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Code : 011512

B.Tech 5th Semester Exam., 2018

ENGINEERING HYDROLOGY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct alternative from any *seven* of the following : 2×7=14

(a) The standard Symon's type raingauge has a collecting area of diameter

(i) 12·7 cm

(ii) 10 cm

(iii) 5·08 cm

(iv) 25·4 cm

(b) A plot between rainfall intensity vs. time is called as

(i) hydrograph

(ii) mass curve

(iii) hyetograph

(iv) isohyet

(c) Depth-area-duration curves of precipitation are drawn as

(i) minimizing envelopes through the appropriate data points

(ii) maximizing envelopes through the appropriate data points

(iii) best-fit mean curves through the appropriate data points

(iv) best-fit straight lines through the appropriate data points

(d) The monthly normal rainfall means

(i) the rainfall in the same month in the previous year

(ii) the rainfall was normally expected based on previous month's data

(iii) the average rainfall computed from past 12 months' record

(iv) the average monthly rainfall for same month computed from a specific 30 years of past record

(e) Lysimeter is used to measure

(i) infiltration

(ii) evaporation

(iii) evapotranspiration

(iv) vapour pressure

(f) Virgin flow is

(i) the flow in the river downstream of a gauging station

(ii) the flow in the river upstream of a gauging station

(iii) the flow unaffected by works of man

(iv) the flow that would exist in the stream if there were no abstractions to the precipitation

(g) The probability of 100 years' flood may not occur at all during 50 years of a project is

(i) 0·395

(ii) 0·001

(iii) 0·605

(iv) 0·133

(h) An instantaneous unit hydrograph is a hydrograph of

(i) unit duration and infinitely small rainfall excess

(ii) infinitely small duration and of unit rainfall excess

(iii) infinitely small duration and of unit rainfall excess of an infinitely small area

(iv) unit rainfall excess on infinitely small area

(i) The use of unit hydrographs for estimating floods is limited to catchment size less than

(i) 5000 km^2

(ii) 500 km^2

(iii) 10^6 km^2

(iv) 5000 ha

(j) The unit of intrinsic permeability is

(i) cm/day

(ii) m/day

(iii) darcy/day

(iv) cm^2

2. (a) Describe the salient characteristics of precipitation on India. 6

(b) The normal annual precipitation of five raingauge stations *P*, *Q*, *R*, *S* and *T* are respectively 125 cm, 102 cm, 76 cm, 113 cm and 137 cm. During a particular storm, the precipitation recorded by stations *P*, *Q*, *R* and *S* are 13·2 cm, 9·2 cm, 6·8 cm and 10·2 cm respectively. The instrument at station *T* was inoperative during that storm. Estimate the rainfall at station *T* during that storm. 8

3. (a) Describe briefly the reference crop evapotranspiration and actual evapotranspiration. 6

(b) An catchment area is at latitude 12°18′ N and at an elevation of 770 m. Calculate the monthly and annual PET for this catchment using the Thornthwaite formula. The mean monthly temperatures are given below : 8

Month	*Mean monthly temp.* (°C)
Jan	22·5
Feb	24·5
Mar	27
Apr	28

Month	*Mean monthly temp.* (°C)
May	27
Jun	25
Jul	23·5
Aug	24
Sep	24
Oct	24·5
Nov	23
Dec	22·5

4. The following are the data obtained in a stream-gauging operation. A current meter with a calibration equation $V = (0{\cdot}32N + 0{\cdot}032)$ m/s, where N = revolution per second was used to measure the velocity at 0·6 depth. Using the mid-section method, calculate the discharge in the stream : 14

Distance (in m)	0	2	4	6	9	12
Depth (in m)	0	0·5	1·1	1·95	2·25	1·85
Number of revolutions	0	80	83	131	139	121
Observation time (in s)	0	180	120	120	120	120

Distance (in m)	15	18	20	22	23	24
Depth (in m)	1·75	1·65	1·5	1·25	0·75	0
Number of revolutions	114	109	92	85	70	0
Observation time (in s)	120	120	120	120	150	0

5. The average monthly inflow into a reservoir in a dry year is given below :

Month	Jun	Jul	Aug	Sep	Oct	Nov
Mean monthly flow (m^3/s)	20	60	200	300	200	150

Month	Dec	Jan	Feb	Mar	Apr	May
Mean monthly flow (m^3/s)	100	80	60	40	30	25

If a uniform discharge at 90 m^3/s is desired from this reservoir, what minimum storage capacity is required? 14

6. Ordinate of the one-hour unit hydrograph of a basin at one-hour intervals are 5 m^3/s, 8 m^3/s, 5 m^3/s, 3 m^3/s and 1 m^3/s. Calculate the *(a)* watershed area represented by this unit hydrograph, *(b)* S_1-curve hydrograph and *(c)* 2-hour unit hydrograph for the catchment. 14

7. *(a)* Explain the rational method of computing the peak discharge of a small catchment. 6

(b) For a data of maximum recorded annual floods of a river, the mean and standard deviation are 4200 m^3/s and 1705 m^3/s respectively. Using Gumbel's extreme value distribution, estimate the return period of a design flood of 9500 m^3/s. Assume an infinite sample size. 8

8. The storage in the reach of a stream has been studied. The values of x and K in Muskingum equation have been identified as 0·28 and 1·6 days. If the inflow hydrograph to the reach is as given below, compute the outflow hydrograph. Assume the outflow from the reach at $t = 0$ as 35 m^3/s : 14

Time (h)	0	6	12	18	24	30
Inflow (m^3/s)	35	55	92	130	160	140

9. Write short notes on any *three* of the following : 14

(a) Orographic precipitation

(b) Unit hydrograph

(c) Well losses

(d) Synder's method for determination of synthetic hydrograph

(e) Darcy's law

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