

**Question Paper Code : 50065**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

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Fourth Semester

Agricultural Engineering

AI 3404 — HYDROLOGY AND WATER RESOURCES ENGINEERING

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. When will orographic precipitation occur?
2. Write any two differences between  $\phi$ - index and W- index.
3. Define Instantaneous Unit Hydrograph.
4. What is flow duration curve?
5. Differentiate between Levees and flood wall.
6. Define agricultural drought.
7. What is Trap efficiency?
8. Write the suitability condition for providing Morning glory spillway.
9. Define specific yield.
10. List the difference between aquifuge and aquitard.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain in detail about the analytical methods of evaporation estimation. (8)
- (ii) A storm with 15 cm precipitation produces a direct runoff of 8.7 cm with incremental hourly rainfall values in cm/h as given below, Estimate the  $\phi$ - index of storm.

T	1	2	3	4	5	6	7	8
R	0.6	1.35	2.25	3.45	2.7	2.4	1.5	0.75

T-Time from start (hours); R – Incremental rainfall (cm/h).

(5)

Or

- (b) (i) Explain in detail about the hydrological cycle and its various components with a neat sketch. (8)
- (ii) The isohyets due to a storm in a catchment has the following details as tabulated below. Estimate the mean precipitation due to the storm. Take precipitation value as 12cm for the first area consisting of a station surrounded by a closed isohyet.

I (cm)	station - 12	12 - 10	10 - 8	8 - 6	6 - 4
A (km <sup>2</sup> )	30	140	80	180	20

l-Isohyets (cm); A - Area (km<sup>2</sup>). (5)

12. (a) Discuss in detail about the SCS curve number method to estimate runoff from a catchment. Also compute the runoff from 12.7 cm of rainfall on a 1000 acre watershed. The hydrologic soil group is 50% Group B and 50% Group C interspaced throughout the watershed. Take Antecedent moisture condition II. The land use details are given in the table below. The 40% Residential area

- (i) (30% and impervious) 12% Residential area  
 (ii) (65% impervious).

Landuse	Roads		Open land (good cover)		Parking lots		Residential area I		Residential area II	
	%	CN	%	CN	%	CN	%	CN	%	CN
Group B	9	98	8	61	7	98	20	72	6	85
Group C	9	98	8	74	7	98	20	81	6	90

Or

- (b) The Instantaneous Unit Hydrograph ordinates of a catchment are given below. Derive the direct runoff hydrograph (DRH) for a catchment due to a storm of duration 4 hrs and having a rainfall excess of 5 cm.

T-Time (hours); IUH ordinate u(t) in (m<sup>3</sup>/s)

T	0	1	2	3	4	5	6	7	8	9
u(t)	0	8	35	50	47	40	31	23	15	10
T	10	11	12							
u(t)	6	3	0							

13. (a) (i) Describe in detail about the structural methods of flood control. (8)  
 (ii) Elaborate the various methods of determining flood discharge in a stream. (5)

Or

- (b) (i) Explain in detail about the NDVI analysis for drought. (5)  
 (ii) Discuss in detail about the DPAP programs in the development of dry land agriculture in India. (8)
14. (a) Discuss how the Geographic Information System is associated in determination of site selection for a reservoir.

Or

- (b) Illustrate in detail about the storage capacity of a reservoir determination from mass curve.
15. (a) Classify the aquifers on the basis of occurrence and field situation with relevant sketches. Also explain in detail the features of such aquifers.

Or

- (b) Describe the different methods adopted for the Artificial Ground Water Recharge.

PART C — (1 × 15 = 15 marks)

16. (a) Construct the probability plot for the annual flood on graph. Determine the flood magnitude with a return period of 50 years and 100 years. The observed annual flood peaks (Q) of a stream period of 16 years from 1951 to 1966 in m<sup>3</sup>/s are given below.

Year	1951	1952	1953	1954	1955	1956	1957	1958	1959
Q	686	705	589	610	726	900	624	814	697
Year	1960	1961	1962	1963	1964	1965	1966		
Q	632	766	634	598	699	721	619		

Or

- (b) Design the critical sequence of rainfall excesses by taking the  $\phi$  index to be 0.15 cm/h. The ordinates of cumulative rainfall from the enveloping maximum depth–duration curve for a basin are given below. Also given are the ordinates of a 6-hour unit hydrograph. T – Time from start (hours); P – Cumulative rainfall (cm); Q – 6 hour Unit Hydrograph ordinate ( $\text{m}^3/\text{s}$ )

T	0	6	12	18	24	30	36	42	48	54	60
P	0	16	24.1	30	34	37	39	40.5	41.3		
Q	0	20	54	98	126	146	154	152	138	122	106
T	66	72	78	84	90	96	102	108	114	129	132
Q	92	79	64	52	40	30	20	14	10	6	0

