Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	URBAN STORM WATER MANAGEMENT
COURSE CODE	:	BFW40503
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 You are a project manager for a dam construction in Selangor. One of your tasks is to prepare an erosion and sediment control plan to ensure that construction works will not affect quality and quantity of runoff within the area. Propose an erosion and sediment control plan with sketches of some imaginary contour lines for the construction area. I Suitable Best Management Practices (BMPs) facilities also need to be included in this proposal.

(20 marks)

Q2 (a) Define average recurrence interval (ARI).

(2 marks)

(b) Compare briefly between design flood and actual flood in flood estimation.

(4 marks)

(c) Determine design peak flow generated from minor (5-year) and major (100-year) ARI for residential area (10 hectares). Given, t_o = 8 min, t_d = 7 min and runoff coefficient C_{minor} and C_{major} are 0.7 and 0.85, respectively. Refer **Figure Q2 (c)** as an aid to find rainfall intensity.

(6 marks)

(d) Rainfall temporal patterns are intended to be used in hydrograph generation design storms with recommended standard time intervals according to MSMA. Discuss the temporal patterns method and justify the effectiveness of this method in solving flood problems.

(8 marks)

Q3 (a) Explain briefly **TWO (2)** types of stormwater pollutants.

(4 marks)

(b) A 50 ha of development area which are consists 28 ha of industrial and 22 ha of commercial area. Mean annual rainfall, R is 2900 mm and runoff coefficient, C for both is 0.9. By referring to **Table Q3 (b)**,

(i) calculate annual runoff in mm.

(2 marks)

(ii) analyse annual pollution loading for Total Dissolved Solid (TDS), Total Nitrogen (TN) and Total Phosphorus (TP) in kg/year and tonne/yr.

(8 marks)

(c) Suggest a detail procedure to estimate preliminary size for water quality pond using removal curves method.

(6 marks)

Q4 (a) Explain briefly the differences between dry basins and flood storage reservoirs as community and regional detention facilities.

(4 marks)

(b) On-site detention (OSD) tank is proposed to be built next to a tennis court in SMK Taiping, Perak. The tennis court area is 0.8 ha and 60% of it shall be paved. The catchment area of the project that connects to the main drain is about 0.7 ha with a steep slope. By referring to **Table Q4 (b)**,

(i) estimate permissible site discharge (PSD) in m^3/s.

(3 marks)

(ii) estimate site storage requirement (SSR) in m^3.

(2 marks)

(iii) propose size of tank storage.

(2 marks)

(c) Regional retention is proposed to be applied in low-cost stormwater management project. Suggest **THREE (3)** suitable facilities of regional retention and support with best justification.

(9 marks)

Q5 (a) State **TWO (2)** types of valves and discuss the advantages of each type.

(6 marks)

(b) A developed factory in Seremban is required to include rain water tank in the proposed design. The roof building area and workers are 4500 m^2 and 450 peoples, respectively. The factory will has toilets with single flush system and small landscaping area at the entrance. Given that the average annual rainwater yield for Seremban is 98 m^3. By referring to **Table Q5 (b)**,

(i) determine annual rainwater demand in m^3.

(3 marks)

(ii) determine rainwater tank size.

(5 marks)

(iii) estimate percentage of rainwater yield over rainwater demand.

(2 marks)

(c) A engineered channel is proposed in a new low-cost residential project. Evaluate suitability of this channel and reason.

(4 marks)

– END OF QUESTIONS –

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FIGURE Q2 (c)

