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Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : ADVANCED STRUCTURAL DESIGN  
COURSE CODE : BFS40903  
PROGRAMME CODE : BFF  
EXAMINATION DATE : JULY/AUGUST 2023  
DURATION : 3 HOURS  
INSTRUCTIONS : 1. ANSWER ALL QUESTIONS  
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **OPEN BOOK**  
3. STUDENTS ARE **ALLOWED** TO CONSULT THEIR OWN MATERIAL AND DESIGN SHOULD BE BASED ON BS EN 1990: 2002+A1:2005, BS EN 1991-1-1:2002, BS EN 1992-1-1:2004, MS 1553: 2002, BS EN 1993-1-1, BS EN 1993-1-8

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

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**Q1** Figure Q1(a) and (b) shows a plan view of a 10-storey building with column size of 350 x 350 mm. Beams in gridline A-F were designed with size of 250 x 500 mm while beams in gridline 1-4 were designed with size of 250 x 600 mm.

- (a) Calculate the shear centre of both layout and comment on the arrangement of the shear wall. Use shear wall thickness as 200 mm.

(10 marks)

- (b) Evaluate the in-plane and transverse actions for wall in gridline 1 in Figure Q1(b). Given:

Slab thickness = 150 mm

All floor height = 3.8 m

Stump height = 1.0 m

Characteristic strength of concrete = 30 N/mm<sup>2</sup>

Characteristic strength of steel = 500 N/mm<sup>2</sup>

Nominal cover = 30 mm

Wind pressure = 1.2 kN/m<sup>2</sup>

Finishes, ceiling and services = 1.50 kN/m<sup>2</sup>

Variable action (floor) = 4.0 kN/m<sup>2</sup>

Variable action (roof) = 0.6 kN/m<sup>2</sup>

(25 marks)

- Q2** (a) Dilapidated school is proposed to improve the education facilities in rural area. The utilization of cold-formed steel frame in the construction of dilapidated school is found to be economic in terms of cost and time. Besides the advantages in terms of save cost and time, describe **FIVE (5)** more advantages of using cold-formed steel members.

(10 marks)

- (b) As a consultant in structural engineering firm, you are requested to proposed a design of elevated disaster relief centre using cold-formed steel frame.

- i) Determine the design consideration that needs to be taken into account in order to design a cold-formed steel frame.

(10 marks)

- ii) The roof beam will be design using double channel (back to back) LC10330. Check the buckling resistance at ULS for simply supported beam using the following specifications:

Double channel (back to back) LC10330	
Permanent action, $G_k$	= 0.53 kN/m
Variable action, $Q_k$	= 1.05 kN/m
Yield strength of steel, $f_{yk}$	= 275 MPa
$M_{cr}$	= 20.17 kNm
Span of beam	= 5.5 m
Beam spacing	= 0.7 m
$I_{eff,y}$	= 4205771 mm <sup>4</sup>
Position of the neutral axis:	
From the flange in compression, $Z_c$	= 102.5 mm
From the flange in tension, $Z_t$	= 96.6 mm

(15 marks)

**Q3** (a) List and explain **THREE (3)** types of steel bracing. (6 marks)

(b) The same 10-storey building as in **Q1** is built without shear wall as shown in **Figure Q3(b)**. The building is braced using steel bracing at bay in gridline 1/A-B, 1/E-F, 4/A-B and 4/E-F with the total wind force acting on the length of the building given as 816 kN.

i) Determine the horizontal load at roof and each floors in proportion to storey heights. Given:

Roof permanent action	= 1.0 kN/m <sup>2</sup>
Roof variable action	= 0.75 kN/m <sup>2</sup>
Floor permanent action	= 4.0 kN/m <sup>2</sup>
Floor variable action	= 1.5 kN/m <sup>2</sup>

(5 marks)

ii) Evaluate the horizontal forces at ground level.

(12 marks)

iii) With the aid of sketching, propose a suitable connection of bracing to beam-column. Use non-preloaded Class 8.8 M20 diameter bolt.

