Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	HYDROLOGY
COURSE CODE	:	BFC 32002
PROGRAMME	:	BFF
EXAMINATION DATE	:	DECEMBER 2019 / JANUARI 2020
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN **PART A**, AND ANY **ONE** (1) QUESTION IN **PART B** ***Student who wish to answer Question 6 in Part B should submit page 7 from question paper together with your answer booklet.***

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

PART A: ANSWER **ALL** QUESTIONS

Q1 (a) Define natural hydrograph, and with the aid of diagram, label the crest, recession limb and rising limb.

(4 marks)

(b) Describe the technique used to separate baseflow from natural hydrograph using variable slope method.

(5 marks)

(c) UH–2 hours is given in **FIGURE Q1(c)**. Derive 2-hr UH as a result of effective rainfall of 1.2 cm.

(6 marks)

(d) According answer in **Q1(c)**, calculate the natural hydrograph ordinates and plot roughly the representation of the hydrograph. Assume the base flow is 0.1 m^3/s.

(10 marks)

Q2 (a) Describe the development of the stage–storage curve used in the reservoir routing.

(5 marks)

(b) The inflow hydrograph of a catchment area is shown in **TABLE Q2(b)**. Perform the flood routing through a river reach using Muskingum method. Given K = 20 hours and X = 0.1.

(6 marks)

(c) Based on the answer obtained from **Q2(b)**, if the weighting factor, X = 0.2 plot the storage, S against weighted discharge for X = 0.1 and X = 0.2.

(10 marks)

(d) According to your judgement, which plot produce the accurate value and state your reason.

(4 marks)

Q3 (a) State **TWO (2)** parameters of groundwater storage.

(4 marks)

(b) Briefly explain and sketch the groundwater hydrology.

(5 marks)

(c) A confined aquifer of 40 m thickness has a porosity of 0.3. Estimate the storage coefficient and specific storage according to Jacob and DeWeist analysis. Given $\alpha = 1.5\text{x}10^{-9}$ cm²/dyn and $\beta = 5\text{x}10^{-10}$ cm²/dyn.

(8 marks)

(d) The banks and bottom of a stream consist of silty clay of hydraulic conductivity 0.008 m/day having an average depth of 150 cm. The underlying aquifer of fine sand has an average thickness of 20 m. Hydraulic conductivity of fine sand = 2.5 m/day. Analyze :-

(i) Coefficient of leakage

(3 marks)

(ii) Retardation coefficient and leakage factor.

(5 marks)

PART B: ANSWER **ANY ONE (1)** QUESTION

Q4 (a) List the meteorological factors affecting runoff.

(4 marks)

(b) Discuss on how to estimate peak runoff using Rational Method.

(5 marks)

(c) **TABLE Q4(c)** provides the filed measurements of width, depth and velocity. Calculate the discharge at the stream cross section by using mid-section method.

(8 marks)

(d) Assume that from section B to F in **Q4(c)** have become 0.2 m deeper. In addition, a tributary has joined the stream and added approximately 50 m^3/s to the flow in the channel. Determine the new discharge for each section by altering the depths and adding the tributary's contribution across the channel in proportion to the modified discharge distribution. Assume velocity distribution remain unchanged.

(8 marks)

Q5 (a) Define transpiration and evapotranspiration.

(4 marks)

(b) Briefly explain **TWO (2)** factors that affecting the infiltration.

(5 marks)

(c) The rainfall intensity in the 20 hectares of catchment area is given in **TABLE Q5(c)**. If volume of surface runoff is 40000 m^3, estimate Φ index for the catchment area and sketch the circumstances in form of hyetograph.

(8 marks)

(d) The infiltration rate for a small catchment area is 6 cm/hr initially and it decreased exponentially toward a constant rate of 0.1 cm/hr. A total of 40 cm of water infiltrated during an 8 hour interval. Determine the k value of the Horton's equation.

(8 marks)

Q6 (a) List down **TWO (2)** different types of rain gauges which are widely use in the market.

(4 marks)

(b) With the aid of the diagram, explain an ideal placement of rain gauge at location.

(5 marks)

(c) **TABLE Q6 (c)** shows rainfall data and the position of rain gauge for Kluang basin. By sketching each and every station in its own region, estimate the rainfall data in station X by using appropriate method.

