



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

- COURSE NAME : HYDROLOGY
- COURSE CODE : DAC 21502
- PROGRAMME CODE : DAA
- EXAMINATION DATE : JULY/ AUGUST 2023
- DURATION : 2 HOURS 30 MINUTES
- INSTRUCTION : 1. ANSWER **FIVE (5)** QUESTIONS ONLY
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA **CLOSED BOOK**

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

- Q1** (a) Define water balance equation in quantitative terms. (2 marks)
- (b) Give **six (6)** parameters of hydrologic data. (6 marks)
- (c) Data observation of 10 hectares reservoir has 1500 liter/s of average inflow, 730 liter/s of average outflow and 150 mm/day of evaporation rate. Calculate:
- (i) Area of reservoir (m^2). (2 marks)
 - (ii) Rate of inflow (m^3/day). (2 marks)
 - (iii) Rate of outflow (m^3/day). (2 marks)
 - (iv) Rate of evaporation (m^3/day). (2 marks)
 - (v) Volume of storage (m^3/day). (2 marks)
 - (vi) Height of water (m/day) in the reservoir. (2 marks)
- Q2** (a) Define precipitation as a type of weather condition. (2 marks)
- (b) Describe the data precipitation measurement. (6 marks)
- (c) Refer to **Table Q2 (c)**, calculate the rainfall depth (cm) at station A. (12 marks)
- Q3** (a) Define Mass Transfer Techniques as a method to estimate evaporation. (2 marks)
- (b) Give **two (2)** methods to estimate the evaporation rate in Mass Transfer Techniques. (2 marks)

- (c) Describe the following factors which are affecting infiltration rate:
- (i) Soil characteristics. (2 marks)
 - (ii) Fluid characteristics. (2 marks)
- (d) Total storage of a pond is 181000 m^3 in a month and the average inflow is $0.07 \text{ m}^3/\text{s}$. Determine the evaporation rate (m^3/month). (4 marks)
- (e) Refer to **Table Q3 (e)**, the mean value for air temperature was $29 \text{ }^\circ\text{C}$, average wind speed was 12.5 km/hr and relative humidity was 39% . Calculate:
- (i) Wind speed, U_2 (km/day). (2 marks)
 - (ii) Saturation vapor pressure, e_a (mmHg). (2 marks)
 - (iii) Actual vapor pressure in air, e_{aRh} (mmHg). (2 marks)
 - (iv) Evaporation rate (cm/day) by using Dunne's equation. (2 marks)
- Q4** (a) Describe catchment area as a natural landscape in collecting water. (2 marks)
- (b) Explain Intensity Duration Frequency that commonly used for flood forecasting. (6 marks)
- (c) Refer to **Table Q4 (c)**, time of concentration is the time required for runoff to travel in a catchment area. Calculate:
- (i) Precipitation in descending value. (3 marks)
 - (ii) Return period. (3 marks)
 - (iii) Intensity Duration Frequency for 10-year. (3 marks)

- (iv) Intensity Duration Frequency for 5-year. (3 marks)
- Q5** (a) Describe current meter as water velocity measurement device. (2 marks)
- (b) Explain the characteristics of vertical axis current meter. (6 marks)
- (c) Refer to **Table Q5 (c)**, determine Unit Hydrograph Ordinate value (m^3/s per cm) when the runoff depth 3.79 cm. (12 marks)
- Q6** (a) State **two (2)** assumptions for steady unconfined radial flow toward a well. (2 marks)
- (b) Explain groundwater replenishment which water is stored in the ground. (6 marks)
- (c) Refer to **Table Q6 (c)**, the Gumbel extreme-value fit the recorded values. Calculate:
- (i) Value of T_p (years). (2 marks)
- (ii) Value of y_t ($T = 5$). (2 marks)
- (iii) Value of σ_{n-1} . (2 marks)
- (d) A soil sample occupies 0.06 m^3 has 100 kg of dry mass. When the soil is poured into a graduated cylinder, it displaces 30 liter of water. Calculate:
- (i) Volume of air void (m^3). (2 marks)
- (ii) Value of porosity. (2 marks)
- (iii) Soil bulk density ($sg_{\text{soil}} = 2.5$). (2 marks)

- END OF QUESTIONS -

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Table Q2 (c)

Station	Precipitation, P (mm)	Coordinate X (km)	Coordinate Y (km)
A	P_A	0	0
B	550	2	5
C	510	5	7
D	590	1	-5
E	530	-3	-7
F	570	-1	3
G	550	-3	3
H	590	-5	5
J	715	-10	7

Table Q3 (e)

Temperature (°C)	Vapor Pressure (mmHg)
25	23.76
30	31.83
35	42.18
40	55.34

Table Q4 (c)

Year	Precipitation (cm) of Duration:		
	20 min	40 min	60 min
2009	33	55	79
2010	35	51	71
2011	31	59	71
2012	39	53	71
2013	37	57	75
2014	31	51	76
2015	38	51	74
2016	31	58	78
2017	34	56	73
2018	36	54	77

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Time (hour)	Total Flow (m ³ /s)	Baseflow (m ³ /s)
1	5.75	2.80
2	5.95	2.60
3	9.33	2.50
4	11.50	2.40
5	9.57	2.20
6	7.13	2.10
7	5.35	2.00
8	3.95	1.80
9	3.75	1.70
10	3.55	1.70
11	3.35	1.70
12	3.15	1.70

Table Q6 (c)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Flood (m ³ /s)	4761	2903	4900	3060	5826	2593	2652	2798	3050	4599

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FORMULAR

$$\Delta S = I - O - E$$

$$L^2 = X^2 + Y^2$$

$$W = 1 / L^2$$

$$E = (0.013 + 0.00016U_2) X e_{aRh} X [(100 - R_h) / 100]$$

$$T = (n + 1) / m$$

$$\sigma_{n-1} = [\Sigma(X - X_{ave})^2 / N - 1]^{0.5}$$

$$V_v = V_t - V_s$$