

CONFIDENTIAL



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020**

COURSE NAME : STRUCTURAL STEEL AND TIMBER DESIGN
COURSE CODE : BFC43003
PROGRAMME CODE : BFF
EXAMINATION DATE : JULY 2020
DURATION : 6 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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

TERBUKA

CONFIDENTIAL

- Q1** (a) List **THREE (3)** important design properties of the steel elements and identify the factors that affected the mechanical properties of the material. (3 marks)
- (b) Referring to Figure 1;
- (i) Identify the slab type. (1 mark)
- (ii) Calculate the design load from the slab. (1 mark)
- (iii) Calculate the total design load (kN) of beam A-B/1. (2 marks)
- (c) Calculate design load combination using expression 6.10, 6.10a and 6.10b, BS EN 1990. Given permanent and variable actions are 3.5 kN/m^2 and 5 kN/m^2 respectively. (3 marks)
- (d) A simply supported beam of 6m span is subjected to a nominal uniformly distributed dead and imposed actions of 60 kN/m and 70 kN/m respectively. Calculate applied bending moment and shear force of the beam. (3 marks)
- (e) What is lateral torsional buckling and factors of lateral torsional buckling. (3 marks)
- (f) Determine the section classification of $610 \times 229 \times 125$ UB of S275 subjected to transverse load and calculate the bending moment resistance and shear force resistance of the section. (9 marks)
- Q2** **Figure Q2(a)** show a simple construction of 2-storey building. Meanwhile **Figure Q2(b)** shows the connection configuration at level 2. Consider a $254 \times 254 \times 73$ Gred 275 for all column,
- (a) Classify the cross section for column at first floor. (3 marks)
- (b) Calculate moment due to beam A and beam B (5 marks)
- (c) Check the buckling resistance and torsional buckling resistance of proposed steel section for the y-y axis at level 1 if the given $M_{cr} = 193 \times 10^6 \text{ Nmm}$. (14 marks)
- (d) Evaluate the adequacy of proposed section (3 marks)

Q3 Figure Q3 shows a roof truss with given applied load from purlins at pin-jointed nodes on its rafter. Answers the following questions:

- (a) Determine internal forces of member GH and member CD. (5 marks)
- (b) Design member DG with welded connections where out-of-plane governs. Use 200 x 200 x 20 L of S275 steel. (10 marks)
- (c) Design member CD with welded connections where out-of-plane governs. Use 200 x 200 x 20 L of S275 steel. (10 marks)

Q4 (a) Describe all modification factors that need to be considered in compression member subjected to combined axial loading and bending. (10 marks)

- (b) A rectangular timber beam of 100 mm wide is to be loaded with uniformly distributed load of 7.5 kN/m throughout 5 m span. The following data are given:-

Allowable bending stress = 24 MPa

Allowable shear stress = 1.24 MPa

Allowable deflection = 1/240 of span

Modulus of elasticity = 18.6 GPa

Weight of wood = 8 kN/m³

Find the depth, d of beam by considering

- (i) Bending stress criteria only (4 marks)
- (ii) Shear stress criteria only (4 marks)
- (iii) Deflection only (4 marks)
- (iv) Combination of bending stress, shear stress and deflection. (3 marks)

– END OF QUESTIONS –

TERBUKA

CONFIDENTIAL

FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2019/2020

PROGRAMME CODE : 4 BFF

COURSE NAME : STRUCTURAL STEEL AND TIMBER DESIGN

COURSE CODE : BFC43003

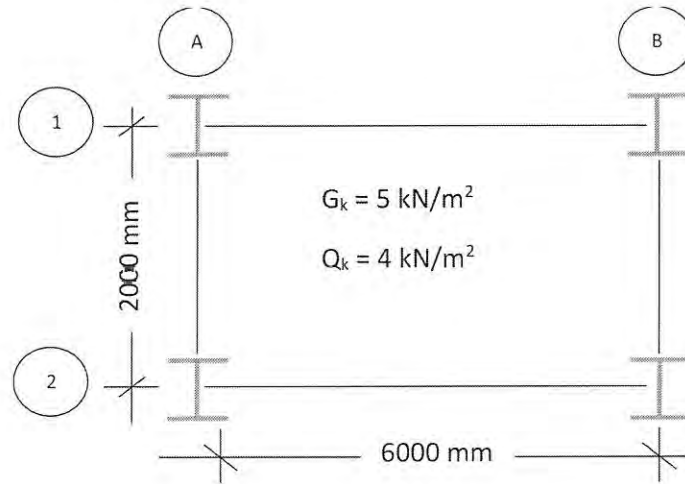


FIGURE Q1

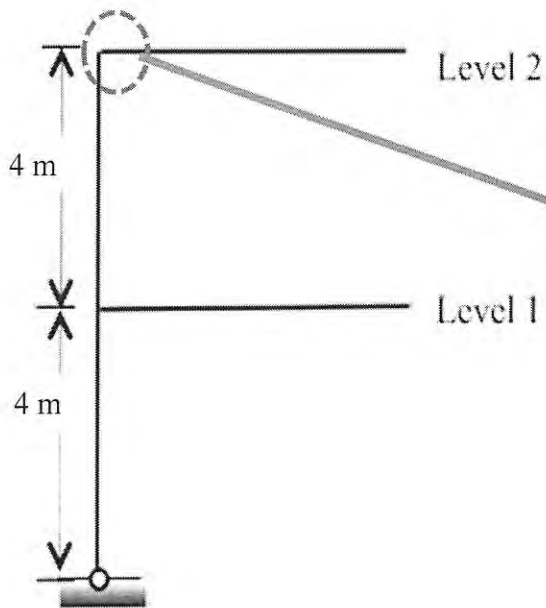


FIGURE Q2(a)

