UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ADVANCED STRUCTURE DESIGN
COURSE CODE	:	BFS 4093/ BFS 40903
PROGRAMME	:	4 BFF
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTION IN **PART 1** AND **THREE (3)** FROM **FOUR (4)** QUESTIONS IN **PART 2**

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

PART 1

Q1 (a) Give **Two (2)** main reasons of structure analysis.

(2 marks)

(b) Discuss **Five (5)** main parts in structure design.

(5 marks)

(c) Describe briefly what you understand about earthquake design.

(3 marks)

PART 2

Q1 (a) A uniform distributed load and point loads are imposed on the simply supported girder as shown in Figure **Q1** and laterally restrained throughout its length. The grade of the steel and the stiffener is S275.

(i) Check the suitability of the girder initial size selection as in Figure **Q1**

(5 marks)

(ii) Classify the flange and web section

(5 marks)

(iii) Check the moment capacity of the steel section

(5 marks)

(iv) Check the shear capacity of the steel section

(4 marks)

(v) Check for deflection

(6 marks)

(vi) Check the bearing capacity for load bearing stiffener.
Use 2 flat 200 mm x 12 mm thick.

(5 marks)

Q2 Figure **Q2** shows the plan view and cross section of water reservoir. The plan size is 21 m x 32 m. The maximum water height is 6.5 m and the normal height of stored water is 6.0 m. (Given f_{cu}, 35, f_y 460 N/mm^2, bar size 12 mm)

(a) Estimate the wall thickness due to shear requirement. Assume steel ratio is 0.5.

(6 marks)

(b) Check applied moment against ultimate moment of resistance based on the wall thickness in **Appendix 1**.

(4 marks)

(c) Calculate the area of reinforcement for the wall

(6 marks)

(d) Calculate the design crack width.

(14 marks)

Q3 Figure **Q3** shows the section and reinforcement detailing of cantilever retaining wall. As a Structural Engineer, you are required to:

(a) Check the stability of the wall against sliding, overturning and settlement;

(15 marks)

(b) Check the adequacy of reinforcement for the wall and the base.

(15 marks)

Q4 (a) Describe briefly the following method for composite construction;

(i) Propped construction method

(3 marks)

(ii) Unproppped construction method

(3 marks)

(b) By using a sketch, show the three possible locations of the neutral axis of the composite beam based on R_{cf}, R_s and R_w value.

Where:

R_{cf} – Resistance of concrete flange; R_s – resistance of steel section;
R_w – Resistance of overall web depth

(9 marks)

(c) Figure **Q4** shows the plan view of composite floor. The connection between beam and column is simply supported. Imposed load on the slab is 6.5 kN/m^2. For beam 3/ A-B, determine:

(i) Moment capacity of the beam;

(5 marks)

(ii) Shear capacity of the beam

(3 marks)

(iii) Longitudinal shear connectors capacity (use 19 mm x 100 mm connector)

(7 marks)

- END OF QUESTION -

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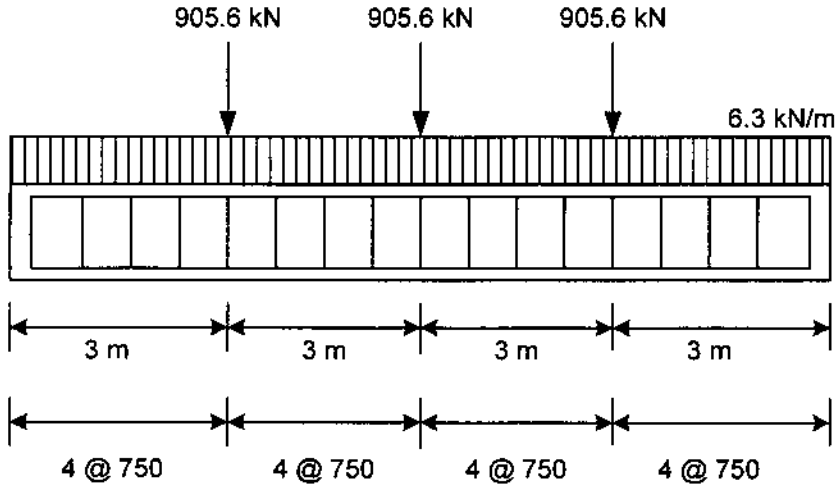

