

A 1078

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Fifth Semester

Civil Engineering

CE 044 --- HYDROLOGY

Time : Three hours

Maximum : 100 marks

Ordinary Graph Sheet and Semi-log Graph Sheet to be supplied on request.

Answer ALL questions.

PART A --- (10 × 2 = 20 marks)

1. Define Relative Humidity.
2. List any four common forms of precipitation.
3. What are Isohyets?
4. Define Infiltration.
5. Define a Unit Hydrograph.
6. What are the two parts of total runoff?
7. What are the chief factors controlling the storage capacity and transmissibility of the earth materials?
8. What is an aquifuge? Give an example.
9. Define 'Standard Project Flood'.
10. What do you mean by 'Reservoir routing'?

PART B — (5 × 16 = 80 marks)

11. (i) Write short notes on 'air mass' and 'fronts'. (6)
- (ii) List the four conditions necessary for the production of rainfall and explain them briefly. (10)

12. (a) The annual rainfall at Station X and the average annual rainfall at 18 surrounding stations are given below. check the consistency of the record at station X and determine the year in which a change in regime has occurred. State how you would adjust the records for the change in regime. Determine the average annual rainfall for the period 1952-1970 for the changed regime.

Year	Annual Rainfall (cm)	
	Station X	18-Station Average
1952	30.5	22.8
1953	38.9	35.0
1954	43.7	30.2
1955	32.2	27.4
1956	27.4	25.2
1957	32.0	28.2
1958	49.3	36.1
1959	28.4	18.4
1960	24.6	25.1
1961	21.8	23.6
1962	28.2	33.3
1963	17.3	23.4
1964	22.3	36.0
1965	28.4	31.2
1966	24.1	23.1
1967	26.9	23.4
1968	20.6	23.1
1969	29.5	33.2
1970	28.4	26.4

(16)

Or

- (b) (i) Briefly explain how the following factors affect evaporation.

- (1) Temperature
- (2) Wind
- (3) Atmospheric pressure
- (4) Soluble solids.

(4 × 2 = 8)

- (ii) A 24-hour storm occurred over a catchment of 1.8 km² area and the total rainfall observed was 10 cm. An infiltration capacity curve prepared had the initial infiltration capacity of 1 cm/hour and attained a constant value of 0.3 cm/hour after 15 hours of rainfall with a Horton's constant $k = 5 \text{ hour}^{-1}$. An IMD pan installed in the catchment indicated a decrease of 0.6 cm in the water level (after allowing for rainfall) during 24 hours of its operation. Other losses were found to be negligible. Determine the runoff from the catchment. Assume a pan coefficient of 0.7. (8)

13. (a) Derive the UH for a drainage basin of area 104 km² from the observed TRH given below:

Date	Time in hours	Runoff in Cumec	Date	Time in hours	Runoff in cumec
June 10th	2	16.0	June 11th	2	76.4
	4	15.0		4	65.0
	6	14.2		6	55.2
	8	158.5		8	46.7
	10	260.0		10	39.6
	12	286.0		12	34.0
	14	221.0		14	28.3
	16	186.5		16	22.7
	18	157.0		18	21.5
	20	133.0		20	20.6
	22	113.0		22	19.9
	24	93.4		24	19.2

The ordinates of the rainfall mass curve which produced the above runoff are as given below.

Date	Time in hours	Cumulative rainfall in cm
June 10th	2	0.0
	4	1.5
	6	3.0
	8	10.5
	10	19.0
	12	20.0
	14	20.0

(16)

Or

- (b) (i) Draw a typical single peaked hydrograph and explain its salient features. (6)
- (ii) Derive a 3-hour synthetic UH of a basin with the following data:
 Basin area = 2500 km²;
 Length of the main stream = 115 km;
 Distance from the centroid to the outlet = 75 km;
 Coefficient, $C_t = 1.6$
 Coefficient, $C_p = 4.0$. (10)
14. (a) (i) State Darcy's law and its applicability. (4)
- (ii) A 20 cm well penetrates 30 m below static water level (GWL). After a long period of pumping at a rate of 1800 lpm, the draw-downs in the observation wells at 12 m and 36 m from the pumped well are 1.2 m and 0.5 m respectively.
 Determine:
 (1) the transmissibility of the aquifer.
 (2) the draw-down in the pumped well assuming radius of influence equal to 300 m.
 (3) the specific capacity of the well. (12)

Or

- (b) (i) Explain the following tests performed to determine the probable yield of the well.
 (1) Pumping test
 (2) Recuperation test.
- (ii) A well of size 7.70 × 4.65 m and depth 6.15 m in lateritic soil has its normal water level 5.08 m below ground level. By pumping for 1.5 hours the water level was depressed to 5.93 m below ground level and the pumping was stopped. The recuperation rates of the well during 4 hours after the pumping stopped are given below. The total volume of water pumped during 1.5 hours of pumping was 32.22 m³.

Time since pumping stopped (minutes)	Water level below ground level (m)
0	5.930
15	5.890
30	5.875

Time since pumping stopped (minutes)	Water level below ground level (m)
45	5.855
60	5.840
90	5.820
120	5.780
180	5.715
240	5.680

Determine:

- (1) Rate of seepage into the well during pumping
- (2) Specific yield of the soil.

15. (a) (i) If frequency analysis is to provide useful answers, it must be based on adequate, accurate and homogenous data. Augment this statement. (4)
- (ii) The observed annual flood peaks of a stream for a period of 40 years from 1961 to 2000 in m^3/s are given below.

Year	Flood Peak (m^3/s)
1961	395
1962	619
1963	766
1964	422
1965	282
1966	990
1967	705
1968	528
1969	520
1970	436
1971	697
1972	624
1973	496

200

1974	589
1975	598
1976	359
1977	686
1978	726
1979	527
1980	310
1981	408
1982	721
1983	814
1984	459
1985	440
1986	632
1987	343
1988	634
1989	464
1990	373
1991	289
1992	371
1993	522
1994	342
1995	446
1996	366
1997	699
1998	560
1999	450
2000	610

Construct the probability plot for the annual flood peak on ordinary graph and on semi-log graph. Determine the flood magnitude with a return period of 100 years in each case. (12)

Or

- (b) Route the flood hydrograph given below through a channel reach. Derive the outflow hydrograph. The values of K and x for the reach may be taken as 12 hours and 0.278 respectively. (16)

Time (hour)	Flow (m ³ /s)
0	42
4	68
8	116
12	164
16	194
20	200
24	192
28	170
32	150
36	128
40	106
44	88
48	74
52	62
56	54