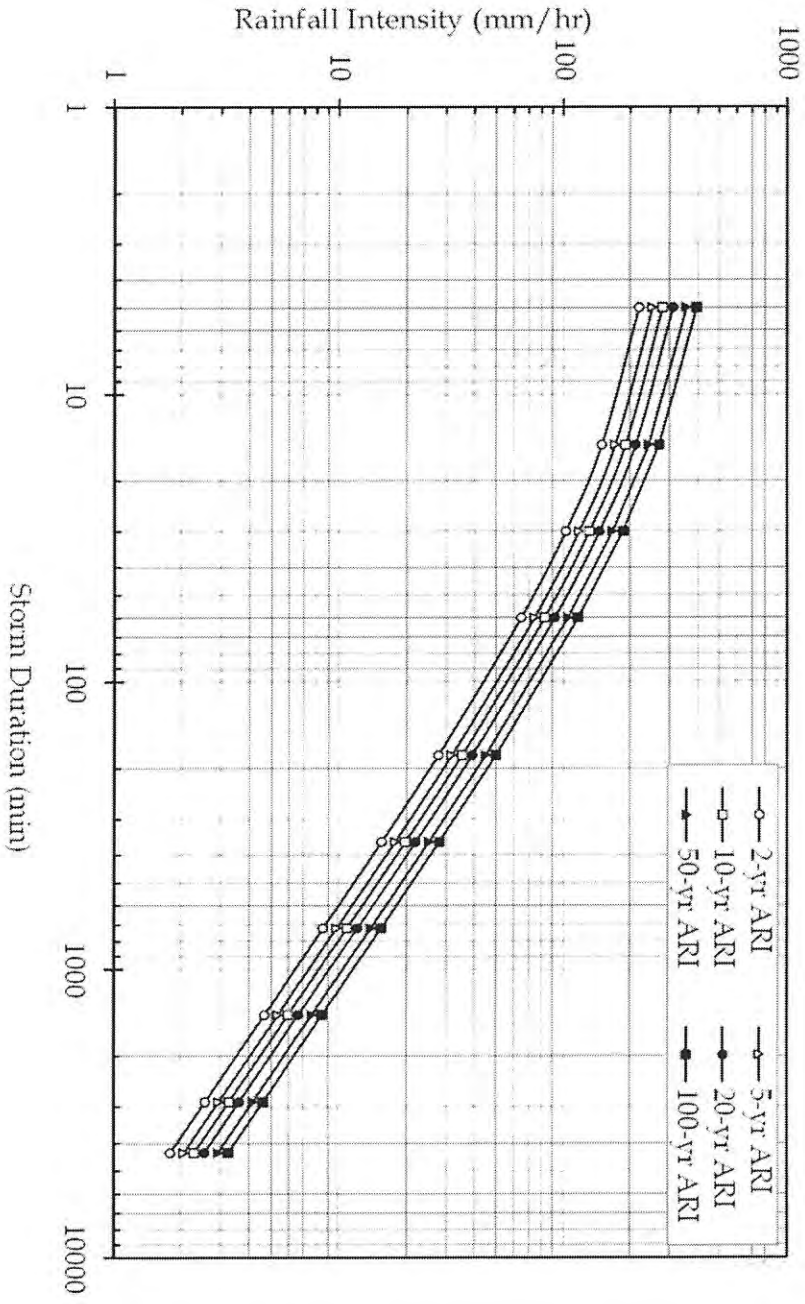

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TABLE Q3 (b): Mean EMC values for selected landuses

Pollutants		Landuses			
Parameter	Unit	Residential	Commercial	Industrial	Highway
TSS	mg/L	128.00	122.00	166.00	80.00
Turbidity	NTU	122.00	96.00	147.00	69.00
TDS	mg/L	131.00	43.00	137.00	38.00
pH	-	6.46	6.77	6.66	6.57
BOD	mg/L	17.90	22.90	19.30	14.90
COD	mg/L	97.00	134.00	140.00	81.00
AN	mg/L	0.73	0.85	1.00	0.41
TKN	mg/L	2.38	2.55	4.25	1.43
TN	mg/L	4.21	4.84	5.00	2.25
TP	mg/L	0.34	0.32	0.49	0.16
O&G	mg/L	2.00	4.00	NA	3.00
Zn	mg/L	0.19	0.34	0.43	0.21
Pb	µg/L	6.00	22.00	12.00	20.00
Cu	µg/L	28.00	37.00	42.00	28.00
Cr	µg/L	4.00	32.00	31.00	11.00
Ni	µg/L	10.00	17.00	30.00	15.00
Cd	µg/L	6.00	26.00	5.00	10.00

