



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER 2
SESSION 2016/2017**

COURSE NAME : HYDROLOGY
COURSE CODE : DAC 20902
PROGRAMME CODE : DAA
EXAMINATION DATE : JUNE 2017
DURATION : 2 HOURS
INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS ONLY

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

- Q1** (a) Briefly describe water balance equation. (4 marks)
- (b) List **six (6)** components in a complete conceptual water budget. (6 marks)
- (c) Referring to **Table 1**, determine the storage changes (m^3) in a reservoir for a week. (15 marks)
- Q2** (a) List **five (5)** classification of precipitation. (5 marks)
- (b) Explain **two (2)** differences between convective precipitation and orographic precipitation. (5 marks)
- (c) Referring to **Table 2**, rain gauge at station J was out of operation. Calculate the rainfall depth (mm) at station J by using quadrant method. (15 marks)
- Q3** (a) Write **two (2)** methods to estimate evaporation rate. (2 marks)
- (b) Explain **four (4)** meteorology factors which affecting evaporation process. (8 marks)
- (c) Referring to **Table 3**, estimate the rate of evapotranspiration (m/year). (6 marks)
- (d) Referring to **Table 4**, determine the daily evaporation rate (cm/day) for a pond. (9 marks)

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- Q4** (a) Compare **three (3)** characteristics between wire gauge and automatic stage recorders in measuring water level. (6 marks)
- (b) Describe **two (2)** functions of stage measurement. (4 marks)
- (c) Referring to **Table 5**, analyse the stream discharge (m^3/s) by using a fluorescent tracer. (5 marks)
- (d) Referring to **Table 6**, analyse 25 years storm using rational method as below:
- (i) Time of concentration, $t_{\text{concentration}}$ (minutes). (7 marks)
- (ii) Peak runoff, Q_p (cfs). (3 marks)
- Q5** (a) Briefly describe soil conservation service method in unit hydrograph. (2 marks)
- (b) List **three (3)** hydraulic structures design by using soil conservation service method. (3 marks)
- (c) Write the workflow to determine soil conservation method in unit hydrograph. (5 marks)
- (d) Referring to **Table 7**, derive 4-hour unit hydrograph. (15 marks)
- Q6** (a) Compare **two (2)** differences between confined aquifer and unconfined aquifer. (4 marks)
- (b) Explain the zones which located in unconfined aquifer as follow.
- (i) Saturated zone. (2 marks)

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- (ii) Unsaturated zone. (2 marks)
- (iii) Water table zone. (2 marks)
- (c) A field test for permeability consists in observing the time required for a tracer to travel between two observation wells. A tracer was found to take 10 hours to travel between two wells 50m apart when the difference in the water surface elevation in them was 0.5m. The mean particle size of the aquifer was 2mm, velocity was $0.01\text{cm}^2/\text{s}$ and the porosity of the medium, n was 0.3. Determine as below:
- (i) Coefficient of permeability of the aquifer (cm/s). (7 marks)
- (ii) Intrinsic permeability of the aquifer (darcy). (4 marks)
- (iii) Reynolds number of the flow. (4 marks)
- Q7** (a) Define flow routing. (2 marks)
- (b) Compare the differences between hydrologic and hydraulic routing. (4 marks)
- (c) Describe the application of flood routing which accounting changes inflow hydrograph. (4 marks)
- (d) Referring to **Table 8**, annual maximum recorded floods for the period 1989 to 2016. Estimate the flood discharge (m^3/s) at T is 10 years by using Gumbel's method which y_{ave} is 0.53 and S_n is 1.1. (15 marks)

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- END OF QUESTIONS -

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Table 1

Area (hectare)	Inflow (m ³ /day)	Outflow (m ³ /day)	Precipitation (m)	Evaporation (mm)	Seepage Loss (cm)
2750	10 x 10 ⁵	55 x 10 ⁶	0.37	19	5

Table 2

Station	Precipitation (mm)	Coordinate (X,Y)
A	22	(1,1)
B	24	(5,4)
C	22	(3,-2)
D	24	(6,-7)
E	37	(-1,-3)
F	39	(-6,-5)
G	35	(-3,3)
H	37	(-4,5)
J	XX	(0,0)

Table 3

Area	Surface Runoff	Average Annual Rainfall
600 hectare	1.3 m ³ /s	139 mm

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Table 4

Average Wind Speed	Air Temperature	Water Temperature	Relative Humidity	Pan Empirical Coefficient
264 mile/day	27 °C	21 °C	23 %	0.33
Values of Vapor Pressure				
10 °C	15 °C	20 °C	25 °C	30 °C
12.27 mb	17.04 mb	23.37 mb	31.67 mb	42.43 mb

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Table 5

Initial Concentration	Concentration At Point 1	Concentration At Point 2	Rate of Tracer
0 g/m ³	0.05 g/m ³	10 x 10 ⁻⁹ g/m ³	20 cm ³ /s

Table 6

Descriptions	Values
Channel Top Width	24 feet
Channel Base Width	12 feet
Channel Height	6 feet
Channel Roughness, n _{values}	0.033
Stream Slope, S _o	0.008
Stream Length, d _{stream}	2000 feet
Time of Overland Flow, t _{overland}	39.5 minutes
Time of Shallow Flow, t _{shallow concentrated}	5.9 minutes
Impervious Area	1 acre
Grass Area	21 acres
Wooded Area	23 acres
Runoff Coefficient of Impervious Area	0.90
Runoff Coefficient of Grass Area	0.35
Runoff Coefficient of Wooded Area	0.25
Average Rainfall Intensity, i	2.6 in/hr

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Table 7

Descriptions	Values
Land Area	1000 km ²
Length of Main Stream From Outlet, L	50 km
Length Along Main Stream From Outlet To Catchment's Centroid	20 km
Basin Coefficient, C _t	1.6
Peak Coefficient, C _p	0.17
Duration of Rainfall, t _r	4 hours
Table of Ratios For SCS Dimensionless Unit Hydrograph	
Time Ratio (t/P _r)	Hydrograph Discharge Ratio (Q/Q _p)
0.5	0.43
1.5	0.66
2.6	0.13
3.5	0.036
4.5	0.009

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Table 8

Year	1989	1990	1991	1992	1993	1994	1995
Max. Flood (m ³ /s)	2988	2709	3873	4593	6761	1971	1969
Year	1996	1997	1998	1999	2000	2001	2002
Max. Flood (m ³ /s)	4903	3757	4798	4290	4652	5050	6900
Year	2003	2004	2005	2006	2007	2008	2009
Max. Flood (m ³ /s)	4366	3380	7826	3320	6599	3700	4175
Year	2010	2011	2012	2013	2014	2015	2016
Max. Flood (m ³ /s)	2947	3521	2399	4124	3496	2947	5060