DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

Major Exam: CVL 282 – ENGINEERING HYDROLOGY

Date: 24-11-2016

Max. Marks: 40

Time: 1.00-3.00 (2hrs)

Note: (i) **All questions are compulsory;**
        (ii) Reasonably assume and state any data that are not provided.

PART A (Total Marks: 12)
USE SEPARATE ANSWER SCRIPTS FOR PART A and PART B

1) Using 23 year of annual precipitation depth for Darbhanga, estimate the design rainfall intensity for a structure with design life of (i) 10 years and 25 years using plotting position approach. Compute the probable maximum precipitation assuming a frequency factor of 15.
   (4 Marks)

Year	Annual Rainfall (cm)	Year	Annual Rainfall (cm)	Year	Annual Rainfall (cm)	Year	Annual Rainfall (cm)
1981	24	1998	19	1994	15	2000	9
1988	23	1980	19	1979	15	1996	8
1986	23	1990	18	1992	11	1989	8
1978	21	1983	18	1984	10	1995	6
1993	20	1987	17	1997	9	1982	5
1999	19	1985	17	1991	9		

2) Draw typical isohyetal maps of region with (a) flat terrain and (b) Hilly terrain. Relate it to raingauge density requirements.   **(3 Marks)**

3) In an article published in the journal Science, Gray (1990) contrasts various aspects of Atlantic hurricanes occurring in drought vs. wet years in sub-Saharan Africa. During the 18-year drought period 1970–1987, only one strong hurricane (intensity 3 or higher) made landfall on the east coast of the United States, but 13 such storms hit the eastern United States during the 23-year wet period 1947–1969.   **(5 Marks)**

   a. Assume that the number of hurricanes making landfall in the eastern U.S. follows a Poisson distribution whose characteristics depend on African rainfall. Fit two Poisson distributions to Gray's data (one conditional on drought, and one conditional on a wet year, in West Africa).

   b. Compute the probability that at least one strong hurricane will hit the eastern United States, given a dry year in West Africa.

   c. Compute the probability that at least one strong hurricane will hit the eastern United States, given a wet year in West Africa.

PART B (Total Marks: 28)

USE A SEPARATE ANSWER SCRIPT FOR PART B

1. Explain simulation model for runoff. Also state the important empirical models developed for various regions in India. [Marks =4]

2. Describe the zone of saturation and aeration with figure. If a sample has a hydraulic conductivity of 10 m/day what would be its intrinsic permeability? [Marks = 4]

3. Discuss Goodrich methods of flood routing. Also using this method write the stepwise procedure to determine the outflow from a particular location of a basin. [Marks = 6]

4. A 4 hour hydrograph is given below. Calculate 12 hour unit hydrograph by S-curve method

Time (h)	0	2	4	6	8	10	12	14	16	18	20	22	24
UH Ordinates (m^3/s)	0	30	110	170	210	180	120	80	40	35	20	15	5

[Marks =4]

5. Derive a 3 hour synthetic unit hydrograph using Synder's method for a catchment area of 2500 km² with the following data:

Length of main stream = 120 km & Distance from central outlet = 80 km

Coefficients C_t and C_p for the catchment are assumed as 1.5 and 0.6 respectively. [Marks =4]

6. Design a tube well from the following data:

(i) Yield required = 0.2 m^3/s. (ii) Thickness of confine aquifer = 40 m (iii) Radius of influence = 300 m (iv) Coefficient of permeability = 80 m/day and (v) drawdown = 6 m.

Also derive the expression used. [Marks =6]