UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	HYDROLOGY
COURSE CODE	:	DAC 21502
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	JULY 2024
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA
		☐ Open book
		☒ 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 **SIX (6)** PAGES

TERBUKA

Q1

(a)   Define the field of hydrology contributions related to Civil Engineering.

(2 marks)

(b)   Discuss the water of the world from all locations.

(3 marks)

(c)   Give three (3) components of surface water.

(3 marks)

(d)   Referring to **Table Q1.1**, data collection on the reservoir in a few days of observation. Calculate:

Table Q1.1

Item	Value
Reservoir area	1.59×10^7 m^2
Observation duration	0.5 month
Average inflow	12.7 m^3/s
Average outflow	20833 m^3/hour
Average infiltration	1.5 mm/15-day
Average precipitation	10.5 cm/15-day
Total evaporation	4.5 mm/15-day

(i)   Total volume of inflow in 15 days (m^3).

(2 marks)

(ii)   Total volume of outflow in 15 days (m^3).

(2 marks)

(iii)   Total volume of infiltration in 15 days (m^3).

(2 marks)

(iv)   Total volume of precipitation in 15 days (m^3).

(2 marks)

(v)   Total volume of evaporation in 15 days (m^3).

(2 marks)

(vi)   Change in storage in 15 days (m^3).

(2 marks)

Q2

(a)   Define the Double Mass Curve in providing consistent precipitation data.

(2 marks)

(b)   Explain the Double Mass Curve procedures in solving inconsistent rain gauge data.

(6 marks)

(c)   Referring to **Table Q2.1**, calculate the adjusted precipitation (mm) from 2010 to 2013.

(4 marks)

Table Q2.1

Item	Value
Original slope	0.19
Adjusted slope	0.25
Original Precipitation 2010	33.5 mm
Original Precipitation 2011	29.3 mm
Original Precipitation 2012	33.9 mm
Original Precipitation 2013	31.7mm

(d)   Referring to **Table Q2.2**, shows six rain gauge stations in a topographic. Calculate:

Table Q2.2

Station	Amounts of Precipitation (cm)	Normal Annual Precipitation (cm)
A	9	95.9
B	9.5	99.3
C	11.9	111.9
D	Missing	113.3
E	9.7	99.5
F	11.1	119.9

(i)   Amount of missing precipitation data (mm) for station D.

(6 marks)

(ii)   Average precipitation depth (mm) in the basin.

(2 marks)

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Q3

(a)   Define the occurrence of evaporation as a main component in the hydrologic cycle.

(2 marks)

(b)   Describe three (3) meteorology factors affecting evaporation occurrence.

(6 marks)

(c)   Referring to **Table Q3.1**, data for drainage area. Calculate:

Table Q3.1

Item	Average Precipitation	Average Monthly Runoff	Drainage Area	Drainage Area
Value	93 mm/month	137 m³/s	1333100 ha	1.3×10^{10} m²

(i)   Rate of runoff (m/month).

(2 marks)

(ii)   Rate of evaporation (m/month).

(2 marks)

(d)   Referring to **Table Q3.2**, Mass Transfer Techniques are based on the turbulent transfer of water vapour to the atmosphere. By using Meyer equations, calculate:

Table Q3.2

Item	R_H	T_{water}	W_{speed}	T_{air}	$C_{panempirical}$
Value	17%	57 °F	9.5 mph	80 °F	0.35
Temperature (°F)	50	60	70	80	90
Vapour Pressure (inHg)	0.36	0.52	0.74	1.03	1.42

(i)   Vapour pressure (inHg) for water temperature.

(2 marks)

(ii)   Vapour pressure (inHg) for air temperature.

(2 marks)

(iii)   Rate of evaporation (in/day).

(2 marks)

(e)   Ladino Clover crop mean monthly consumptive use coefficient is 0.87, average monthly temperature 75 °F and average daytime value 9.5%. Calculate monthly consumptive (in).

(2 marks)

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Q4

(a)   Define two (2) elements represented by hydrograph shape.

(2 marks)

(b)   Explain three (3) types of terminology used in hydrograph shape.

(6 marks)

(c)   Referring to **Table Q4.1**, precipitation data for Intensity Duration Frequency study.

Table Q4.1

No.	Precipitation (in) of duration:			
	5 min	15 min	25 min	35 min
1	0.13	0.33	0.51	0.73
2	0.11	0.39	0.49	0.69
3	0.09	0.29	0.53	0.71
4	0.15	0.41	0.47	0.79
5	0.19	0.37	0.55	0.67
6	0.07	0.35	0.59	0.77
7	0.17	0.31	0.57	0.75
8	0.21	0.43	0.45	0.63
9	0.23	0.27	0.41	0.65
10	0.05	0.45	0.43	0.61

(i)   Arrange precipitation values in descending order.

(1 mark)

(ii)   Calculate the return period.

(1 mark)

(iii)   Estimate 10-year intensity duration frequency using interpolation.

(4 marks)

(iv)   Estimate 5-year intensity duration frequency using interpolation.

(4 marks)

(v)   Convert precipitation depth (in) to intensity value (in/hour) 5 min duration.

(2 marks)

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Q5

(a)   Define surface runoff, which flows off due to precipitation occurrence.

(2 marks)

(b)   Explain the paths of runoff after a rainfall occurrence.

(4 marks)

(c)   Describe a wire gauge as a gauge used to measure the water surface elevation.

(2 marks)

(d)   A storm hydrograph is given in **Table Q5.1** with the corresponding excess rainfall. The time interval is an hour between readings. Determine the unit hydrograph.

(12 marks)

Table Q5.1

Time (hour)	Rainfall Excess (mm)	Direct Discharge (m³/s)
1	20	20
2	60	140
3	40	400
4		1150
5		4450
6		9700
7		9480
8		4360
9		1560
10		940
11		525
12		375
13		195

- END OF QUESTIONS -

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