Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	ADVANCED STRUCTURE DESIGN
COURSE CODE	:	BFS40903
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 **Figure Q1(a)** shows the plan view of concrete slab supported by steel beams. The beam is propped during construction. The total thickness of the slab is 130 mm with the concrete volume on the steel profile is 0.121 m^3/m^2. The steel profile weight is 0.14 kN/m^2. Finishes load on the beam (inclusive beam selfweight) is 1.0 kN/m, and the variable action is 7 kN/m. Concrete grade is C25/30, density of 25 kN/m^3 and E_{cm} = 31 kN/mm^2. Steel beam is grade 235, A_a = 2848 mm^2, E_a = 210 kN/mm^2 and I_a = 1943 cm^4.

(a) Determine the design load imposed on composite beam B/2-3. The cross section of the beam is shown in **Figure Q1(b)**.

(2 marks)

(b) Calculate the design moment and shear force for beam C/2-3.

(2 marks)

(c) Calculate and sketch the position of plastic neutral axis of the composite beam C/2-3.

(3 marks)

(d) Determine the moment capacity of composite beam.

(2 marks)

(e) Design the shear connector on composite beam C/2-3 for full shear connection. Given f_u = 450 N/mm^2, d = 19 mm, h_{sc} = 100 mm, b_o = 110 mm.

(4 marks)

(f) Check the longitudinal shear resistance of the concrete flange.

(5 marks)

(g) Calculate the deflection of the composite beam.

(7 marks)

Q2 **Figure Q2(a)** shows a concrete septic tank with dimension 2500 mm long x 1500 mm width. The height of tank wall is 1800 mm and the thickness is 150 mm for wall and slab. The characteristic strength of concrete (f_{ck}) and steel (f_{yk}) are 30 N/mm^2 and 500 N/mm^2 respectively. Unit weight of the concrete is 25 kN/m^3.

(a) Calculate the self-weight of the concrete tank.

(3 marks)

(b) If the tank will be placed on the area with higher ground water level as in **Figure Q2 (b)**. Check the stability against floating. Density of water is 10 kN/m^3 and factor of safety against floating is 1.15.

(2 marks)

(c) Sketch the pressure distribution on the wall and calculate the flexural moment of the wall A.

(3 marks)

(d) Design the main reinforcements of wall A. Use Φ_{bar} = 12 mm, concrete cover 40 mm and minimum steel area of $0.002bh$.

(5 marks)

(e) Based on thermal and shrinkage reinforcement requirement, check the crack limit due to flexural tension. Given E_s = 200 kN/mm^2, E_c = 33 kN/mm^2, f_{ctm} = 2.9 N/mm^2, k_t = 0.4.

(12 marks)

Q3 The girder shown in **Figure Q3** is fully restrained against lateral buckling throughout its span. The span is 27 m and carried two concentrated load of 300 kN and the uniform load of 20 kN/m

(a) Sketch the shear force and bending moment diagram of the girder.

(3 marks)

(b) Determine the suitable depth of the girder if the recommended span/ depth ratio is 15.

(1 mark)

(c) Determine the size of web and the flanges, with flange is 25 mm. Check web thickness against serviceability and buckling.
($p_{yf} = p_{yw}$ = 235 N/mm^2)

(7 marks)

(d) Classify the flange and the web. Given; welding size is 12 mm.

(3 marks)

(e) Calculate the moment capacity of the proposed section.

(2 marks)

(f) Check shear buckling resistance of Panel X-Y. Assume rigid end post.

(4 marks)

(g) Design a bearing stiffener at A. Used double sided stiffeners consisting of two flats 200 x 20 mm with f_{ys} = 235 N/mm^2

(5 marks)

- END OF QUESTIONS -

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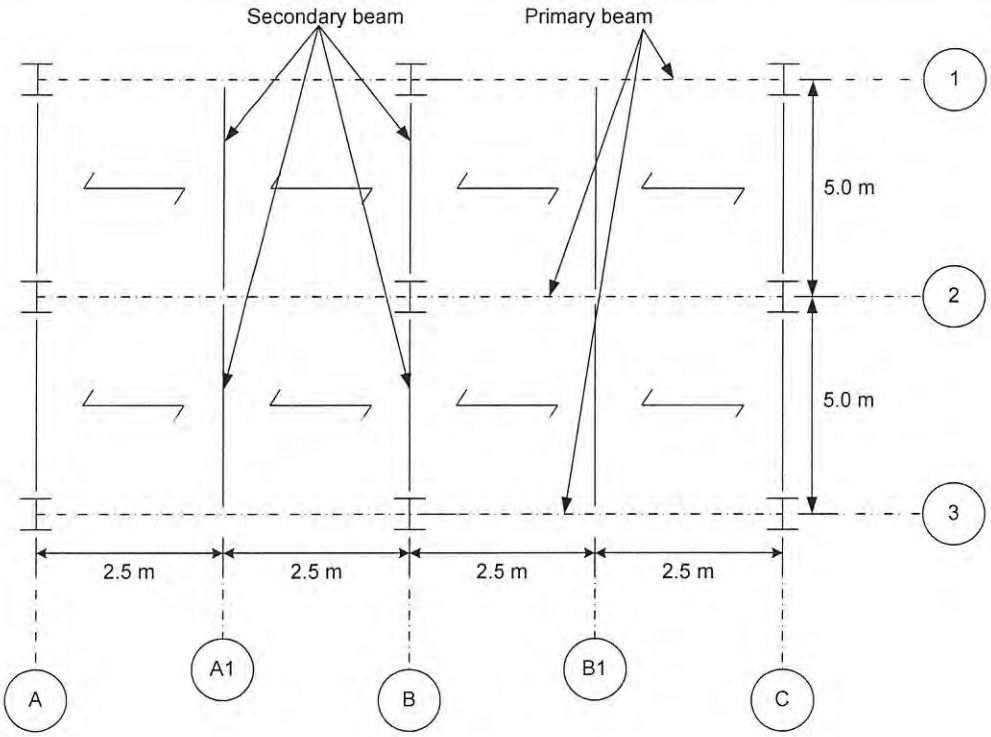

