[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

15397

M. Tech 1st Semester Examination

Advanced Hydrology

WRE-102

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Describe the hydrologic cycle. Explain briefly the man's interface in various parts of this cycle. (10)

   (b) Write short notes on following:
   (i) Reynolds transport theorem.
   (ii) Water budget equation.
   (iii) Hydrologic model.
   (iv) Watershed. (10)

2. (a) Describe briefly the sources of hydrological data in India. (10)

   (b) What are the significant features of global water balance studies? (10)

SECTION - B

3. (a) Explain the different methods of determining the average rainfall over a catchment due to a storm. Discuss relative merits and demerits of the various methods. (10)

   (b) A reservoir with a surface area of 250 hectares had the following average values of parameters during a week: water temperature = 20°C, relative humidity = 40%, wind velocity at 1m above ground = 16 km/h. Estimate the average daily evaporation from the lake and the volume of water evaporated from the lake during that one week. (10)

[P.T.O.]

4. Briefly explain the following:
   (a) Porosity.
   (b) Double mass curve method.
   (c) Horton's, Phillip's and Green Ampt model of infiltration.
   (d) Pan evaporation.
   (e) Energy balance method of evaporation.
   (f) Factors affecting infiltration.
   (g) Factors affecting evaporation.
   (h) Infiltration indices. (8x2.5=20)

SECTION - C

5. (a) Describe surface water resources of India. (5)

   (b) Ordinates of a 4-h unit hydrograph are given. Using this, derive the ordinate of a 2 h unit hydrograph for the same catchment. (15)

Time (h) Ordinate	0	4	8	12	16	20	24	28	32	36	40	44
4-h UH (m^3/s)	0	20	80	130	150	130	90	52	27	15	5	0

6. (a) Distinguish between:
   (i) Hyetograph and hydrograph
   (ii) D-h UH and IUH (5×2=10)

   (b) Two catchment A and B, are considered meteorologically similar. Their catchment characteristics are given below:

Catchment	A	B
Basin length, L	30 km	45 km
Distance from gauging stations to a point to watershed centroid, L_{ca}	15 km	25 km
Area	250 km^2	400 km^2

For catchment A, a 2-h hydrograph was developed and was found to have a peak discharge of 50 m^3/s. The time to peak from the beginning of the rainfall excess in this unit hydrograph was 9.0 h. Using Snyder's method develop a unit hydrograph for catchment B. (10)

SECTION - D

7. (a) Explain Gumbels's method of flood estimation. (10)

(b) Flood frequency computations for the river Chambal at Gandhisagar dam, by using Gumbel's method, yields the following results:

Return period T (years)	Peak flood (m^2/s)
50	40809
100	46300

Estimate the flood magnitude in this river with a return period of 500 years. (10)

8. Write short notes on following:

(i) Chi-square test.

(ii) Laws of probability.

(iii) Flood forecasting methods.

(iv) Log Pearson distribution. (4×5=20)

SECTION - E

9. Select one correct answer from the given option for the given statements:

(a) The average precipitation over India is 119 cm. From this annual average runoff that could be expected is about:

(i) 100cm (ii) 55cm

(iii) 24cm (iv) 75cm

(b) Orographic precipitation occurs due to air masses being lifted to higher altitudes by:

(i) the density difference of air masses

(ii) frontal action

(iii) the presence of mountain barriers

(iv) extra-tropical cyclones

(c) The standard Symons type rain gauge has a collecting area of diameter:

(i) 12.7 cm (ii) 10 cm

(iii) 5.08 cm (iv) 25.4 cm

(d) An isohyets is a line joining points having:

(i) Equal evaporation values

(ii) Equal pressure values

(iii) Equal height above the MSL

(iv) Equal rainfall depth in a given duration

(e) Which method is used to check the consistency of rain fall data:

(i) Double mass curve (ii) S curve analysis

(iii) Mass curve of rainfall (iv) None of these

(f) Lysimeter is used to measure

(i) Infiltration (ii) Evaporation

(iii) Evapotranspiration (iv) Vapour pressure

(g) Wind speed is measured with

(i) wind vane (ii) heliometers

(iii) Stevenson box (iv) Anemometer

(h) A mean annual runoff off 1 m^3/s from a catchment of area 31.54 km^2 represents an effective rainfall of

(i) 100 cm (ii) 1cm

(iii) 100 mm (iv) 3.17cm

(i) The water year in India starts from the first day of:

(i) January (ii) April

(iii) June (iv) September

(j) The ordinate IUH of a catchment at any time t is the :

(i) Slope of the 1 hour UH at that time

(ii) Slope of the ERH at that time

(iii) Slope of the S curve of intensity 1 cm/h

(iv) Difference in slope of the S-curve and 1-hour UH at that time. (10×2=20)