Spacing arrangement

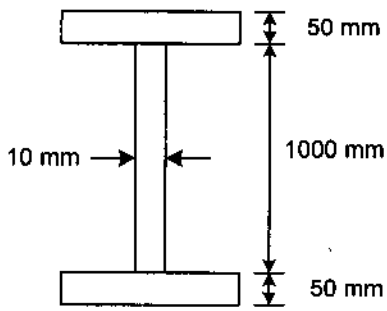

FIGURE Q1

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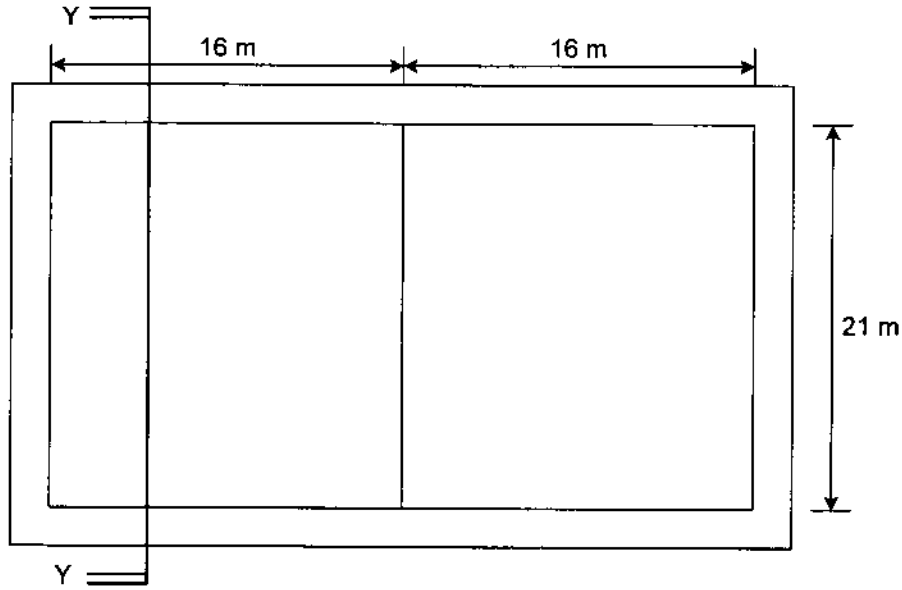
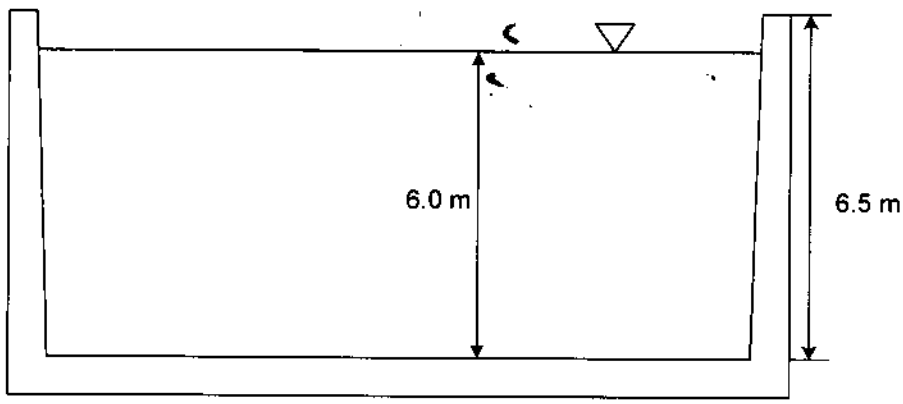


a) Plan view



b) Section Y-Y

FIGURE Q2

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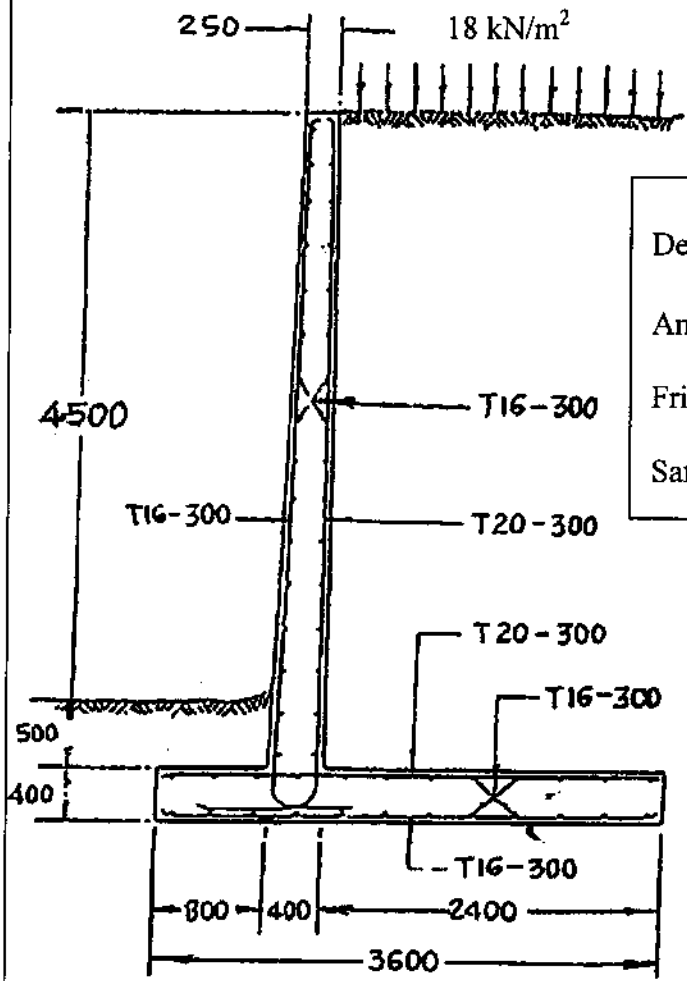

