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

Total Number of Pages: 02 **Course: B.Tech**
Sub_Code: RCI7D006

7th Semester Regular/Back Examination: 2024-25
SUBJECT: Water Resource Engineering
BRANCH(S): C&EE, CIVIL
Time: 3 Hours
Max Marks: 100
Q.Code: R110

Answer Question No.1 (Part-1) 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) What type of rainfall data is recorded in the Tipping-bucket type rain gauge and Weighing-bucket type rain gauge?
b) How is the consistency of precipitation data tested?
c) How is the storage volume of a reservoir calculated from a mass curve?
d) What is effective rainfall, and how is it determined in hydrograph analysis?
e) What is flood routing, and why is it necessary in hydrology?
f) How does frequency analysis help in flood estimation?
g) What is critical depth in open channel flow?
h) A hydraulic jump occurs in a horizontal rectangular channel with a flow depth of 2m and 3m before and after the jump. Calculate the energy dissipation head.
i) The Froude number of a flow in a rectangular channel is 0.73. If the depth of flow is 1.50 m, find the specific energy.
j) Differentiate supercritical and subcritical depth.

Part-II

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

a) Describe the depth-area-duration relationships in precipitation and their application in hydrological studies.
b) Explain ϕ-index and W-Index. The average rainfall over 45 ha of a watershed for a particular storm is given below. The volume of runoff from this storm was determined as 2.25 ha-m. Determine w-index and ϕ-index.

Time (hr)	0	1	2	3	4	5	6	7
Rainfall (cm)	0	0.5	1.0	3.25	2.5	1.5	0.5	0

c) What is the SCS-CN method for estimating runoff volume? Describe how it is applied in hydrological modeling.
d) Discuss the use of flow duration curves and flow-mass curves in streamflow analysis.
e) Explain the factors affecting a runoff hydrograph and how these factors are used to interpret hydrographs.
f) What is base flow separation, and how is it performed in hydrograph analysis?

g) What is the return period, and what is its significance of it?
A one-day rainfall of 20.0 cm at place X was found to have a period of 100 years. Calculate the probability that a one-day rainfall of magnitude equal to or larger than 20.0 cm:
(i) It will not occur at station X during the next 50 years.
(ii) It will happen in the next year.

h) Define drought and classify it based on different characteristics.

i) Define uniform flow in open channels and explain the Chezy and Kutter equations for flow estimation.

j) Describe gradually varied flow in open channels and the factors that affect its behavior.

k) Explain the concept of non-uniform flow and the factors that influence it.

l) In a 4.0-m wide rectangular channel (n = 0.017), the bed slope is 0.0006. When the channel is conveying 50 m^3/s of flow, estimate the nature of GVF profiles at two far away sections, P and R, in this channel where the depth of flow is measured as 1.6 m and 2.1 m, respectively.

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

Q3 **(a)** Explain the maximum intensity/depth-duration-frequency relationship in relation to rainfall events. **(8)**

(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. **(8)**

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)** Explain the Sequent Peak Procedure and its use in reservoir planning and flood control. **(8)**

(b) What are synthetic unit hydrographs, and how are they used in flood estimation? **(8)**

Q5 **(a)** Describe channel routing in the context of flood management and explain its importance in hydrological studies. **(8)**

(b) Determine the 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 side slope = 3:4. **(8)**

Q6 **(a)** What is the most economical cross-section in open channel flow design, and how is it determined? **(8)**

(b) What is a hydraulic jump in open channel flow, and how does it affect water flow and energy dissipation? **(8)**