(8 marks)

(d) A catchment has five rainfall gauges as shown on **FIGURE Q6(d)**. The total storm rainfall depths are given as; A = 55 mm, B = 65 mm, C = 82 mm, D = 71 mm and E = 68 mm.

(i) Determine the mean precipitation over the area by using Thiessen polygon method.
Note : Please attach page 7 question paper with your answer script and write down your name and matrix number at the top of the paper.

(5 marks)

(ii) Explain in term of accuracy the different of this method with the arithmetic mean method and isohyetal method.

(3 marks)

"END OF QUESTION"

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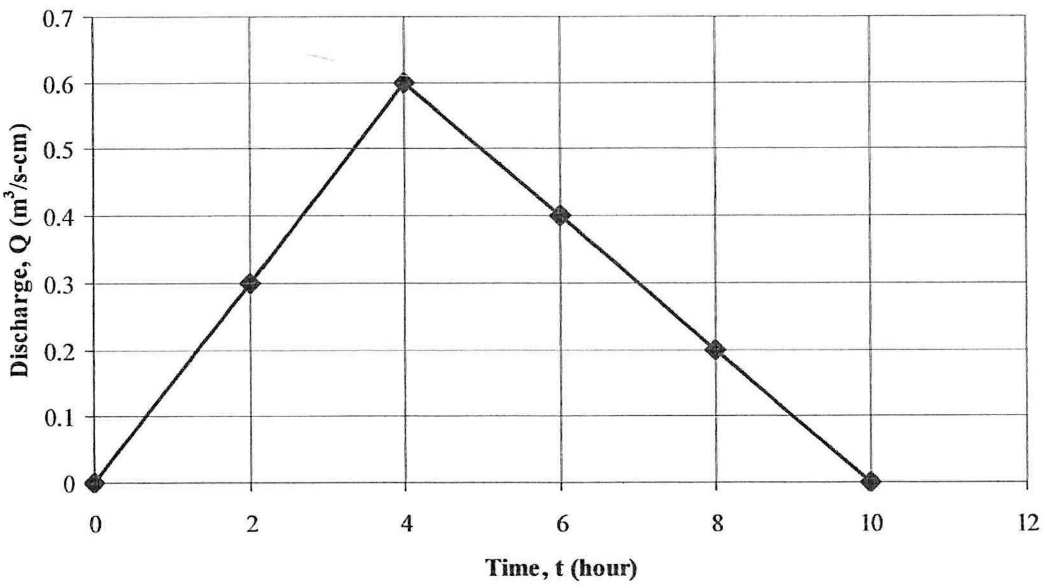

FIGURE Q1(c)

TABLE Q2(b): River inflow hydrograph

Time (hour)	I = Inflow (m^3/s)
12	2.8
24	8.5
36	19.2
48	14.2
60	11.3
72	8.7
84	6.5
96	5.1
108	2.8
120	1.4

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TABLE Q4(c)

Vertical Section	Distance across stream (m)	Depth (m)	Average Velocity (m/s)
A	0.0	0.0	0.00
B	4.2	4.0	0.40
C	7.5	5.2	0.45
D	12.3	6.0	0.68
E	16.0	5.3	0.50
F	21.1	3.8	0.35
G	26.3	0.0	0.00

TABLE Q5(c)

Time (hour)	Rainfall intensity (mm/hour)
1	5
2	10
3	38
4	25
5	13
6	5
7	0

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Name : ....

Matrix No. : ....

Section : ....

TABLE Q6 (c)

Station	Rainfall (mm)	Coordinates	
		X	Y
X	-	4	5
A	100	-2	-3
B	105	-1	6
C	109	5	-3
D	110	-2	6
E	98	7	8
F	85	5	-1