Desity, γ: 19 kN/m^3

Angle of internal friction, ϕ : 30^0

Friction coefficient, μ: 0.5

Safe bearing pressure, q: 150 kN/m^2

FIGURE Q3

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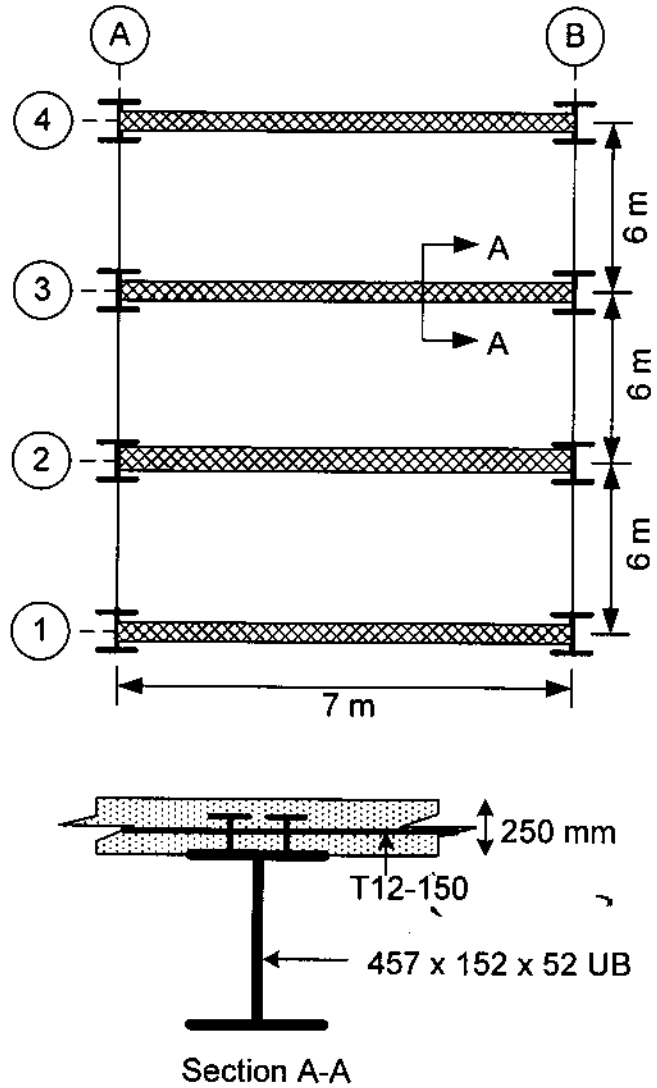

FIGURE Q4

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APPENDIX 1:

Table 3.1 Approximate minimum thickness h (mm) of R. C. Cantilever wall subjected to water pressure

Height of wall (m)	Minimum wall thickness h (mm)
8	800
6	700
4	450
2	250

Table A2.12 $h = 800$ Cover to main bars = 56 Crack width = 0.2

Bar size (mm)	Bar spacing (mm)						
	100	125	150	175	200	250	300
12	*317.2* *285* *279*	*253.7* *285* *259*					
16	372.8 275 338	318.0 290 313	*374.9* *285* *295*	*321.3* *285* *280*	*281.2* *285* *268*		
20	484.1 233 391	399.7 238 363	344.6 245 342	306.7 253 326	279.8 262 310	*245.2* *285* *288*	*292.1* *285* *271*
25	654.7 207 453	526.8 206 420	442.5 206 396	384.0 207 376	342.1 209 359	287.7 218 334	255.3 231 314
32	945.4 189 532	746.8 184 494	614.2 180 465	521.3 176 442	454.0 174 422	365.7 174 392	312.4 177 369

$$w = \frac{3a_{cr}\,\epsilon_m}{1 + 2\left(\frac{a_{cr} - c_{min}}{h - x}\right)}$$

For limiting crack width of 0.2 mm:

$$\epsilon_2 = \frac{b_t(h - x)\,(a' - x)}{3E_s A_s (d - x)}$$

For limiting crack width of 0.1 mm:

$$\epsilon_2 = \frac{1.5b_t(h - x)\,(a' - x)}{3E_s A_s (d - x)}$$

$$\varepsilon_1 = \frac{(h-x)}{(d-x)} \times \frac{f_s}{E_s}$$

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Table 3.2 Allowable ultimate shear force in slabs (kN/m). Grade 35 concrete

Steel ratio $100A_s$	Effective depth (mm)							
bd	140	190	240	330	430	630	730	920
0.17	71.3	89.6	106.8	135.6	168.4	246.7	285.9	360.3
0.25	81.1	101.9	121.5	154.2	191.5	280.6	325.1	409.8
0.50	102.1	128.4	153.0	194.3	241.3	353.5	409.6	516.3
0.75	116.9	147.0	175.2	222.4	276.2	404.7	468.9	591.0
1.00	128.7	161.8	192.8	244.8	304.0	445.4	516.1	650.5
1.50	147.3	185.2	220.7	280.2	348.0	509.9	590.8	744.6

Note: A_s is the area of steel that is fully anchored.