(7 marks)

– END OF QUESTIONS –

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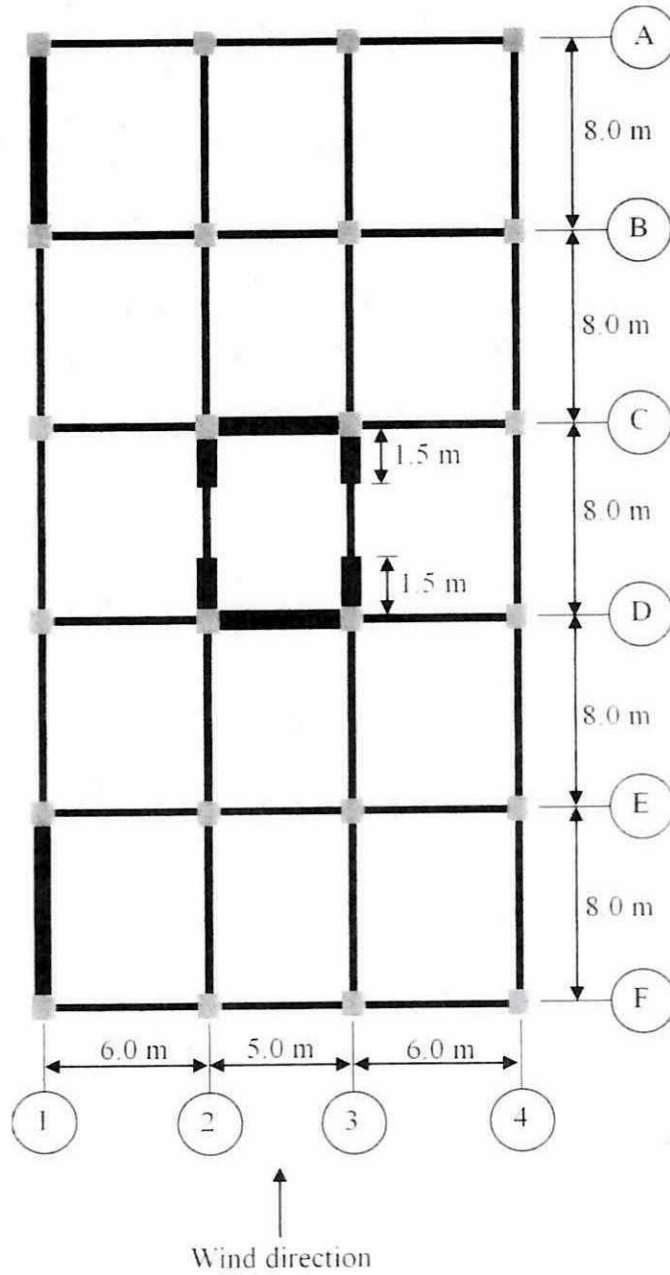


Figure Q1(a): Plan view of a 10-storey building

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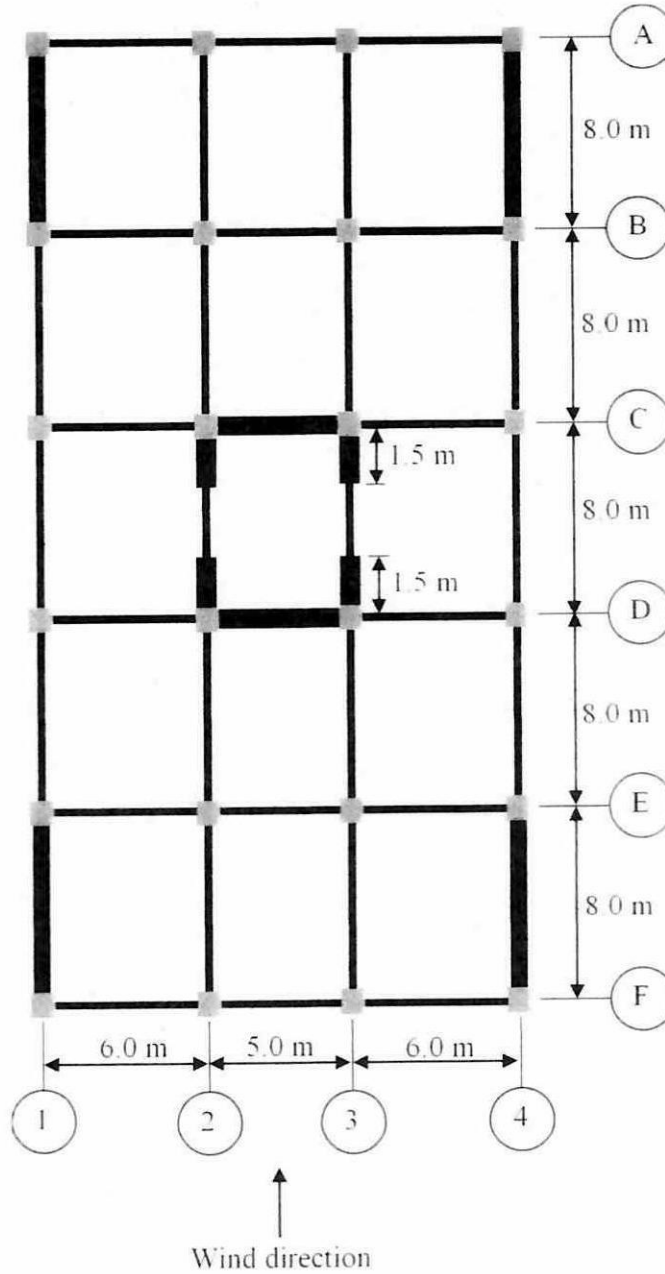


