This question paper contains 6 printed pages.

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Your Roll No. .....

B.Tech. (C) / III **J**

Paper ECE–305 : HYDROLOGY AND IRRIGATION ENGINEERING

Time : 3 hours *Maximum Marks* : 70

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. 1 is compulsory. Answer two questions each from Part A and Part B.

1. Answer *four* parts of the question from the following:

   (*a*) Enlist different types of aquifers and compare their suitability in brief.

   (*b*) Write a brief note on: Cone of depression, radius of influence, specific capacity of well, Phreatic water surface, Dupits assumptions.

   (*c*) Write diffusion equation in 3-D cartesian coordinates and cylindrical coordinates and derive an expression for coefficient of storage by using Jacob's approximate technique.

   (*d*) A 45 cm well penetrates an unconfined aquifer of saturated thickness 30 m completely. Under a steady pumping rate for a long time the draw-downs at two observation wells 15 m and 30 m from the well are 5·0 m and 4·2 m respectively. If

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the permeability of the aquifer is 26 m/day, determine the discharge from the well and drawdown at the well.

(*e*) Estimate the discharge of a well pumping water from a confined aquifer of thickness 20 m with the following data:

(*i*) Distance of observation well (O.W.) from pumping well = 100 m

(*ii*) Drawdown at O.W. after 4 hours of pumping = 1·5 m

(*iii*) Drawdown at O.W. after 16 hours of pumping = 2·1 m

(*iv*) Storage coefficient, S = 0·0003. $3_{1/2} \times 4$

PART A

2. (*a*) Briefly explain use of double mass curve in preparation of hydrologic data. 2

(*b*) Briefly explain application of intensity-duration-frequency relationship of precipitation in hydrology. 2

(*c*) Compare between:

(*i*) ϕ index and W index

(*ii*) Plotting position method and station year method

(*iii*) Permanent control and shifting control. 6

(*d*) The following are the coordinates of a smooth curve drawn to best represent the stage discharge data of a river:

Stage (*m*)	20·8	21·4	22·0	23·4	23·0	23·5	23·0
θ (m^3/s)	100	200	300	400	600	800	1000

Determine the stage corresponding to zero discharge. 4

3. (*a*) Write a brief note on discharge frequency curve. Enlist some of its applications. Also compare the curve with flow duration curve. 4

(*b*) A 6 hour unit hydrograph of a catchment is triangular in shape with a base width of 64 hours and a peak ordinate of 30 m^3/s. Calculate the equilibrium discharge obtainable from this catchment for an effective rainfall intensity of 1/6 cm/hr. 5

(*c*) The IUH of a catchment is triangle with a base of 36 hours and a peak of 20 m^3/s at 8 hour from the start. Derive a 6 hour unit hydrograph for this catchment. 5

4. (*a*) Compare the applicability of Partial duration series and Regional flood frequency analysis in estimating flood discharge. 2

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(*b*) Write a brief note on flood forecasting methods. 2

(*c*) A factory is proposed to be located on the edge of the 75 year flood plain of a river. If the design life of the factory is 25 years, what is the reliability that it will not be flooded during its design life? 5

(*d*) In order to obtain IUH from interisochrone area distribution data, Muskinghum flood routing equation gets simplified. Derive the simplified formula used. 5

PART B

5. (*a*) Compare Drip irrigation with Sprinkler irrigation in terms of their limitations and suitability. 2

(*b*) Write a brief note on different types of irrigation efficiencies in reference to canal irrigation. 2

(*c*) A water course commands an irrigation area of 1000 ha. The intensity of irrigation of rice in this area is 50%. The transplantation of rice crop takes 15 days and total depth of water required by the crop is 60 cm on the field during the transplantation period. Calculate the discharge at the head of water course. (Losses in water course 20%.) 5

(*d*) Design an irrigation channel section and longitudinal slope required for the following data given:

Discharge = 40 cumecs

Silt factor = 1·1

Side slopes = $\frac{1}{2}$: 1. 5

6. (*a*) Write a brief note on economics of canal lining. 2

(*b*) Explain in brief various measures which may prove useful to minimise cost of cross-drainage works for a certain canal irrigation network. 2

(*c*) Design a concrete lined channel to carry a discharge of 300 cumecs at a slope of 1 in 6400. The side slopes of the channel may be taken as 1$_{1/2}$: 1. The value of *n* for lining material may be taken as 0·013. Assume limiting depth of the channel as 4·0 m. 5

(*d*) Determine the size of a tile at outlet of a 6 ha drainage system, if drainage coefficient is 1 cm and the tile grade is 0·3%. Assume Mannings roughness coefficient for material as 0·011. 5

7. (*a*) Write a brief note on rigid module outlets. 2

(*b*) Briefly explain the necessity of canal fall in a canal network. Suggest some steps which may curtail the costs involved with canal falls. 2

(*c*) The following hydraulic data pertain to a bridge site of a river:

Maximum discharge = 5000 cumecs

Highest flood level = 104·00 m

River bed level = 100·00 m

Average diameter of river bed material = 0·10 m

Design launching apron as a part of guide bank design. 5

(*d*) Draw a sketch of Sarda type canal fall and enlist relevant formulae to be used for the design of these components. 5