Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	INFRASTRUCTURE ENGINEERING TECHNOLOGY
COURSE CODE	:	BNC 31703
PROGRAMME CODE	:	BNC
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Earthwork are engineering works created through the moving of massive quantities of soil or unformed rock. List **FIVE (5)** main activities involved in earthwork.

(5 marks)

(b) Table **Q1(b)** shows ground levels and formation levels for a proposed road construction. Embankments are to be built with side slopes of 1:2.0 and cuttings with slopes of 1:1.5. The embankment crest width and cutting base width is 9 m. It may be assumed that the ground is horizontal across the section. Given, bulking factor = 0.7 and shrinkage factor = 1.0. Calculate total equivalent volume (m^3)

(20 marks)

Q2 As an Engineer Technologist in infrasturcture consultant firm, you are required to prepare a planning for a bungalow development in Puchong, Kuala Lumpur. After completion of earthworks planning, drainage and road design will be made.

(a) Explain generally on the MSMA (*Manual Saliran Mesra Alam*) in civil engineering perspective.

(5 marks)

(b) Referring to MASMA 2nd Edition, design the size of a lined rectangular drain to convey a 5 year ARI minor system design flow from a proposed 5 hectare bungalow development in Puchong, Kuala Lumpur. The post development time of concentration t_c at the development outlet is estimated to be 20 minutes.

(20 marks)

Q3 (a) Groundwater control is the temporary process when dealing with groundwater to allow excavations to be made in dry and stable condition below natural ground water level. Describe **FIVE (5)** purposes of Groundwater control in construction building.

(5 marks)

(b) Demonstrate and sketch **THREE (3)** techniques in the Exclusion Method that can be implemented to control Groundwater level.

(9 marks)

(c) In Malaysia, there are two types of road construction such as bituminous road and concrete road.

(i) List **THREE (3)** advantages and **TWO (2)** disadvantages using concrete road compared to bituminous road.

(5 marks)

(ii) Sketch and label the cross section of bituminous road. Determine the thickness of each layer of the road construction.

(6 marks)

Q4 You work as an Engineering Technologist in the consultant company, where you are required to provide an infrastructure planning of sewerage system in new development for residential area.

(a) Sketch and explain components of the sewerage line system from the housing toilet to the sewerage treatment plant.

(10 marks)

(b) Your sewerage treatment system is 3 km away from the housing area, sketch and differentiate on **THREE (3)** factors to be considered on manhole construction and give your suggestion if the sewerage pipe system cannot be connected to receiving last manhole at sewerage treatment system by gravity flow.

(15 marks)

– END OF QUESTIONS –

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Table Q1(b) Levelling data.

Chainage	Ground Level (mAD)	Formation Level (mAD)
0	35	40
100	30	36
200	19	22
300	11	17
400	7	9
500	-3	5
600	-7	2
700	-10	2
800	15	8
900	21	11
1000	28	14

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APPENDIX

Table 1 Quantity Design Storm ARIs

Type of Development (See Note 1)	Minimum ARI (year) (See Note 2)	
	Minor System (See Note 3)	Major System (See Note 3)
Residential		
Bungalow and semi-detached dwellings	5	50
Link house / apartment	10	100
Commercial and business center	10	100
Industry	10	100
Sport field, park and agricultural land	2	20
Infrastructure / utility	5	100
Institutional building / complex	10	100

Notes:

1. For mixed developments, the highest of the applicable storm ARIs from the Table shall be adopted.
2. In the case where designing to the higher ARI would be impractical, the selection of appropriate ARI should be adjusted to optimise the cost to benefit ratio or social factors. If justified, a lower ARI might be adopted for the major system, with consultantion and approval from the Department OF Irrigation and Drainage (DID). Even if the stormwater system for the existing developed condition is designed for a lower ARI storm, sufficient land should be reserved for higher ARI flow rates, so that the system can be upgraded when the area is built up in the futute.
3. All development projects shall be protected from both minor and major floods and, therefore, must have combination of minor and major systems. Habitable floor levels of the buildings (platform levels) shall be set above the 100 year ARI flood level based on the most recent data available. The drainage submission must show the minor and major system components in their drawings and plans.

