

Code : 011512

**B.Tech 5th Semester Exam., 2017****ENGINEERING HYDROLOGY**

Time : 3 hours

Full Marks : 70

**Instructions :**

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **EIGHT** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct option of the following  
(any seven) : akubihar.com 2×7=14

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

- (i) the density difference of air masses
- (ii) a frontal action

✓(iii) the presence of mountain barriers

(iv) extratropical cyclones

(b) The average annual rainfall over the whole of India is estimated as

- (i) 189 cm
- (ii) 319 cm
- (iii) 89 cm
- (iv) 118 cm

8AK/41

( Turn Over )

( 2 )

(c) Which of the following recording raingauges does not produce the mass curve of precipitation as record?

- (i) Symon's rainauge
- ✓(ii) Tipping-bucket type gauge
- (iii) Weighing-bucket type gauge
- (iv) Natural siphon gauge

(d) Double-mass curve technique is adopted to

- ✓(i) check the consistency of rainauge records
- (ii) find the average rainfall over a number of years
- ✓(iii) find the number of rainauge required
- (iv) estimate the missing rainfall data

(e) The ISI standard pan evaporimeter

- (i) is the same as the US class A pan
- (ii) has an average pan coefficient value of 0.6
- (iii) has less evaporation than a US class A pan
- (iv) has more evaporation than a US class A pan

8AK/41

( Continued )

- (f) Wind speed is measured with .
- (i) a wind vane
  - (ii) a heliometer
  - (iii) Stevenson box
  - ~~(iv)~~ anemometer
- (g) Which of the following is not a direct stream-flow determination technique?
- (i) Dilution method
  - (ii) Ultrasonic method
  - (iii) Area-velocity method
  - ~~(iv)~~ Slope-area method
- (h) The water year in India starts from the first day of
- (i) January
  - (ii) April
  - ~~(iii)~~ June
  - (iv) September
- (i) The flow-mass curve is an integral curve of
- (i) the hydrograph
  - (ii) the hietograph
  - (iii) the flow-duration curve
  - (iv) the S-curve

- (j) An aquifer confined at the bottom but not at the top is called
- (i) semiconfined aquifer
  - (ii) unconfined aquifer
  - (iii) confined aquifer
  - (iv) perched aquifer

- (2) (a) Explain the different methods of determining the average rainfall over a catchment due to storm. 6

- (b) A catchment area has seven raingauge stations. In a year, the annual rainfall recorded by the gauges are as follows :

Station	P	Q	R	S	T	U	V
Rainfall (in cm)	130.0	142.1	118.2	108.5	165.2	102.1	146.9

- (i) Determine the standards error in the estimation of mean rainfall in the existing set of raingauges.

- (ii) For a 5% error in the estimation of the mean rainfall, calculate the minimum number of additional raingauge stations to be established in the catchment. 8

- (3) (a) Discuss the factors that affect the evaporation from a water body. 6

- (b) A reservoir has an average area of  $50 \text{ km}^2$  over a year. The normal annual rainfall at the place is 120 cm and the class A pan evaporation is 240 cm. Assuming the land flooded by the reservoir has a runoff coefficient of 0.4, estimate the net annual increase or decrease in the stream flow as a result of the reservoir. Assume pan coefficient is 0.7. 8

4. (a) Explain briefly the infiltration process and the resulting soil moisture zones in the soil. 6

- (b) The mass curve of rainfall of 100 min duration is given below. If the catchment had an initial loss of 0.6 cm and a  $\Phi$ -index of 0.6 cm/h, calculate the total surface runoff from the catchment : 8

Time from start of rainfall (min)	0	20	40	60	80	100
Cumulative rainfall (cm)	0	0.5	1.2	2.6	3.3	3.5

5. (a) Define hydrograph. Draw a single-peaked hydrograph and indicate its various components. 6

- (b) The ordinate of a 6-h unit hydrograph is as given below :

Time (h)	0	6	12	18	24	30
Ordinate of 6-h UH ( $\text{m}^3/\text{s}$ )	0	20	60	150	120	90

Time (h)	36	42	48	54	60	66
Ordinate of 6-h UH ( $\text{m}^3/\text{s}$ )	66	50	32	20	10	0

- If two storms, each of 1 cm rainfall excess and 6-h duration occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at  $10 \text{ m}^3/\text{s}$ . 8

6. (a) Briefly explain the Gumbel's method of frequency distribution. Write the Gumbel's equation for practical use. 6

- (b) Flood frequency computations for the river Chambal at Gandhisagar dam, by using Gumbel's method, yielded the following results. Estimate the flood magnitudes in this river with a return period of 500 years : 8

Return period $T$ (years) :	50	100
Peak flood ( $\text{m}^3/\text{s}$ ) :	40809	46300

7. (a) Explain the Darcy's experimental law. 5

(b) An extensive aquifer is known to have a groundwater flow in N 30° E direction. Three wells A, B and C are drilled to tap this aquifer. The well B is to East of A and the well C is to North of A. The following are the data regarding these wells :

Distance (m)	Well	Surface Elevation (m above datum)	Elevation of water table (m)
	A	170.0	167.0
AB = 600 m	B	169.0	166.5
AC = 1800 m	C	168.0	?

Estimate the elevation of water table at well C when the wells are not pumping. 9

8 Write short notes on any three of the following : 14

~~(a)~~ Hydrologic cycle

~~(b)~~ Infiltration capacity

(c) Methods of base flow separation

(d) Flow duration curve

~~(e)~~ Synder's method for determination of Synthetic hydrograph

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