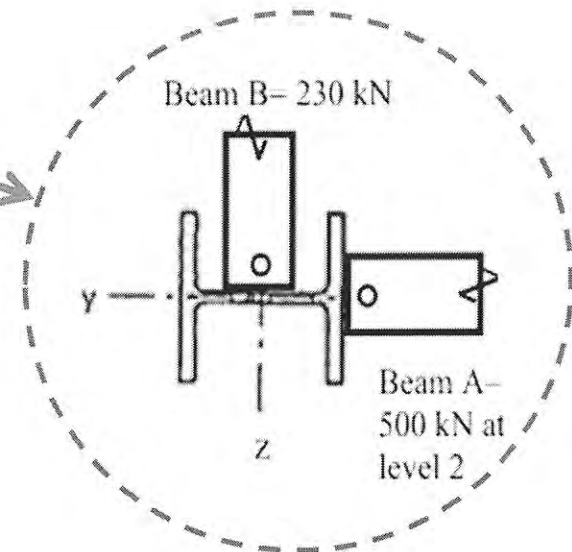


FIGURE Q2(b)

TERBUKA

FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2019/2020

PROGRAMME CODE : 4 BFF

COURSE NAME : STRUCTURAL STEEL AND TIMBER
DESIGN

COURSE CODE : BFC43003

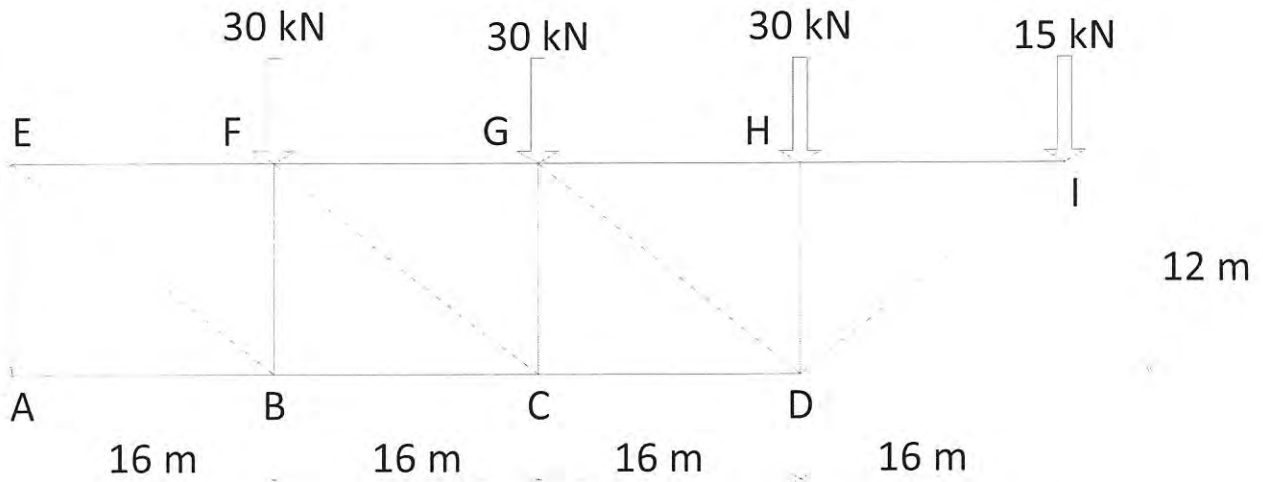


FIGURE Q3

TERBUKA

FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2019/2020

PROGRAMME CODE : 4 BFF

COURSE NAME : STRUCTURAL STEEL AND TIMBER
DESIGN

COURSE CODE : BFC43003

APPENDIX

Column in Simple Construction

$$\frac{N_{Ed}}{N_{b,z,Rd}} + \frac{M_{y,Ed}}{M_{b,Rd}} + 1.5 \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1.0$$

$$M_{b,Rd} = \frac{\chi_{LT} W_y f_y}{\gamma_{M1}}, \quad M_{z,Rd} = \frac{W_{pl,z} f_y}{\gamma_{M1}}, \quad N_{b,z,Rd} = \frac{\chi_z A f_y}{\gamma_{M1}}$$

$$\bar{\lambda} = \frac{\lambda}{\lambda_1}, \quad \lambda_1 = \pi \sqrt{\frac{E}{f_y}} = 93.9 \varepsilon$$

$$M_{cr} = \frac{\pi^2 E I_z}{L^2_{cr}} \left(\frac{I_w}{I_z} + \frac{L^2_{cr} G I_t}{\pi^2 E I_z} \right)^{0.5}$$

Equation 6.10b

$$\xi \gamma_{Gj,sup} G_{j,sup} + \gamma_{Q,1} Q_1 + \gamma_{Q,i} \psi_{0,i} Q_i$$

ξ is a reduction factor for unfavourable permanent actions G

