The Open University of Sri Lanka
Faculty of Engineering Technology
Final Examination- 2005/2006

AEI6235 Hydrology and water resources

Date : **26-03-2006**
Time : **0930-1230 hours**

SECTION 2: Answer any four (04) questions. All questions carry equal marks.

1. Precipitation data for a 36-hour storm period recorded at 14 stations is as follows.

Station	Latitude		Longitude		Rainfall depth
	Degrees	minutes	degrees	minutes	(mm)
A	350	23'	910	46'	32
B	330	32'	900	22'	75
C	310	45'	930	26'	160
D	300	24'	920	35'	42
E	310	51'	910	40'	80
F	330	30'	940	40'	35
G	340	56'	900	24'	45
H	340	27'	910	31'	80
I	330	10'	930	09'	101
J	310	07'	940	33'	48
K	330	36'	910	28'	158
L	320	45'	930	10'	201
M	320	14'	900	16'	30
N	320	28'	920	20'	205

(a) Plot the location of the stations and the precipitation data and draw an Isohyetal map at 50 mm interval. Assume the storm boundary to be the 50 mm isohyet and compute the average rainfall by the isohyetal method.

(b) Further, assume that the 50 mm isohyet is the watershed area boundary and then draw Thiessen polygons for each station. Compute the average rainfall by the Thiessen method.

2. Annual precipitation at rain gauge X and the average annual precipitation at 20 surrounding rain gauges are listed in the following table.
   (a) Examine the consistency of station X data.
   (b) When did a change in regime occur? Discuss possible causes.
   (c) Adjust the data and determine what difference this makes to the 36-year annual average precipitation at station X.

Annual precipitation mm			Annual precipitation mm		
Year	Gauge X	20 station average	Year	Gauge X	20 station average
1954	223	360	1972	188	264
1953	173	234	1971	185	228
1952	282	333	1970	310	386
1951	218	236	1969	295	297
1950	246	251	1968	208	284
1949	284	284	1967	287	350
1948	493	361	1966	183	236
1947	320	282	1965	304	371
1946	274	252	1964	228	234
1945	322	274	1963	216	290
1944	437	302	1962	224	282
1943	389	350	1961	203	246
1942	305	228	1960	284	264
1941	320	312	1959	295	332
1940	328	284	1958	206	231
1939	308	315	1957	269	234
1938	302	280	1956	241	231
1937	414	343	1955	284	312

3. The 4-hour unit hydrograph for a 550 km^2 catchment is given below. A uniform-intensity storm of 4 hours' duration with an intensity of 6 mm/h is followed after a 2 hour break by a further uniform-intensity storm of 2 hours duration and an intensity of 11mm/h. The rain loss is estimated at 1mm/h on both storms. Ignoring baseflow, compute the likely peak discharge and its time of occurrence.

Hours	Q m^3/s	Hours	Q m^3/s
0	0	12	62
1	11	13	51
2	71	14	40
3	124	15	31
4	170	16	24
5	198	17	17
6	172	18	11
7	147	19	5
8	127	20	3
9	107	21	0
10	90		
11	76		

4 (a) Derive the Theim equation for a steadily flowing well in a confined aquifer under equilibrium conditions as given below (with standard notation)

$$Q = \frac{2\pi kb[H - H_0]}{\ln R / r_w}$$

(b) A well with a diameter of 200 mm in a confined aquifer with a thickness of 10 m is pumped at a steady rate of 30 l/minute. The drawdown at the pumping well is 2 m below ground level and the drawdown at an observation well 500 m away is 0.5 m. Assuming the ground to be flat and equilibrium conditions determine the transmissivity of the aquifer.

5 (a) Briefly explain the important physical, chemical and biological properties of water and also explain how you would measure them.
(b) List the common pollutants which lead to reduce surface water quality.
(c) Briefly describe the possible sources of contamination of groundwater and describe what steps you would take to minimize the contamination.

6 Write a short essay on "River abstractions and Springwater tapping" using clearly labelled diagrams wherever necessary to supplement your essay.