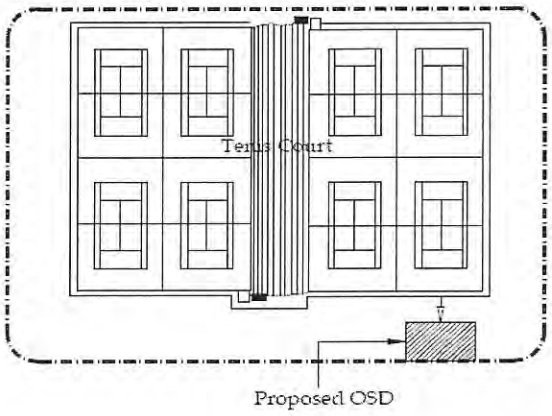

FIGURE Q4 (b): Proposed on-site detention (OSD) in SMK Taiping, Perak

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TABLE Q4 (b): Maximum permissible site discharge (PSD) and minimum site storage requirement (SSR) values in accordance with the four regions in Peninsular Malaysia

Terrain / Slope Condition	PSD (l/s/ha)					SSR (m³/ha)				
	Impervious Area (as a Percentage of Project Area)									
	25%	40%	50%	75%	90%	25%	40%	50%	75%	90%
REGION 1 - WEST COAST										
Lowlying	63.4	64.2	64.5	65.2	65.5	322.2	363.0	394.2	478.3	540.4
Mild	76.7	77.5	77.9	78.7	79.1	306.6	340.0	367.2	448.5	504.7
Steep	87.7	88.6	89.1	90.1	90.5	294.0	327.0	350.5	426.7	478.8
REGION 2 - EAST COAST										
Lowlying	53.0	53.6	53.9	54.5	54.7	276.6	350.4	410.7	609.1	768.8
Mild	61.1	61.8	62.2	62.8	63.1	257.6	321.7	373.9	546.1	678.7
Steep	67.4	68.2	68.6	69.3	69.6	243.5	302.6	351.0	509.9	625.9
REGION 3 - NORTHERN										
Lowlying	54.8	55.4	55.7	56.3	56.5	311.1	353.3	389.7	493.3	564.4
Mild	68.0	68.8	69.2	69.9	70.2	295.5	328.3	360.3	454.0	521.6
Steep	77.3	78.2	78.6	79.5	79.8	284.8	316.2	341.8	430.3	492.6
REGION 4 - HIGHLAND										
Lowlying	42.6	43.1	43.4	43.8	44.0	227.8	285.7	331.4	460.5	546.6
Mild	49.6	50.2	50.5	51.0	51.2	212.3	266.0	307.3	428.2	509.2
Steep	55.0	55.6	56.0	56.5	56.8	202.1	252.3	291.0	405.5	484.1
REGION 5 - SOUTHERN										
Lowlying	61.1	61.9	62.2	62.8	63.1	315.0	362.0	398.4	501.0	572.7
Mild	74.8	75.7	76.1	76.9	77.2	298.5	340.9	372.6	465.9	532.3
Steep	83.4	84.3	84.8	85.7	86.1	288.5	323.3	352.5	442.8	505.0

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TABLE Q5 (b): Rainwater demand for domestic application

Use (Appliance)	Type	Average Consumption	Average Total Rainwater Demand
A. Indoor			
Toilet	Single Flush	9 litres per flush	120 litres per day
	Dual Flush	6 or 3 litres per flush	40 litres per day
Washing Machine	Twin Tub (Semi- auto)		40 litres per wash
	Front Loading		80 litres per wash
	Top Loading		170 litres per wash
Dishwasher	-		20-50 litres per load
General Cleaning	-	10-20 litres per minute	150 litres per day
B. Outdoor			
Sprinkler or Handheld Hose		10-20 litres per minute	1000 litres per hour
Drip System			4 litres per hour
Hosing Paths/Driveways		20 litres per minute	200 litres per wash
Washing Car with a Running Hose		10-20 litres per minute	100-300 litres per wash