Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech**

Sub_Code: RCI7D006

5th Semester Regular/Back Examination: 2025-26

SUBJECT: Water Resource Engineering

BRANCH(S): C&EE, CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: U380

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) List any two factors affecting the accuracy of mean areal precipitation estimation and briefly state how each factor influences the result.

b) Why is the double mass curve method used for checking the consistency of rainfall data? Mention the hydrologic condition that the method assumes.

c) State two major catchment characteristics that influence runoff response and explain their effect in one sentence each.

d) Why is the SCS-CN method preferred for ungauged catchments? Mention two limitations that restrict its universal applicability.

e) Define effective rainfall. Why is it essential in deriving a unit hydrograph?

f) What is the purpose of the flow–mass curve in hydrologic design? State one advantage and one disadvantage of this method.

g) State two differences between reservoir routing and channel routing in terms of controlling variables and system behavior.

h) Mention two indicators used in drought classification and briefly explain what each indicator represents.

i) Why is the critical depth important in open channel flow computations? State two hydraulic conditions associated with it.

j) Define gradually varied flow (GVF). What two assumptions are made in deriving the GVF differential equation?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the hydrologic significance of interception, depression storage, and infiltration. How do these processes collectively modify the shape and peak of the runoff hydrograph during a storm event?

b) Discuss the various methods used for estimating missing precipitation data. Compare the Normal Ratio Method and Inverse Distance Method with proper conditions for their applicability.

c) Derive and explain the steps involved in constructing a Flow Duration Curve (FDC). What hydrologic inferences can be drawn from high-flow and low-flow segments of the curve?

d) Describe in detail the *Sequent Peak Algorithm used in* reservoir capacity estimation. Explain its advantage over the mass curve method for variable demand scenarios.

e) Explain the procedure for deriving a Unit Hydrograph (UH) from a storm hydrograph. Discuss two major limitations of the unit hydrograph theory.

f) Why is baseflow separation not uniquely defined? Give the hydrologic reason for multiple acceptable baseflow curves from the same hydrograph.

g) Describe the various methods used for flood estimation and compare Rational Method with Empirical Formulae in terms of assumptions and applicability.

h) Explain the concept of Environmental Flow (E-flow). Discuss any two hydrological methods used for assessing environmental flow requirements.

i) Determine dimensions of a concrete-lined (n = 0.012) trapezoidal channel of efficient proportions to carry a discharge of 12.5 m^3/s. The bed slope of the channel is 0.0005, and the side slope = 3:4.

j) Explain the concept of Specific Energy in open channel flow. Using the specific energy diagram, discuss how critical flow conditions influence channel design.

k) Discuss the various steps involved in Modified Pul's method of reservoir routing.

l) If y_1 and y_2 are alternate depths in a rectangular channel, show that

$$y_c^3 = \frac{2y_1^2 y_2^2}{(y_1 + y_2)}$$

and hence the specific energy,

$$E = \frac{y_1^2 + y_1 y_2 + y_2^2}{(y_1 + y_2)}$$

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain direct runoff hydrograph and Unit hydrograph. **(4)**

b) The following are the ordinates of the hydrograph of flow from a catchment area of 800 km^2 due to a 6-h rainfall. Derive the ordinates of the 6-h unit hydrograph. Make suitable assumptions regarding the base flow. **(12)**

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66	72
Discharge (m^3/s)	40	65	215	360	400	350	270	205	145	100	70	50	42

Q4 **a)** Derive the SCS-CN runoff equation and describe the procedure for selecting CN under varying land-use, soil, and AMC conditions. **(8)**

b) Explain the application of Sequent Peak Method for reservoir capacity determination with a conceptual example. **(8)**

Q5 Observed values of inflow and outflow hydrographs at the end of a reach of a river are given below. Determine the best deals of K and x for use in the Muskingum flood routing method. **(16)**

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66
Inflow (m^3/s)	20	80	210	240	215	170	130	90	60	40	28	16
Outflow (m^3/s)	20	20	50	150	200	210	185	155	120	85	55	23

Q6 **a)** A trapezoidal channel has a bottom width of 6.0 m and side slopes of 1:1. The flow depth is 1.5 m at a discharge of 15 m^3/s. Determine the specific energy and alternate depth. **(8)**

b) Describe the classification of flow profiles in gradually varied flow. **(8)**