UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	WATER RESOURCES ENGINEERING
COURSE CODE	:	MFA 10603
PROGRAMME CODE	:	MFA
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL QUESTIONS** 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**

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

Q1 **(a)** River Corridor Management is identified as one of the elements in water resources management. Discuss **TWO (2)** ways to improve our river system highlighted in the River Corridor Management.

(4 marks)

(b) Many flood mitigation projects have been implemented to prevent and minimize flood magnitude in Kuala Lumpur. However, series of flood events still occurred in the last 5 years. Explain **THREE (3)** causes that contribute to the flood event in Kuala Lumpur.

(6 marks)

(c) A river of 30 m wide and 3 m depth has a mean velocity of 1.2 m/s. Determine the height of a weir to raise the water level by 1 m.

(10 marks)

Q2 **(a)** Explain **TWO (2)** factors that influence the shape of hydrograph.

(4 marks)

(b) Justify **THREE (3)** reasons why engineers collect a watershed streamflow data, produce hydrograph and apply the regional water balance equation.

(6 marks)

(c) Based on tabulated runoff data in **Table Q2 (c)**, determine the runoff depth if the area of catchment is 200 km^2. Separate the baseflow using intersection method where, $N=0.8A^{0.2}$.

(10 marks)

Q3 **(a)** Explain **TWO (2)** applications of frequency analysis.

(4 marks)

(b) Based on **Table Q3 (b),** estimate the probability that the annual maximum discharge Q will exceed 10.00 m^3/s at least once within the next 6 years.

(6 marks)

(c) The annual minimum discharge between 1982 and 2012 show a mean of $74.1 m^3/s$ and a standard deviation of 65.1 m^3/s. Assuming that the annual minimum flows are described by an extreme-value Type I (Gumbel) distribution, estimate the annual-minimum flowrate with the return period of 50 years.

(10 marks)

Q4 **(a)** Analyse **THREE (3)** causes of dam failures.

(6 marks)

(b) A reservoir covers an area of 850 km^2 and has an average depth of 18.7 m. The sediment load to reservoir and the percentage of sediment trapped is 1.97×10^{10} kg/yr and 85% respectively. Assume that the accumulated sediment has a bulk density of 1600 kg/m^3. Calculate,

(i) Time it will take for the reservoir storage to decrease by 15%,
(8 marks)

(ii) Sediment release from the reservoir, and
(3 marks)

(iii) Sediment concentration
(3 marks)

Q5 **(a)** Explain **TWO (2)** factors that affect the increasing of the water demand.
(4 marks)

(b) The design of road drainage system depends on several factors. Discuss **THREE (3)** concepts and drainage criteria in road drainage system.
(6 marks)

(c) A galvanized iron with 350 m long pipe and 1.5 m diameter was used for water distribution system pipes. Calculate the head loss in pipe if flowrate, $Q = 1.5\ m^3/s$ and $Q = 2.5 m^3/s$ using;

(i) Manning's equation with n = 0.015, and
(4 marks)

(ii) Hazen-William with coefficient of friction, C = 135
(4 marks)

(iii) Compare the results of these two methods.
(2 marks)

– END OF QUESTIONS –

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Table Q2 (b): Runoff data for 14 hours

Time (hours)	Runoff (m^3/s)	Time (hours)	Runoff (m^3/s)
1	3.40	8	11.32
2	3.15	9	6.87
3	4.56	10	4.25
4	8.67	11	2.12
5	14.56	12	1.89
6	17.89	13	1.45
7	15.54	14	1.45

Table Q3 (b): Discharge data (m^3/s)

Year	1970	1980	1990	2000	2010
0		5.90	13.31	14.56	9.19
1	4.55	5.80	12.88	5.58	9.74
2	5.65	8.93	3.54	10.88	5.85
3	6.55	7.71	9.45	4.10	13.34
4	3.5	1.34	8.56	5.73	2.53
5	3.45	2.25	4.95	15.2	3.33
6	4.34	11.79	11.73	9.79	14.23
7	17.67	4.67	28.5	7.55	
8	10.22	6.97	5.83	4.430	
9	6.87	12.45	10.17	15.20	

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EQUATIONS

$$K_T = w - \frac{2.515517 + 0.802853w + 0.010328w^2}{1 + 1.432788w + 0.189296w^2 + 0.001308w^3}$$

$$x_T = \mu_x + K_T\sigma_x \qquad p = \frac{1}{T} \qquad w = \left[\ln\left(\frac{1}{p^2}\right)\right]^{\frac{1}{2}}$$

$$\mu_x = b + 0.577a \qquad \sigma_x^{\,2} = 1.645a^2 \qquad g_x = 1.1396$$

$$\mu_x = b - 0.577a \qquad \sigma_x^{\,2} = 1.645a^2 \qquad g_x = -1.1396$$

$$F(y) = \exp[-\exp(-y)] \qquad F(y) = 1 - \exp[-\exp(y)] \qquad y = \frac{x-b}{a}$$

$$h_L = \left[\frac{n^2 L}{\left[AR^{\frac{2}{3}}\right]^2}\right] Q^2 \qquad R = \left[\frac{A}{P}\right]$$

$$C_1 = \frac{\Delta t - 2KX}{2K(1-X) + \Delta t} \qquad C_3 = \frac{2K(1-X) - \Delta t}{2K(1-X) + \Delta t}$$

$$C_2 = \frac{\Delta t + 2KX}{2K(1-X) + \Delta t} \qquad O_{j+1} = C_1 I_{j+1} + C_2 I_j + C_3 O_j$$

$$\text{Sediment concentration} = \frac{\text{sediment release}}{\text{sediment load}} \qquad \text{Return Period} = \frac{\text{rank (m)}}{\text{year}}$$

$$P(X \geq x_T) = \frac{1}{T}$$

$$P(X < x_T \text{ each year for } N \text{ years}) = (1-P)^N$$

$$P(X \geq x_T \text{ at least once in } N \text{ years}) = 1 - (1-P)^N$$