UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	HYDROLOGY
COURSE CODE	:	BFC 32002
PROGRAMME	:	BFF
EXAMINATION DATE	:	JUNE 2012
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1   (a)   List and briefly explain **TWO (2)** dilution methods for flow measurement in a stream.

(4 marks)

(b)   **Table 1 (b)** shows velocity measurements ofr a river cross section. Calculate the discharge of the river using mean section method.

Table 1 (b)

X (m)	0	5	10	20	30	35	40	47
y (m)	0	1.8	3.7	9.0	12.6	10.1	5.3	0
v (m/s)	0	0.1	0.2	0.6	1.1	0.8	0.5	0

Note : X = distance from left bank; y = river depth; v = mean flow velocity

(21 marks)

Q2   The initial infiltration rate f_o on the ground during a 10 hour rainfall event is 5.5 cm/hour. Infiltration rate decreases with time and reaches a fixed final rate f_c of 0.4 cm/hour. Taking the constant value of K as 0.32 /hour, estimate

(a)   Infiltration rate on the 5th hour of the rainfall.

(5 marks)

(b)   Infiltration rate on the 8th hour of the rainfall.

(5 marks)

(c)   Total infiltration amount for the first 8 hours of the rainfall event.

(5 marks)

(d)   Total infiltration between the 5th and the 10th hour of the rainfall event.

(5 marks)

(e)   Sketch the Infiltration Function Curve and show the above infiltration rates and total infiltration.

(5 marks)

Q3   (a)   Explain, with a sketch, the hydrologic cycle and show the water balance in the cycle with an equation.

(5 marks)

(b)   A pond is 100 ha-cm with outflow Q of 3 m^3/sec while inflow I is 10 m^3/sec. After 2 hours later the outflow Q increases to 10 m^3/sec when the inflow I reduces to 5 m^3/sec and precipitation of 15 mm. Neglecting evaporation and infiltration find

(i)   Storage change in the pond

(10 marks)

(ii)   Volume of the pond

(10 marks)

(Given 1 ha = 10,000 m^2)

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Q4 (a) What are the measurement of precipitation?

(5 marks)

(b) Define point rainfall and areal rainfall.

(2 marks)

(c) **Table 4 (c)** shows the coordinates for rainfall stations AH, SG, BP, YP and UT and their annual rainfall for 1985. Calculate:

i) Mean areal rainfall in 1985

(9 marks)

ii) Point rainfall for station UT by Quadrant Method

(9 marks)

Table 4 (c)

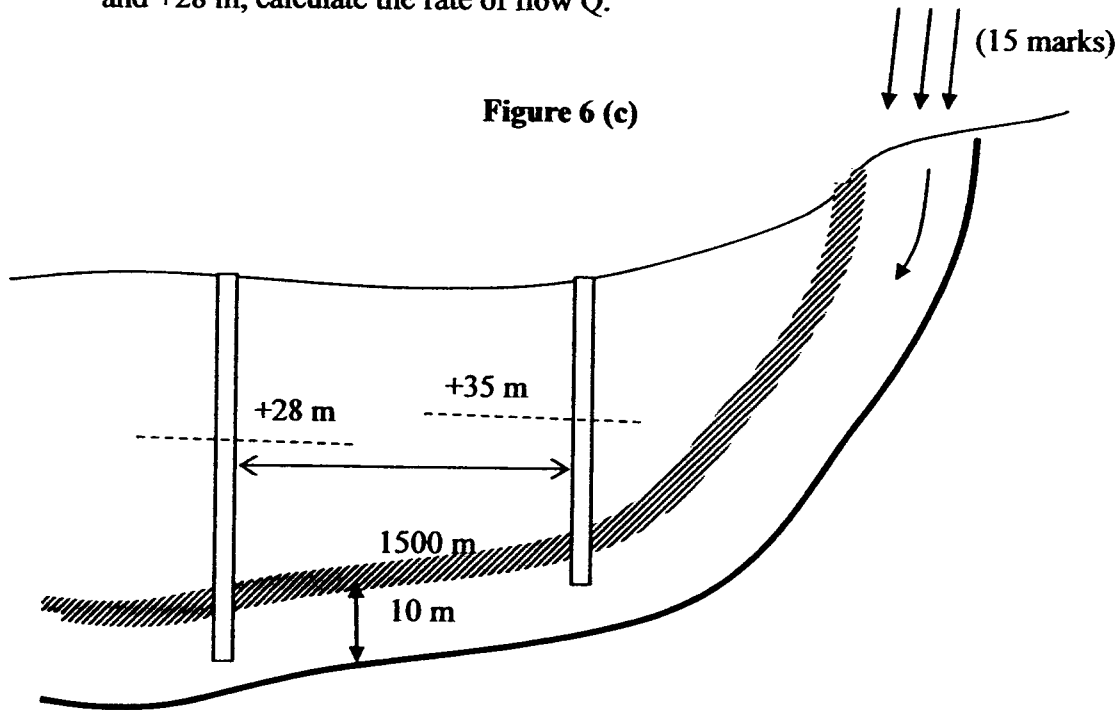| Station	North (km)	East (km)	Annual rainfall mm
AH	100	120	1690
SG	103	100	1550
BP	126	98	1700
YP	139	110	1570
UT	112	110	Unknown?

