M.E. (Water Resources & Hydraulic Engineering) Examination, 2018

(2nd Semester)

ADVANCED HYDROLOGY

Time : Three Hours Full Marks : 100

Answer any ***four*** questions

1. (a) What is the objective of storm maximization?
   (b) What are the steps of storm transposition?
   (c) What are the guidelines that should be considered for storm transposition?
   (d) A rainstorm over an area of 800 km^2 produced the highest rainfalls of 50 cm, 75 cm and 105 cm in 1, 2 and 3 days respectively. The 24 hour persisting 1000 mb dew point temperature for the storm was 25 ^{0}C and the highest 24 hour persisting dew point for the concerned area was 29 ^{0}C. Calculate theMMF as well as PMPrainfall depths.
   (e) Determine the PMP of sub-catchments A and B, which are part of catchment C?
   Area of Catchment A – 7388 Sq.km
   Area of Catchment B - 6302 Sq.km
   Total catchment C area – (catchment A + catchment B) = 13690 Sq.km.

   3 day maximum isohyet and area enclosed within the isohyets are given below.

Isohyetals (*mm*)	290	225	190	160	125	75	25
Area enclosed (*Sq. km.*)	721.06	2141.29	3327.26	4526.54	6923.14	9412.38	13875

   Measured 3 day maximum rainfall of two stations located inside the isohyet 290 mm are – 305.55 mm and 296.87 mm.

   2 day maximum isohyet and area enclosed within the isohyets are given below.

Isohyetals (*mm*)	260	200	150	125	100	50	20
Area enclosed (*Sq. km.*)	750	2820	3923	5394	7223.64	10720.36	13889.36

   Measured 2 day maximum rainfall of two stations located inside the isohyet 260 mm are – 281.05 mm and 277.65 mm.

(2+2+4+4+13)

2. (a) Discuss the scope and limitations of flood frequency studies?
   (b) The following table quotes the observed annual flood values of a river at a station. Estimate the flood peaks with return periods 100 and 500 years by using Log –Pearson Type III Distribution

Year	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Flood Discharge (cumec)	2520	1850	750	1100	1380	1910	3170	1200	820	690	1240
Year	1974	1975	1976	1977	1978						
Flood Discharge (cumec)	1730	1950	2160	3320	1480						

   (c) Develop a 30 min SCS triangular unit hydrograph foa watershed of area 550 ha and time of concentration of 50 minutes.

(4+16+5)

3. (a) What is the utility of a synthetic unit hydrograph ?
   (b) Calculate Snyder synthetic unit hydrograph parameters for the following data: catchment area A=350 km^2; L=20 km; L_{ca}=15km; C_t=1.4; C_p=0.6; Develop full 2-hour unithydrograph by using SCS Dimensionless unit hydrograph .Comment on your result.

(2+18+5)

4. (a) What is Dimensionless unit hydrograph and what is an IUH?
   (c) Distinguish between D-h UH and IUH
   (b) The coordinates of the IUH of a catchment are given below. Derive the direct runoff hydrograph (DRH) for this catchment due to a storm of duration 4 hours and having a rainfall excess of 5 cm.

Time (hours)	0	1	2	3	4	5	6	7	8	9	10
IUH ordinate $u(t)$ (m^3/s)	0	10	35	50	35	30	20	15	5	2	0

(5+2+18)

5. (a) What significant rainfall characteristic is absent from the SCS runoff curve number method?
   (b) Discuss the hydrologic soil –cover complex used in SCS Runoff Curve Number method.
   (c) A watershed250 ha in size has group C soil. The land cover can be classified as 30% open forestand 70% poor quality pasture. Assuming AMC at average condition and the soil to be black soil,estimate the direct runoff volume due to a rainfall of 75 mm in one day. Deduce the expression used for the estimation.

(2+7+16)

6. (a) The average monthly flows into a reservoir in a period of two consecutive dry years 1981-82 and 1982-83 is given below.

Month	Mean monthly flow (m^3/s)	Month	Mean monthly flow (m^3/s)
1981-June	20	1982-June	15
July	60	July	50
Aug	200	Aug	150
Sept	300	Sept	200
Oct	200	Oct	80
Nov	150	Nov	50
Dec	100	Dec	110
1982-Jan	80	1983-Jan	100
Feb	60	Feb	60
March	40	March	45
April	30	April	35
May	25	May	30

If a uniform discharge at 90 m^3/s is desired from this reservoir calculate the minimum storage capacity required.

(25)