NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONS) DEGREE
DEPARTMENT OF CIVIL AND WATER ENGINEERING
PART II SUPPLEMENTARY EXAMINATIONS – AUGUST 2014

HYDROLOGY – TCW 2202

Instructions: Total marks: 100
Answer any four (4) questions   Time: 3 Hours

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QUESTION 1
a.   Define the following hydrologic processes and briefly explain the importance of each component to the hydrologic cycle
     i.   Surface runoff
     ii.   Interflow
     iii.   Evapotranspiration   (12 marks)
b. Estimate the amount of evapotranspiration for the year from a watershed with a 10,000 km^2 area. Consider that the drainage area receives 50 mm of rain over the year and the river draining the area has an annual flow rate of 200 m^3/s
                                                                              (8 marks)
c.   Briefly explain the application of the intensity-duration-frequency relationship of precipitation in hydrology.   (5 marks)

QUESTION 2
   a. A catchment has 6 raingauge stations. In a year, the annual rainfall recorded by the gauges is as follows
   Table 2a

Station	A	B	C	D	E	F
Rainfall (cm)	82.6	102.9	180.3	110.3	98.8	136.7

   Calculate the optimum number of raingauges if a 10% error is allowed.
                                                                              (5 marks)
b.   For a station A, the recorded annual 24 h maximum rainfall are given Table 2b.
     i. Estimate the 24 h maximum rainfall with return periods of 13 and 50 years.
     ii. What would be the probability of a rainfall of magnitude equal to and exceeding 10 cm occurring in 24 h at station A.

   Table 2b

Year	1950	51	52	53	54	55	56	57	58	59	60	61	62
Rainfall (cm)	13	12	7.6	14.3	16	9.6	8	12.5	11.2	8.9	8.9	7.8	9

Year	63	64	65	66	67	68	69	70	71			
Rainfall (cm)	10.2	8.5	7.5	6	8.4	10.8	10.6	8.3	9.5			

(20 marks)

QUESTION 3
a.   Describe the following: i) aquifer; ii) aquitard; iii) aquifuge; iv) aquiclude and v) potentiometric surface   (5 marks)

b.   With the aid of diagram, describe a flowing artesian well.   (5 marks)

c.   3 wells in a confined aquifer are equally spaced a distance of 150 m on a straight line and have a diameter of 225 mm. The aquifer thickness is 65 m and at steady state a discharge of 346 m^3/s was recorded in the middle well. If the drawdown is 5 m in all wells, determine:

     i.   the transmissivity of the aquifer if the radius of influence of each well is 800 m

     ii.   the discharge of the first and third wells   (15 marks)

QUESTION 4
a.   Briefly explain what a runoff hydrograph is and explain 2 main properties of a watershed that influence a runoff hydrograph significantly.   (6 marks)

b.   Explain *stream stage* and *rating curve*. How does each term vary over time due to hydrological events in the watershed?   (6 marks)

c.   Describe 3 methods that can be used for measuring stream discharge. Provide sketches were applicable.   (13 marks)

QUESTION 5
a.   Define infiltration capacity, infiltration rate, W-index, percolation capacity and percolation rate.   (10 marks)

b.   Discuss the disadvantages of Horton's model for determining the infiltration capacity.   (5 marks)

c.   For a 3-hr duration storm, the rainfall rates are as shown in Table 5c:

Table 5c

Time period (mins)	30	30	30	30	30	30
Rainfall rate (cm/hr)	1.4	3.4	4.8	3.2	2.0	1.2

If the surface runoff is 3.4 cm, determine the ϕ-index and W-index   (10 marks)