Q5 (a) What are the usages of Unit Hydrograph?

(4 marks)

(b) **Table 5 (b)** shows the ordinates of a 3 hour Unit Hydrograph UH. Determine the 1 hour Unit Hydrograph UH and derive the Direct Runoff Hydrograph DRO for an excess rainfall of 0.75 cm from a 1 hour storm.

Table 5 (b)

Time (hour)	3 hr UH (m^3/s/mm)
0	0.0
1	4.5
2	10.0
3	12.0
4	8.0
5	4.0
6	0.0

(21 marks)

Q6 (a) Explain, with a groundwater formation diagram, the confined and unconfined aquifers.

(5 marks)

(b) Referring to **Q6 (a)**, explain why is the artesian well has a spring with water shooting out.

(5 marks)

(c) **Figure 6 (c)** shows recharge into a 10 m high confined aquifer capped by an impervious layer 10 km wide. If hydraulic conductivity of this aquifer K= 25m/day and water levels from two observation wells 1500 m apart are +35 m and +28 m, calculate the rate of flow Q.

(15 marks)

Figure 6 (c)

Q7. (a) What is flood routing and how does it effect flood hydrograph?

(5 marks)

(b) A 7 days inflow hydrograph is shown in **Table 7(b)**. If Muskingum coefficients are C_0= 0.09 , C_1= 0.46 and C_2= 0.46, determine the ordinates of outflow hydrograph.

Table 7 (b)

Time (hours)	Inflow (m³/s)
12	30
24	100
36	250
48	180
60	130
72	95
84	45

(20 marks)

4

Q8   (a)   List down **FIVE (5)** characteristics of a watershed that determine the hydrologic cycle.

(5 marks)

(b)   What is the runoff coefficient C of a 10 acre drainage basin where 2 acres is residential with $C_{residential}$= 0.90, 0.25 acres is pond with C_{pond}= 0.20 and the balance 7.75 acres is a wooded area C_{wood}= 0.40?

(5 marks)

(c)   Use the Rational Method to calculate the peak discharge Q_{peak} of the drainage basin in **Q8 (b)** if rainfall intensity is 1.2 in/hour.

(5 marks)

(d)   The residential area is later increased to 3 acres. Use trial and error method to determine what is the increased pond area required to maintain the same peak discharge Q_{peak} from the 10 acre drainage basin in **Q8 (b)**.

(10 marks)

S1 (a) Senaraikan dan terangkan dengan ringkas **DUA (2)** kaedah larutan bagi pengukuran kadar alir sungai.

(4 markah)

(b) **Jadual 1(b)** menunjukkan halaju suatu keratan rentas sebuah sungai. Kirakan nilai kadar alir sungai tersebut menggunakan kaedah keratan purata.

