Faculty of Engineering & Technology

Fifth Semester B.E. (Civil Engg.) (C.B.S.) Examination

HYDROLOGY AND WATER RESOURCES

Time : Three Hours]   [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated against each question.

(2) All questions are compulsory.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

(5) Use of non-programmable calculator and Drawing instruments is permitted.

1. (a) Define 'hydrological cycle' with neat sketch. Explain various components of it in detail.   6

(b) In a catchment whose shape is approximated by a pentagon, four raingauges are located inside the catchment. Details of co-ordinates of the corners of pentagon, co-ordinates of raingauge stations and annual rainfall of each station are given below. Determine the mean precipitation over the catchment by using

'Thiessen mean' method :

Catchment Boundary		Raingauge Station		
Corner	Co-ordinate	Station	Co-ordinate	Annual Rainfall (cm)
A	(0, 0)	P	(40, 20)	120
B	(120, 0)	Q	(80, 20)	110
C	(120, 80)	R	(80, 60)	100
D	(60, 140)	S	(40, 60)	125
E	(0, 80)			

7

2. (a) What is raingauge ? State various types of raingauges and explain 'Float type of raingauge' with neat sketch.

6

(b) Raingauge network consists of 7 raingauges. The annual rainfalls recorded by these raingauges are 58, 94, 60, 45, 20, 88 and 68 cm respectively. What is the % accuracy in the measurement of rainfall in the existing raingauge network ? Also determine the additional number of raingauges required if the allowable error is limited to 10%.

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3. (a) What is 'Evapotranspiration' ? State and explain various factors affecting evapotranspiration.

6

(b) In the catchment basin having total area of 1830 km², the rates of rainfall for successive 30 minutes interval of a 6 hours storm are 4, 9, 20, 18, 13, 11, 12, 8, 16, 17, 13 and 3 mm/h respectively. Determine total precipitation and ϕ_{index} for the above storm.

7

OR

4. (a) What is 'evaporation' ? State various pans used for the measurement of evaporation. Hence explain 'IS class A' pan with neat sketch.

6

(b) The Horton's infiltration equation for a basin is given by $f = 8 + 20e^{-2t}$, where 'f' is in mm/h and 't' is in hours. What is the value of f_0, f_c and k ? If a storm occurs on this basin with an intensity of more than 28 mm/h ? Determine the depth of infiltration and average rate of infiltration for the first 90 minutes.

7

5. (a) Write notes on following :

(i) Area-Velocity Method

(ii) Slope-Area Method.

6

(b) The ordinates of 3-h UH at every 1 hour intervals starting from 0 to 11 hours are 0, 25, 100, 160, 190, 170, 130, 80, 30, 10, 5 and 0 m³/s respectively. Derive the ordinates of 4-h UH.

8

OR

6. (a) What is runoff ? State and explain various components of runoff with neat sketch. 6

(b) The ordinates of 6-h UH at every 6-hours interval starting from 0 to 66 hours are 0, 20, 60, 150, 120, 90, 65, 50, 30, 20, 10 and 0 m³/s respectively. Three storms each of 6-h interval and effective rainfall magnitude of 2.0, 4.0 and 3.0 cm occurs successively. Derive the ordinates of flood hydrograph for the above storm. Assume uniform base flow of 20 m³/s. 8

7. (a) Define the following :

(i) Recurrence interval of a flood

(ii) Risk of the project

(iii) Reliability of the project. 6

(b) The annual peak flood of stream is estimated to have 50 years and 100 years floods of 2500 m³/s and 2900 m³/s respectively. What is 250 years flood for the same stream ? 7

OR

8. (a) What is design flood ? State and explain '100-Yrs flood', 'Standard Project Flood' and 'Probable Maximum Flood'. 6

(b) A small watershed consists of 5 km² of total area. There is a fall of 22 m in a watercourse length of 1.8 km. The intensity-frequency-duration relation for the area is given by ;

$$I = \frac{80 Tr^{0.2}}{(t+15)^{0.5}} \cdot$$

where, I is rainfall intensity in cm/h, Tr is return period in years and 't' is rainfall duration in minutes. Estimate the peak flood for a 25 years frequency. Assume runoff coefficient 'C' = 0.35. Use Rational Method. 7

9. (a) What is aquifer ? Differentiate 'unconfined aquifer' and 'confined aquifer' with neat sketch. 6

(b) In a water table aquifer of 50 m thickness, a 20 cm diameter well is pumped at a uniform rate of 50 lit/s. If the steady state drawdown measured in the observation wells located at 10 m and 100 m distance from the wells are 6.5 m and 0.25 m respectively, determine the hydraulic conductivity of the aquifer. 7

OR

10. (a) Define the following and establish the inter-relationship between them ;

(i) Specific yield and specific retention

(ii) Darcy's velocity and actual velocity. 6

(b) During a recuperation test conducted on an open well in a region, the water level in the well was depressed by 4 m and it was observed to rise by 2.5 m in 90 minutes. What would be the yield from the well under a depression head of 3 m, if the diameter of the well is 7.5 m ? 7

11. (a) What is watershed ? State and explain various objectives of watershed management. 6

(b) Write notes on following :

(i) Roof-top rain water harvesting

(ii) Urban-storm water harvesting. 8

OR

12. Write notes on the following (any **three**) :

(i) Interstate river dispute

(ii) Induced infiltration method of groundwater recharge.

(iii) Interbasin water transfer

(iv) Rainwater harvesting. 14