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Course Code: ACEC15



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

**B.Tech V SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2022**

Regulation: UG20

**HYDROLOGY AND WATER RESOURCES ENGINEERING**

**Time: 2 Hours**

**(CIVIL ENGINEERING)**

**Max Marks: 70**

**Answer ALL questions in Module I and II**

**Answer ONE out of two questions in Modules III, IV and V**

**All Questions Carry Equal Marks**

**All parts of the question must be answered in one place only**

## MODULE – I

- (a) Describe the working principle of a tipping bucket-type rain gauge with a neat sketch. [BL: Understand| CO: 1|Marks: 7]  
(b) The average annual rainfall of 5 rain gauges in a basin is 890, 540, 450, 410 and 550 mm respectively. How many additional gauges are required if it is desired to limit the error to only 10%? [BL: Apply| CO: 1|Marks: 7]

## MODULE – II

- (a) Discuss step-by-step procedure involved to adjust the rainfall record at a suspicious station through the double mass curve technique. [BL: Understand| CO: 2|Marks: 7]  
(b) The rate of rainfall for successive 30 minutes periods of a 4hour storm are as follows: 3.5, 6.5, 8.5, 7.8, 6.4, 4.0, 4.0, 6.0 cm/hr, Taking a value of phi-index as 4.5 cm/hr. Compute the following:  
i) Total rainfall ii) Total rainfall excess iii) W-index [BL: Apply| CO: 2|Marks: 7]

## MODULE – III

- (a) Illustrate the various factors which affecting runoff. Discuss in brief, various methods of surface runoff. [BL: Understand| CO: 3|Marks: 7]  
(b) Unit hydrograph ordinates of 4 hour are given in Table 1. Find out ordinates of 8 hour unit hydrograph. [BL: Apply| CO: 3|Marks: 7]

Table 1

Time (Hr)	0	4	8	12	16	20	24	28	32	36
U.H.O.	0	17	28	42	72	60	47	32	15	0

- (a) Explain its use in the construction of flood hydrograph resulting from two or more periods of rainfall. [BL: Understand| CO: 4|Marks: 7]  
(b) The total runoff is  $1600 \text{ m}^3/\text{sec}$ , the drainage basin area is  $104 \text{ km}^2$ , and the time interval is 2 hours, then calculate the depth of direct runoff ( $d = \text{direct runoff depth}$ ). [BL: Apply| CO: 4|Marks: 7]

## MODULE – IV

5. (a) Illustrate with sketches what do you understand by the principle of linearity and principle of time invariance in the unit hydrograph theory? [BL: Understand| CO: 5|Marks: 7]
- (b) Design a channel section by Kennedy's theory given the following data: Discharge  $Q = 2828$  cumecs Kutter's  $N=0.0225$ ,  $m=1$ , Side slope 05:1,  $B/D = 7.6$ . Also find the bed slope of the channel. [BL: Apply| CO: 5|Marks: 7]
6. (a) Discuss the classification of irrigation water based on sodium absorption ratio and its suitability for irrigation. [BL: Understand| CO: 5|Marks: 2]
- (b)  $800 \text{ m}^3$  of water is applied to a farmer's rice field of 0.6 hectares. When the moisture content in the soil falls to 40 percent of the available water between the field capacity of 36 percent of soil and permanent wilting point is 15 percent of the soil crop combination, determine the field application efficiency. The root zone depth of rice is 60cm. Assume porosity as 0.4. [BL: Apply| CO: 5|Marks: 3]

## MODULE – V

7. (a) List the components of all types of dams. Discuss the types of investigations and surveys required for planning of reservoir. [BL: Understand| CO: 6|Marks: 7]
- (b) An ogee-type spillway has 30 crest gates each having 15m clear span. Find the maximum flood that can be safely passed by lifting all the gates when the maximum reservoir elevation is 110.0 m and the crest level is 106.00m. take coefficient  $C$  as 2.16m. The Coefficient of end contractions is 0.05 and 0.10 for the piers and abutments respectively. [BL: Apply| CO: 6|Marks: 7]
8. (a) Describe how the storage capacity of the reservoir is calculated using trapezoidal and Prismoidal formula. [BL: Understand| CO: 6|Marks: 7]
- (b) Identify the stability analysis of a concrete gravity dam with the following data.
- i) Total overturning moment toe =  $1 \times 10^6 \text{ kN-m}$
  - ii) Total resisting moment about toe =  $2 \times 10^6 \text{ kN-m}$
  - iii) Total vertical force above base = 50000 kN
  - iv) Base width of the dam = 50 m
  - v) Slope of the d/s face = 0.8H:1V.
- Calculate the maximum and minimum vertical stress to which the foundation will be subjected to. What is the principal stress at toe? Assume there is no tail water. [BL: Apply| CO: 6|Marks: 7]

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