Jadual 1(b)

X (m)	0	5	10	20	30	35	40	47
y (m)	0	1.8	3.7	9.0	12.6	10.1	5.3	0
v (m/s)	0	0.1	0.2	0.6	1.1	0.8	0.5	0

Perhatian : X = jarak dari tebing kiri; y = kedalaman sungai; v = halaju purata aliran

(21 markah)

S2   Kadar penyusupan permulaan f_o diatas bumi semasa hujan 10 jam adalah 5.5 cm/sejam. Kadar penyusupan berkurangan dengan masa dan mencapai kadar muktamat f_c sebagai 0.4 cm/sejam. Jika nilai konstan K ialah 0.32 /sejam, anggarkan

(a) Kadar penyusupan pada jam ke 5 semasa hujan.

(5 markah)

(b) Kadar penyusupan pada jam ke 8 semasa hujan.

(5 markah)

(c) Jumlah penyusupan untuk 8 jam pertama semasa hujan.

(5 markah)

(d) Jumlah penyusupan diantara jam ke 5 hingga jam ke 8 semasa hujan..

(5 markah)

(e) Lakarkan Lekungan Fungsi Penyusupan dan tunjukan kadar kadar penyusupan dan jumlah jumlah penyusupan.

(5 markah)

S3 (a) Terangkan, dengan lakaran, kitaran hidrologi dan tunjukan keseimbangan air dalam kitaran ini dengan sebuah rumusan.

(5 markah)

(b) Sebuah kolam 100 ha-cm dengan aliran keluar Q sebanyak 3 m³/sec manakala air masuk I ialah 10 m³/sec. Selepas 2 jam kemudian air keluar Q bertanbah sehingga 10 m³/sec manakala air masuk I berkurangan sehingga 5 m³/sec dan hujan adalah 15 mm. Dengan mengabaikan penyejatan dan penyusupan , kirakan;

(i) Perubahan simpanan dalam kolam

(10 markah)

(ii)   Isipadu kolam

(10 markah)

(Diberi 1 ha = 10,000 m^2)

S4   (a)   Apakah pengukuran prespitasi?

(5 markah)

(b)   Takrikan hujan titik dan hujan kawasan.

(2 markah)

(c)   Jadual 4 (c) menunjukan koordinat untuk steysen steysen hujan AH, SG, BP, YP dan UT dan hujan tahunan untuk 1985. Kirakan;

(i)   Purata hujan tahunan kawasan pada 1985

(9 markah)

(ii)   Hujan titik untuk steysen UT menggunakan kaedah Empat Quadran

(9 markah)

Jadual 4 (c)

Steysen	Utara (km)	Timur (km)	Hujan Tahunan mm
AH	100	120	1690
SG	103	100	1550
BP	126	98	1700
YP	139	110	1570
UT	112	110	Tidak tahu?

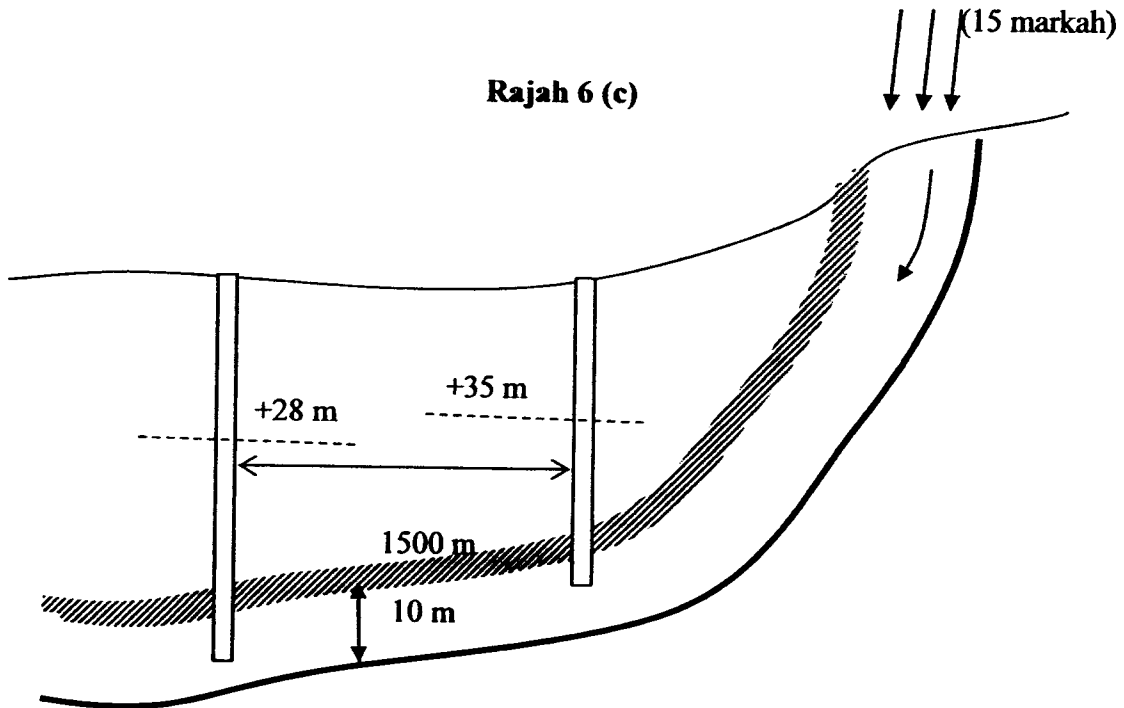**S5**   (a)   Apakah penggunaan penggunaan Unit Hidrograf?