Figure Q1(b): Plan view of a 10-storey building

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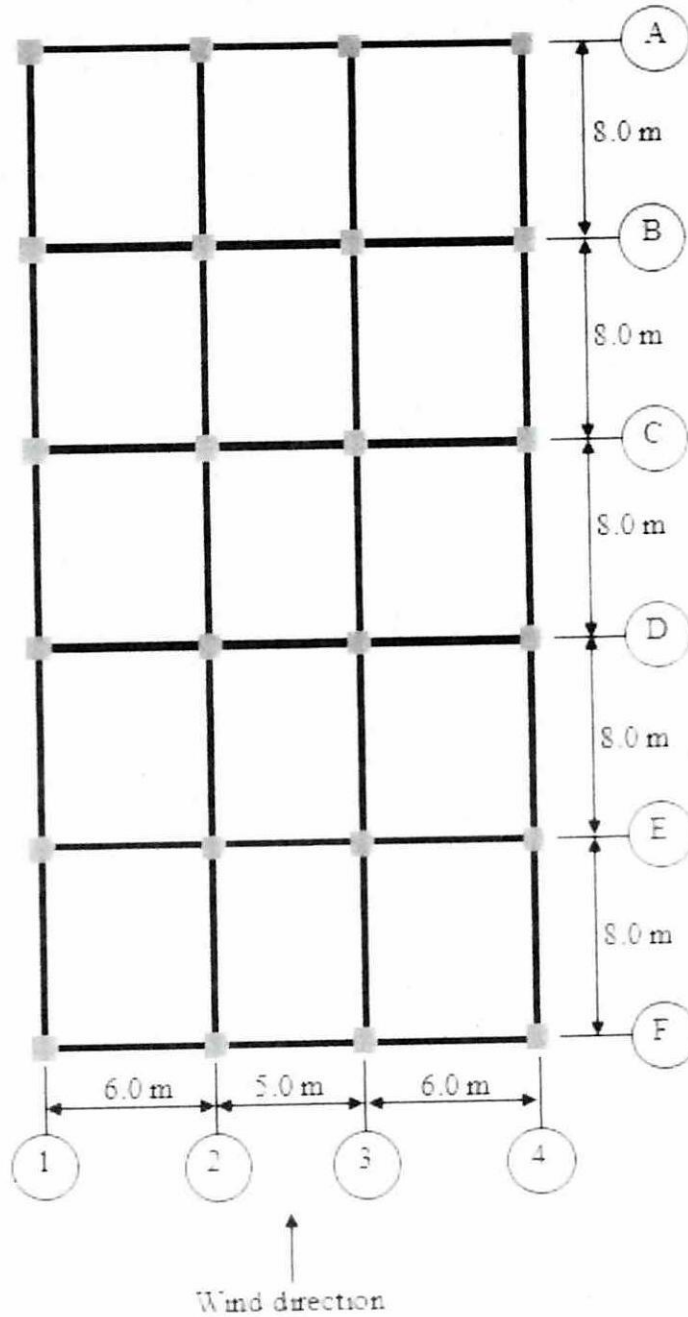


Figure Q3(b): Plan view of a 10-storey building

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