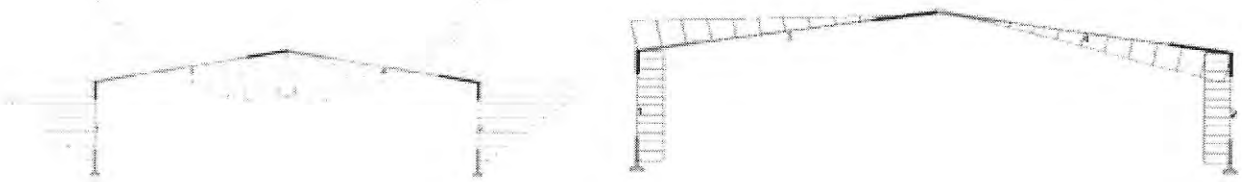

FIGURE Q4 (b)

TABLE Q4

Member	Start Moment (kNm)	End Moment (kNm)	Start Shear Force (kN)	End Shear Force (kN)
1	0	851	-126	-126
2	0	-851	126	126
3	851	-369	189	-21.9
4	-369	851	21.9	-189

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APPENDIX

Table 1: Nominal buckling length

End Restraint (in the plane under consideration)		Buckling length, Lcr
Effectively held in position at both ends	Effectively retrained in direction at both ends	0.7L
	Partially retrained in direction at both ends	0.85L
	Restrained in direction at one end	0.85L
	Not restrained in direction at either end	1.0L