University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2012
Program: B. Sc Engineering (Civil)

Course Title: Engineering Hydrology Course Code.: CE 363 Credit hrs: 3
Time: 3 hours Full Marks: 150

Part A
There are FOUR questions answer any THREE

1. (a) Explain the following (any Three): (9)
   i) Depth-duration-frequency curve
   ii) Infiltration capacity
   iii) Rational method to estimate the magnitude of a flood peak
   iv) Consistency test for rainfall records
   v) Pan coefficient

   (b) Distinguish between the following (any Four): (8)
   i) Depression storage and interception
   ii) Field capacity and permanent wilting point
   iii) Hydraulic and hydrologic method of flood routing
   iv) Cold and warm fronts
   v) Storm hydrograph and direct runoff hydrograph

   (c) At a climate station, the following measurements are made: air pressure=101.1 kPa, air temperature = 25^0C, and dew point temperature = 20^0C. Calculate the corresponding vapor pressure, relative humidity, specific humidity and air density. (8)

2. (a) Explain the procedure for (i) checking a rainfall data for consistency and (ii) supplementing the missing rainfall data. (10)

   (b) Seven rain gauges located within a catchment area whose shape can be approximately described by smooth lines joining the following coordinates: (20,30), (15,45), (20,60), (40,85), (60,95), (80,95), (85,90), (75,60), (60,40) and (40,30). Recorded rainfall data are tabulated as below. All co-ordinates are expressed in Km.
   Compute the average rainfall in the area using Thiessen polygon method. (15)

Raingauge Location	Annual Rainfall (cm)
(25, 45)	132
(15, 75)	136
(45, 75)	93
(75, 85)	81
(85, 65)	85
(65, 55)	124
(35, 15)	156

3. (a) Discuss the factors that affect the process of evaporation? (10)

(b) A reservoir had an average area of 20 km^2. In a particular month the mean rate of inflow = 10 m^3/s, outflow = 15 m^3/s, monthly rainfall = 10 cm and increase in storage = 16 million m^3. Assuming the seepage losses to be 1.8 cm, estimate the evaporation in that month. (5)

(c) The following data were collected for a stream at a gauging station. Compute the discharge. (10)

Distance from left water edge (m)	Depth, d (m)	Revolution of current meter kept at 0.6d depth below water surface	Duration (sec)
3	1.4	12	50
6	3.3	29	53
9	5.0	35	56
12	9.0	42	59
15	5.4	32	51
18	3.8	33	53
21	1.8	18	50

Calibration equation of current meter: $v = 0.3N + 0.05$, N = revolutions per seconds, v = velocity, m/s.

4. (a) Discuss the role of the shape, slope and drainage density of a basin affecting the shape of a flood hydrograph. (6)

(b) Rainfall of magnitude 3.8cm and 2.8cm occurring on two consecutive 4-h durations on a catchment of area 27 km^2 produced the following hydrograph of flow at the outlet of the catchment. Estimate the rainfall excess and Φ-index. (7)

Time (hr)	-6	0	6	12	18	24	30	36	42	48	54	60	66
Observed Flow (m^3/s)	6	5	13	26	21	16	12	9	7	5	5	4.5	4.5

(c) The ordinates of 6-hr UH are given below. Derive the ordinates of a 8-hr UH by the S-curve method. (12)

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44
4-hr UH ordinates (cumec)	0	24	82	159	184	151	103	64	36	17	6	0

Part B

There are FOUR questions answer any THREE

(Assume any reasonable data if not given)

5. (a) What are the assumptions of a unit hydrograph? (3)

(b) A basin has the following parameters: A = 400 km^2, L = 35 km and L_{ca} = 10 km. Assuming C_t = 1.5 and C_p = 0.7 develop a 3-h synthetic unit hydrograph for this basin using Snyder's method. (10)

(c) The ordinates of a 6-h unit hydrograph are as given below: (12)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinate of 6-hr UH (m^3/s)	0	20	60	150	120	90	66	50	32	20	10	0

If two storms, each of 1 cm rainfall excess and 6-h duration occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at $10 m^3/s$.

6. (a) How does channel routing differ from reservoir flood routing? What are the factors to be considered in choosing the routing period? (5)

(b) The inflow hydrograph for a reach of a river is given below. Determine the outflow hydrograph using the values of the Muskingum coefficients K=18 and x=0.25 for the reach. 20)

Time (hr)	0	12	24	36	48	60	72	84	96	108
Inflow (cumec)	20	191	249	164	110	82	62	48	32	28

7. (a) Derive the required expression and different steps for reservoir routing. What data are required for reservoir routing? (10)

(b) The storage in the reach of a stream has been studied. The values of x and K in Muskingum equation have been identified as 0.28 and 1.6 days, respectively. If the inflow hydrograph to the reach is as given below, compute the outflow hydrograph. Assume the outflow from the reach at t=0 as 3.5 m^3/s. (15)

Time (hr)	0	6	12	18	24	30
Inflow (cumec)	35	55	92	130	160	140

8. (a) What are the different methods to estimate the magnitude of a flood peak. Explain the rational method of computing the peak discharge. (7)

(b) Flood data statistics of two rivers around Dhaka city are given as below. (18)

River	Length of Records (years)	Mean annual flood (m^3/s)	σ_{n-1}
Buriganga	92	6437	2951
Shitalakhya	54	5627	3360

(i) Estimate the 100 and 1000 year floods for these two rivers by using Gumble's method.

(ii) What are the 95% confidential intervals for the predicted values?