

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2688

Roll No.

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B.Tech.

(SEM. VII) ODD SEMESTER THEORY

EXAMINATION 2013-14

ENGINEERING HYDROLOGY

Time : 3 Hours

Total Marks : 100

Note :- Attempt all questions. All questions carry equal marks. If required any missing data; then choose suitably.

1. Attempt any **four** parts of the following : **(5×4=20)**

- (a) What is meant by hydrological cycle ? How can the parameters of the cycle be written in an equation form ? Draw a neat diagram to illustrate your answer.
- (b) A one-day rainfall of 100 mm at a station was found to have a return period of 50 years. Determine the probability that a one-day rainfall of this or larger magnitude will occur atleast once in 20 successive years.
- (c) What is the purpose of Water Budget Equation in Hydrology ? Also give the expression for the water budget of a catchment for a time interval Δt and write in brief about all the associated terms in this equation.
- (d) A catchment has six rain gauge stations. In a year, the annual rainfall recorded by the gauges are as follows :

| Station | A | B | C | D | E | F |
|---------------|------|-------|-------|-------|------|-------|
| Rainfall (cm) | 82.6 | 102.9 | 180.3 | 110.3 | 98.8 | 136.7 |

For a 10% error in the estimation of the mean rainfall, calculate the optimum number of stations in the catchment.

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- (e) What is probable maximum precipitation over a basin ? Explain any one of the approaches to estimate the probable maximum precipitation value.
- (f) What is an intensity–duration curve and how will you proceed to derive such a curve for a given frequency at a rain gauge station from the available data of worst storms of different durations kept for a sufficient number of cycles.
2. Attempt any **four** parts of the following : (5×4=20)
- (a) What are the analytical methods to determine the lake evaporation ? Explain the 'Energy Budget Method' to calculate this.
- (b) Write about the I.S.I. Evaporated Pan with the help of its neat sketch.
- (c) Discuss about the empirical relationship for finding out the net radiation value used in the Penman's equation.
- (d) Show, how the decrease of the ratio AET/PET with available moisture depends upon the type of soil and rate of drying ?
- (e) The infiltration capacity in a basin is represented by Horton's equation as $f_p = 4.0 + e^{-3t}$; where f_p is in cm/h and t is in hours. Assuming the infiltration to take place at capacity rates in a storm of 60 minutes duration, estimate the depth of infiltration in the first 15 minutes and in the second 45 minutes of the storm.
3. Attempt any **two** parts of the following : (10×2=20)
- (a) Write in brief the SCS-CN method for estimating the runoff volume. The peak of flood hydrograph due to a 3-h duration isolated storm in a catchment is 270 m³/s. The total depth of rainfall is 5.9 cm. Assuming an average infiltration loss

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of 0.3 cm/h and a constant base flow of $20 \text{ m}^3/\text{s}$, estimate the peak of the 3-h hydrograph (UH) of this catchment. If the area of the catchment is 567 km^2 ; determine the base width of the 3-h unit hydrograph by assuming it to be triangular in shape.

- (b) Explain the factors that affect the runoff from a catchment area. How will you estimate the amount of runoff? A 4-hour storm in a basin producing 10 cm of runoff results the following flows in the stream;

| | | | | | | | | |
|---------------------|-----|------|------|-------|-------|------|------|-----|
| Time (hour) | 0 | 2 | 4 | 6 | 8 | 12 | 16 | 20 |
| Flow (cumec) | 0.0 | 2.44 | 8.10 | 13.50 | 11.34 | 6.75 | 2.70 | 0.0 |

Calculate the peak flow and the time of its occurrence of the flood created by an 8-hour storm in the basin which produces 5 cm of runoff during first 4-hours and 7.5 cm runoff during the second 4-hours. Assume base flow is negligible.

- (c) Explain with the help of neat sketches, the flow duration curve method and mass curve method to measure the runoff.
4. Attempt any **two** parts of the following : **(10×2=20)**
- (a) What do you mean by design flood? What are the factors affecting the flood hydrograph? Explain the procedure of using a unit hydrograph to develop the flood hydrograph due to a storm in a catchment.
- (b) What is flood frequency analysis? How flood frequency analysis at a project site is conducted? What are the data requirements?

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(c) What do you mean by hydrologic reservoir routing ?
Describe any two methods of hydrologic reservoir routing.

5. Attempt any **two** parts of the following : (10×2=20)

(a) What are the differences between confined and unconfined aquifers for the determination of discharge with steady flow condition ? A well penetrates into an unconfined aquifer having a saturated depth of 100 m. The discharge is 250 litres per minute at 12 m drawdown. Assuming equilibrium flow conditions and a homogeneous aquifer, estimate the discharge at 18 m drawdown. The distance from the well where the drawdown influences are not appreciable may be taken equal for both cases.

(b) Describe an expression for discharge from a well fully penetrating a confined aquifer. Design a tubewell for the following data :

Yield required = 0.08 cumec, thickness of confined aquifer = 30 m, radius of circle of influence = 300 m, coefficient of permeability = 60 m/day and draw down = 5 m.

(c) Write short notes on any **four** of the following :

(i) *Well losses*

(ii) *Specific capacity and specific yield of an aquifer*

(iii) *Rain water harvesting*

(iv) *Aquifer and aquiclude*

(v) *Radius of influence and cone of depression.*