POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

CIVIL ENGINEERING DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSION

CN201: HYDROLOGY & WATER RESOURCES

DATE : 22 NOVEMBER 2012

DURATION: 2 HOURS (2.30PM - 4.30PM)

This paper consists of **SEVEN (7)** pages including the front page.
Essay (6 questions – answer 4 questions)

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only)

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ESSAY (100 marks)

Instruction: This section consists of **SIX (6)** questions. Answer **FOUR (4)** questions only.

QUESTION 1

a)   Describe briefly about surface water and ground water.

CLO1 :C2

(8 marks)

b)   Explain briefly **THREE (3)** factors affecting the ground water quality.

CLO1: C4

(9 marks)

c)   Explain the function of each following dam below.   CLO1 :C4

    i.   Storage dam   **(2 marks)**

    ii.   Detention dam   **(2 marks)**

    iii.   Diversion dam   **(2 marks)**

    iv.   Coffer dam   **(2 marks)**

QUESTION 2

(a)   Explain briefly the hydrologic cycle in nature with the help of a neat sketch, and indicate its various phases.   CLO 1 : C2

(13 marks)

(b)   For the analysis and design of any hydrologic project adequate data and length of records are necessary. List down **FIVE (5)** basic hydrological data required.

CLO 1 : C1

(5 marks)

(c) The drainage area of a river in a city is 11,839 km^2. If the mean annual runoff is determined to be 144.4 m^3/s and the average annual rainfall is 1.08 m, estimate the ET losses for the area. Assume negligible changes in groundwater flow and storage (i.e. G and $\Delta S = 0$)

CLO 1 :C4

(7 marks)

QUESTION 3

(a)   **Figure 3a** shows the Thiessen polygons map areas and precipitation values are tabulated. Compute the average precipitation over the basin.

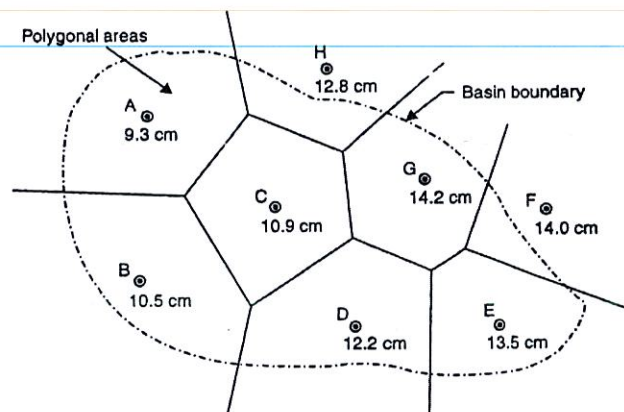| STATION	THIESSENS POLYGON AREA(km^2)	PRECIPITATION (cm)
A	170	9.3
B	164	10.5
C	156	10.9
D	150	12.2
E	116	13.5
F	36	14.0
G	124	14.2
H	42	12.8

CLO1: C3

(8 marks)

FIGURE 3a

(b)   **Table 3b** shows the annual precipitation at rain-gauge station X and the average annual precipitation at 15 surrounding rain-gauge stations are given below. Indicate at what year a change in regime and adjust the recorded data at a station X.   CLO 3 : C3

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Table 3b

Year	Annual rainfall at stn X (cm)	Average annual rainfall of 15 stations (cm)
1982	30.5	22.8
1983	38.7	35.0
1984	43.7	30.2
1985	32.2	27.4
1986	27.4	25.2
1987	32.0	28.2
1988	49.3	36.1
1989	28.4	28.4
1990	24.6	25.1
1991	21.8	23.6
1992	28.2	33.3
1993	17.3	23.4
1994	22.3	36.0
1995	28.4	31.2
1996	24.1	23.1
1997	26.9	23.4
1998	20.6	23.1
1999	29.5	33.2
2000	28.4	26.4

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(17 marks)

QUESTION 4

(a)   Explain the following characteristics that affect the runoff ;

   i.   Intensity

   ii.   Vegetation

   iii.   Size   CLO 3 : C2

(6 marks)

(b)   **Table 4b** shows the catchment of area 200 km ^{2} is subjected to a storm with the following profile. If the volume of storm surface runoff is 1.6×10^7 m ^{3} estimate the Φ index (mm/h) (neglect the effect of ET)

CLO3 : C3

(19 marks)

Time (h)	3	6	9	12	15	18	21	24
Rainfall (mm)	16.5	48	20	12.8	9.1	5.5	3.1	1.2

Table 4b

QUESTION 5

(a)   **Table 5a** shows the observed flows from storm 6-h duration on a stream with a catchment area of 500 km ^{2}. Assuming the base flow to be zero, derive the ordinates of a 6-h unit hydrograph.   CLO3 : C3

(10 marks)

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66	72
Observed flow (m^3/s)	0	100	250	200	150	100	70	50	35	25	15	5	0

Table 5a

(b)   **Table 5b** shows the ordinates of a 4-hour hydrograph for a particular basin. Determine the ordinates of the S-curve hydrograph and the form ordinates of the 6-hour unit hydrograph.   CLO3 : C3

(**15 marks**)

Time (h)	4- h UH (m^3/s)
0	0
2	25
4	100
6	160
8	190
10	170
12	110
14	70
116	30
18	20
20	6
22	1.5
24	0

Table 5b

QUESTION 6

Table 6 shows the inflow hydrograph readings for a stream reach for which the Muskingum coefficients of K=36 h and x = 0.15. Route the flood through the reach and determine the outflow hydrograph. Also determine the reduction in peak and the time of peak of outflow.

CLO3 : C4

(25 marks)

Time (h)	Inflow (m^3/s)
0	42
12	45
24	88
36	272
48	342
60	288
72	240
84	198
96	162
108	133
120	110
132	90
144	79
156	68
168	61
180	56
192	54
204	51
216	48
228	45
240	42

Table 6