FIGURE Q1(a)

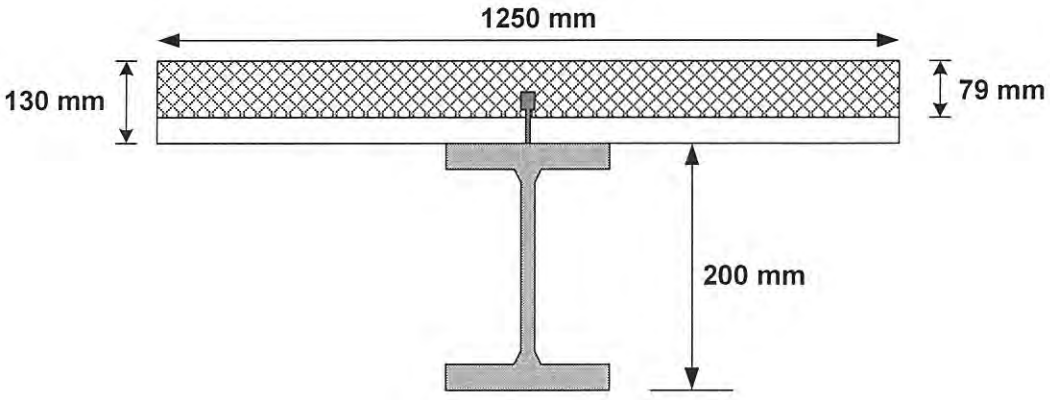

FIGURE Q1(b)

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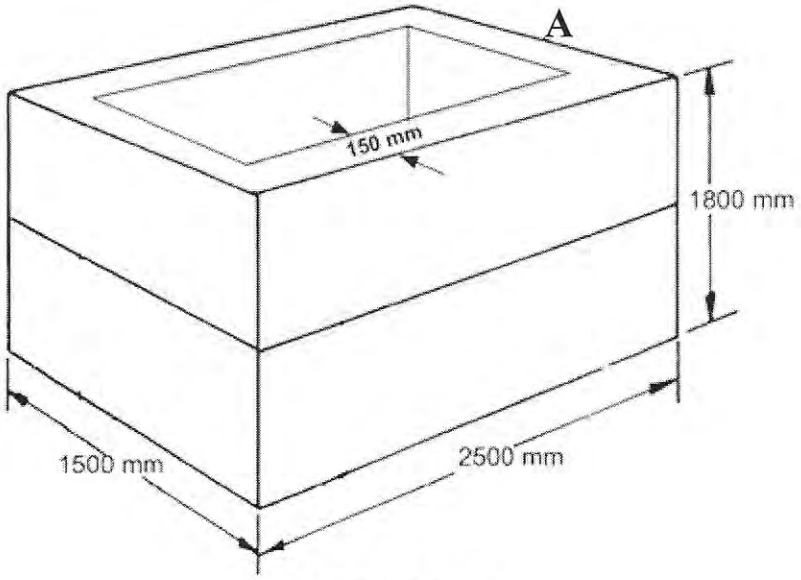

FIGURE Q2(a)

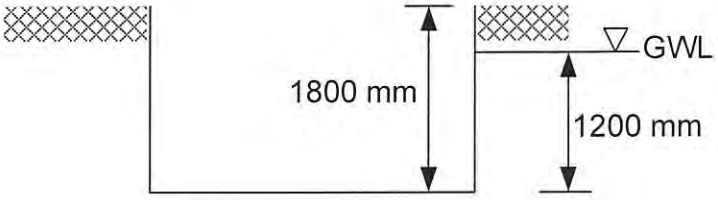

FIGURE Q2(b)

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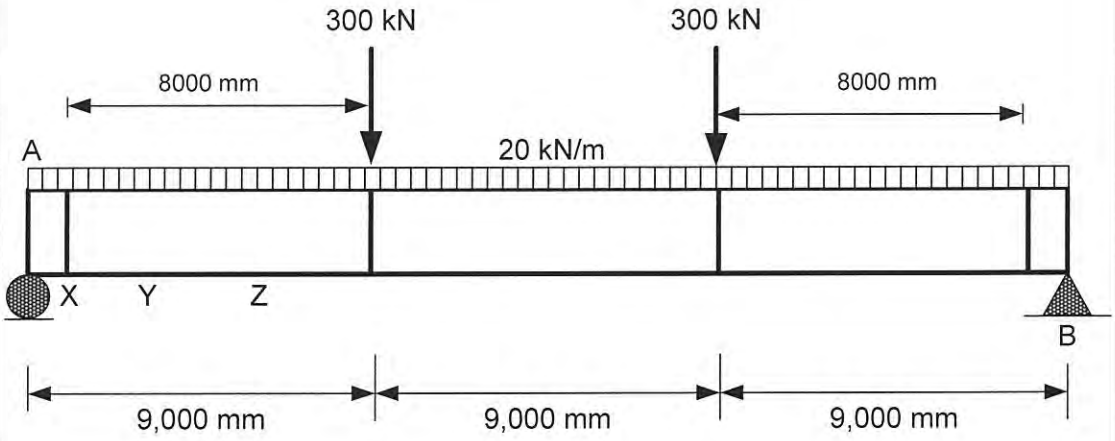

FIGURE Q3