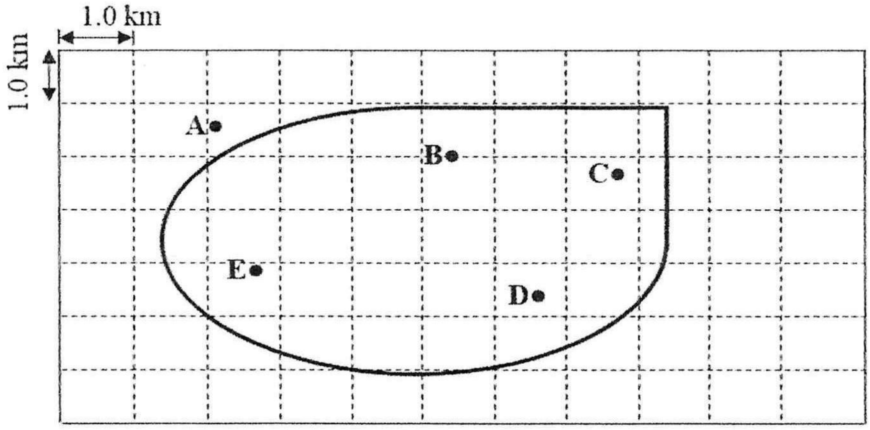

FIGURE Q6(d)

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Equations sheet

$$Q_2 = C_0 I_2 + C_1 I_1 + C_2 Q_1 \qquad (I_1 + I_2) + \left(\frac{2S_1}{\Delta t} - O_1\right) = \left(\frac{2S_2}{\Delta t} + O_2\right)$$

$$C_0 = \frac{0.5\Delta t - Kx}{K(1-x) + 0.5\Delta t} \qquad C_1 = \frac{0.5\Delta t + Kx}{K(1-x) + 0.5\Delta t} \qquad C_2 = \frac{K(1-x) - 0.5\Delta t}{K(1-x) + 0.5\Delta t}$$

$$\mathrm{xI} + (1-x) \qquad S = \rho g b(\alpha + \eta\beta) \qquad S_s = \frac{S}{b} \qquad S_s = \gamma_w[(1-\eta)\alpha + \eta\beta]$$

$$L_e = \frac{K'}{b'} \qquad a = \frac{K}{L_e} \qquad \beta = \sqrt{\frac{Kb}{L_e}} \qquad P_x = \frac{1}{M}\sum(P_i) \qquad P_x = \sum[W_i P_i]$$

$$t_2 = \frac{L}{C - v_p} \qquad v = \frac{L}{2cos\theta}\left[\frac{1}{t_1} - \frac{1}{t_2}\right] \qquad t_1 = \frac{L}{C + v_p} \qquad Q = K_1\left[\frac{Ed}{I} + K_2\right]$$

$$Q = \frac{(C_1 - C_2)}{(C_2 - C_o)}q \qquad \Delta Q_N = \overline{V_N}\Delta A_N \qquad \Delta A_N = \overline{W_N} y_N \qquad \overline{W_N} = \frac{\left[W_N + \frac{W_{N-1}}{2}\right]^2}{2W_N}$$

$$E = \kappa(e_o - e_a) \qquad E = C(e_o - e_a)\left[1 + \frac{W}{10}\right] \qquad E = (0.013 + 0.00016U_2)e_a\left[\frac{100 - R_h}{100}\right]$$

$$\phi_{index} = \frac{P - R}{t_e} \qquad f = f_c + (f_o - f_c)e^{(-kt)} \qquad F = \left[f_c t + \frac{(f_o - f_c)}{k}\left(1 - e^{(-kt)}\right)\right]_0^t$$

$$P = \frac{P_1 + P_2 + P_3 + \cdots + P_n}{n} = \sum_{i=1}^{n}\frac{P_i}{n} \qquad P_x = \frac{N_x}{M}\sum\frac{P_i}{N_i} \qquad I - Q = \frac{dS}{dt}$$

$$\mathrm{P} = \frac{A_1P_1 + A_2P_2 + A_3P_3 + \cdots + A_nP_n}{A_1 + A_2 + A_3 + \cdots + A_n} = \sum_{i=1}^{n}\frac{A_iP_i}{A} \qquad W_i = \frac{\left[\frac{1}{d_i^{\,2}}\right]}{\sum\left[\frac{1}{d_i^{\,2}}\right]} \qquad P_a = P_o\left[\frac{M_a}{M_o}\right]$$

$$ET_P = \frac{\Delta H + 0.27E_o}{\Delta + 0.27} \qquad E_o = 0.35(e_s - e_a)\,(1 + 0.0098u_2)$$

$$H = R_A(1 - r)\left[0.18 + 0.55\frac{n}{D}\right] - B(0.56 - 0.092{e_a}^{0.5})\left(0.10 + 0.9\frac{n}{D}\right)$$

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