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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : URBAN STORM WATER
MANAGEMENT

COURSE CODE : BFW40503

PROGRAMME CODE : BFF

EXAMINATION DATE : DECEMBER 2019/ JANUARY 2020

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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- Q1** (a) Variety of Best Management Practices (BMPs) facilities can be applied in runoff quality estimation for urban stormwater management. List **FOUR (4)** factors that should be considered in BMPs) selection process. (4 marks)
- (b) Explain briefly, **TWO (2)** principles of erosion and sediment control (ESC) which are suggested by MASMA for construction site. (6 marks)
- (c) Runoff management is important part in erosion and sediment control (ESC) to control direction and sediment transportation. Recommend and discuss briefly **TWO (2)** types of method to control runoff process. (6 marks)
- (d) Plan a procedure to evaluate the performance of BMPs facilities in achieving project objectives. (4 marks)
- Q2** (a) Explain **TWO (2)** objectives of hydrologic analysis and design in stormwater management. (4 marks)
- (b) Based on **Table Q2 (b)**, construct the temporal pattern and display in bar chart form. (10 marks)
- (c) Rational method is proposed to estimate the peak flow, Q_p . Recommend steps for this method in flow chart form. (6 marks)
- Q3** (a) Describe stormwater pollutants and explain briefly **TWO (2)** types of stormwater pollutants. (6 marks)
- (b) A 50 ha of development area which are consists 25 ha of residential and 25 ha of commercial area. Mean annual rainfall, R is 2850 mm and runoff coefficient, C for residential and commercial area are 0.76 and 0.9, respectively. Referring to **Table Q3 (b)**, calculate the annual pollution loading for Total Phosphorus (TP), Oil & Grease (O&G) and Total Suspended Solid (TSS) in tonne/yr. (10 marks)
- (c) Floatable pollutants is one of stormwater pollutant. Suggest and discuss **ONE** method to eliminate or reduce this pollutant. (4 marks)

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- Q4** (a) Discuss briefly the important of detention and retention facilities in stormwater management planning. (4 marks)
- (b) Construct a procedure to determine pond size for volume and primary outlet in flow chart form. (7 marks)
- (c) Suggest and discuss **TWO (3)** facilities of regional retention that can be applied in urban stormwater management. (9 marks)
- Q5** (a) Define rainwater harvesting and discuss briefly **TWO (2)** benefits of rainwater harvesting. (6 marks)
- (b) A grassed swale is proposed to convey design flow for a 10-year ARI minor system from sub-catchment A. By referring to **Table Q5**, determine size of swale in trapezoidal shape and sketch the cross section of this swale (10 marks)
- (c) Storage tank for rainwater harvesting will be sized or designed for residential building. Consider and discuss briefly, **TWO (2)** factors that will influence to this process. (4 marks)

– END OF QUESTIONS –

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Table Q2 (b)

Storm Duration = 15 min, Number of intervals = 3		Rain (mm) at a 5 minutes interval		
Date	Total Rain (mm)	1st	2nd	3rd
3.12.1985	37.8	11.2	17.3	9.3
12.1.1972	34.0	9.2	12.8	12.0
7.12.1983	33.7	8.0	11.7	14.0
17.11.2001	33.1	9.6	12.8	10.7
21.07.1992	33.0	9.5	12.3	11.2
30.6.1989	31.2	11.2	10.7	9.3
19.01.1999	30.1	4.8	13.3	12.0
14.6.2005	29.3	9.3	10.3	9.7
27.4.2003	28.8	10.7	7.2	10.9
4.2.1990	26.9	8.1	8.9	9.9

Table Q3 (b)

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	0.44
TKN	mg/L	2.38	2.53	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

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Table Q5 (b)

Data	Value
<i>Sub-catchment A:</i>	
- Area	0.25 ha
- Open space (grass)	0.4
- Rainfall intensity for 10 year ARI, i	243 mm/hr
<i>Proposed Swale:</i>	
- Manning's n roughness coefficient	0.03
- Side slope, z	2.5
- Swale longitudinal slope	0.20%
- minimum freeboard	5 cm

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