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Table 2 Fitting Constant for the IDF Empirical Equation for the Different Locations in Malaysia for High ARIs between 2 and 100 Year and Storm Durations from 5 minutes to 72 Hours

State	No.	Station ID	Station Name	Constants			
				λ	ƙ	θ	η
Kelantan	1	4614001	Brook	49.623	0.159	0.242	0.795
	2	4726001	Gunung Gagau	43.024	0.220	0.004	0.527
	3	4819027	Gua Musang	57.132	0.155	0.119	0.795
	4	4915001	Chabai	47.932	0.169	0.108	0.794
	5	4923001	Kg Aring	47.620	0.187	0.020	0.637
	6	5120025	Balai Polis Bertam	61.338	0.168	0.193	0.811
	7	5216001	Gob	41.783	0.175	0.122	0.720
	8	5320038	Dabong	51.442	0.189	0.077	0.710
	9	5322044	Kg Lalok	53.766	0.197	0.121	0.705
	10	5522047	JPS Kuala Krai	39.669	0.231	0.000	0.563
	11	5718033	Kg Jeli, Tanah Merah	72.173	0.196	0.360	0.703
	12	5719001	Kg Durian Daun Lawang	51.161	0.193	0.063	0.745
	13	5722057	JPS Machang	48.433	0.219	0.000	0.601
	14	5824079	Sg Rasau Pasir Putih	51.919	0.216	0.062	0.560
	15	6019004	Rumah Kastam Rantau Pjg	49.315	0.228	0.000	0.609
	16	6122064	Setor JPS Kota Bharu	60.988	0.214	0.148	0.616
Kuala Lumpur	1	3015001	Puchong Drop, K Lumpur	69.650	0.151	0.223	0.880
	2	3116003	Ibu Pejabat JPS	61.976	0.145	0.122	0.818
	3	3116004	Ibu Pejabat JPS1	64.689	0.149	0.174	0.837
	4	3116005	SK Taman Maluri	62.765	0.132	0.147	0.820
	5	3116006	Ladang Edinburgh	63.483	0.146	0.210	0.830
	6	3216001	Kg. Sungai Tua	64.203	0.152	0.250	0.844
	7	3216004	SK Jenis Keb. Kepong	73.602	0.164	0.330	0.874
	8	3217001	Ibu Bek. KM16, Gombak	66.328	0.144	0.230	0.859
	9	3217002	Emp. Genting Kelang	70.200	0.165	0.290	0.854
	10	3217003	Ibu Bek. KM11, Gombak	62.609	0.152	0.221	0.804
	11	3217004	Kg. Kuala Saleh, H. Klg	61.516	0.139	0.183	0.837
	12	3217005	Kg. Kerdas, Gombak	63.241	0.162	0.137	0.856
	13	3317001	Air Terjun Sg. Batu	72.992	0.162	0.171	0.871
	14	3317004	Genting Sempah	61.335	0.292	0.292	0.868

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APPENDIX

Table 3 Values of Manning's Roughness Coefficient (η) for Open Drains and Pipes (Chow, 1959; DID, 2000 and French, 1985)

Drain/Pipe	Manning Roughness, η
Grassed Drain	
Short Grass Cover (< 150 mm)	0.035
Tall Grass Cover (≥ 150 mm)	0.050
Lined Drain	
Concrete	
Smooth Finish	0.015
Rough Finish	0.018
Stone Pitching	
Dressed Stone in Mortar	0.017
Random Stones in Mortar or Rubble Masonry	0.035
Rock Riprap	0.030
Brickwork	0.020
Pipe Material	
Vitried Clay	0.012
Spun Precast Concrete	0.013
Fibre Reinforced Cement	0.013
UPVC	0.011

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Table 4 Recommend Loss Values for Rainfall Excess Estimation (Chow et al., 1988)

Catchment Condition	Initial Loss (mm)	Continuous Loss (mm/hr)
Impervious	1.5	0
Pervious	10	(i) Sandy Soil: 10 – 25 mm/hr (ii) Loam Soil: 3 – 10 mm/hr (iii) Clay Soil: 0.5 – 3 mm/hr

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FORMULA

$$i = \frac{\lambda T^{k}}{(d + \theta)^{\eta}}$$

$$Q = \frac{C.I.A}{360}$$

$$Q = V \times A$$

$$V = \frac{1}{n} S_o^{\frac{1}{2}} R^{\frac{2}{3}}$$

$$A = (B + ZD)D$$

$$P = B + 2D\sqrt{1 + Z^2}$$

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