SECTION - E

9. Briefly answer all the following questions.

(a) What parts of India can be classified as semi-arid?

(b) Differentiate between solar constant and insolation.

(c) Define Pan coefficient.

(d) Can evaporation from lake surface be reduced? If so explain.

(e) Distinguish between □-index and W-index.

(f) What do you understand by 'a 6-hour unit hydrograph'?

(g) What are the limitations of unit hydrograph?.

(h) Distinguish between a hydrograph and a hyetograph.

(i) Distinguish between instantaneous and synthetic unit hydrograph.

(j) The probability density function for a random variable x is given by

$f(x) = k\,x,$ for $0 \le x \le 9.$

What is the probability density function?   (2×10=20)

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 : Candidates are required to attempt five questions in all selecting one question from sections A, B, C, D and all the subparts of question in section E.

SECTION - A

1. (a) With the help of a neat sketch, explain the hydraulic cycle in nature indicating its various phases.

   (b) How are the mathematical models classified in hydrology? Briefly explain each of them.   (2×10= 20)

2. (a) What is a control volume? Why the concept of control volume is used in the fluid mechanics?   (10)

   (b) Consider a control volume V having the surface velocity w, Using the control volume approach derive the Reynold's transport theorem:

$$\frac{d}{dt}\int_{v} \Psi(x,1)\,dV = \int_{v}\left[\frac{d\psi}{dt} + \nabla.(w\Psi)\right]dV$$

   where ψ is some fluid property.   (8+2=10)

SECTION - B

3. (a) Define 'rain-gauge density' and explain how you would determine the optimum number of rain-gauges to be erected in a given basin.

    (b) In a certain river basin there are six rain-gauge stations, the normal annual rainfall depths at the stations be(42.4, 53.6, 67.8, 78.5, 82.7 and 95.5 cm, respectively. Determine the optimum number of rain-gauge stations to be established in the basin if it is desired to limit the error in the mean value of rainfall over the catchment to 10% and indicate how you distribute them.   (2×10=20)

4. (a) Discuss the various methods of estimating evaporations from water bodies.

    (b) Derive the Penman's equation for estimating evaporation from a lake. Explain how it differs from other methods.
                                                            (2×10=20)

SECTION - C

5. (a) What are the different method for estimating infiltration? Briefly explain Green-Ampts model and explain ho(. differs from model proposed by Horton.

    (b) A plot of land comprises of sandy loam soil. The initial degree of saturation is 40 %, porosity 0.45 and hydraulic conductivity 30 mm/hr. Calculate the infiltration rate and cumulative infiltration through the plot at $t = 30$ min under continuous ponding condition if the suction head is 60mm.
                                                            (2×10=20)

6. (a) What are the three basic propositions of the unit hydrograph theory?

    (b) Given below are the stream flows from a catchment area of 20 km^2 due to a storm of 1-hour duration. Find the surface runoff hydrograph ordinates from an effective rainfall (net rain) of 6 cm and of duration 1 hour. Assume a constant base flow of 15 cumecs.

Time (hr):	0	1	2	3	4	5	6	7	8	9	10
Stream flow (cumec):	15	25	50	55	48	35	30	27	24	20	15

                                                            (8+12=20)

SECTION - D

7. (a) What is meant by 'frequency of rainfall' and 'recurrence interval'?

    (b) What should be the recurrence interval of a flood such that the probability of its occurrence in a 10-year period is 0.01?

    (c) The mean of the annual maximum floods at a gauging station with 40 years of records is 1300 m^3/s and the variance is 1620 m^3/s. Estimate the magnitude of 100-years flood.   (6+6+8=20)

8. (a) Explain Log-Normal distribution model for flood frequency analysis.

    (b) The annual rainfall over a basin follows a normal distribution with mean as 80 cm and standard deviation as 10 cm. What is the probability that the annual rainfall exceed 100 cm in any year?

    (c) The probability density function for a random variable is given by

         $f(x) = k x,$ for $0 \leq x \leq 9$.

         Evaluate k and find out the mean, Standard deviation and Skewness coefficient of the distribution.   (8+4+8=20)