(4 markah)

(b)   Jadual 5 (b) menunjukan ordinat Unit Hidrograf UH 3 jam. Carikan Unit Hidrograf UH 1 jam dan hasilkan the air larian terus DRO untuk hujan lebihan 0.75 cm daripada ribut 1 jam.

Table 5 (b)

Masa (jam)	UH 3 jam (m^3/s/mm)
0	0.0
1	4.5
2	10.0
3	12.0
4	8.0
5	4.0
6	0.0

(21 markah)

S6   (a)   Terangkan, dengan rajah pembentukan air bumi, akuifer akuifer *confined* dan *unconfined*.

(5 markah)

(b)   Rujuk kepada S6 (a), terangkan kenapa air memancut keluar dari perigi artesian.

(5 markah)

(c)   **Rajah 6 (c)** menunjukan proses mengecaj semula kedalam akuifer shows setinggi 10 m yang dilapisi lapisan tanpa telus selebar 10 km. Jika konductiviti hidraul akuifer K= 25 m/sehari dan paras air dalam dua telaga cerapan 1500 m terasing adalah +35 m and +28 m, kirakan kadar alir Q.

(15 markah)

Rajah 6 (c)

S7   (a)   Apakah penghalaan banjir dan kesannya terhadap hidrograf banjir?

(5 markah)

(b)   Hidrograf air masuk untuk 7 hari ditunjuk dalam **Jadual 7 (b)**. Sekiranya koefisen koefisyen Muskingum adalah $C_0= 0.09$, $C_1= 0.46$ and $C_2= 0.46$, carikan hidrograf air keluarnya..

Table 7 (b)

Masa (jam)	Air masuk (m³/s)
12	30
24	100
36	250
48	180
60	130
72	95
84	45

(20 markah)

S8
    (a)   Senaraikan **LIMA (5)** sifat sifat kawasan tadahan air yang menentukan bagaimana kitaran hidrologinya.

(5 markah)

    (b)   Apakah koefisyen air larian C sebuah tadahan hujan 10 ekar dimana 2 ekar adalah perumahan dimana $C_{residential}$= 0.90, 0.25 ekar adalah kolam dimana C_{pond}= 0.20 dan bakinya 7.75 ekar adalah hutan dimana C_{wood}= 0.40?

(5 markah)

    (c)   Gunakan Kaedah Rasional untuk mengira aliran puncak Q_{peak} untuk kawasan tadahan seperti di **Q8 (b)** sekiranya keamatan hujan adalah 1.2 in/sejam

(5 markah)

    (d)   Kawasan perumahan kemudiannya ditambahan kepada 3 ekar. Gunakan kaedah cuba dan ralat untuk mengira berapa besar kawasan kolam perlu dibesarkan supaya aliran puncak Q_{peak} dari kawasan tadahan 10 ekar seperti dalam **S8 (b)** perlu dikekalkan.

(10 markah)

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GLOSSARY OF EQUATIONS

$Q = iCA$	$O_2 = C_0 I_2 + C_1 I_1 + C_2 O_1$	$C = (C_1 A_1 + C_2 A_2 + C_3 A_3)/A$
$Q = KAi$	$f = f_o + (f_o - f_c)e^{-Kt}$	