Time of rainfall (h)	0	3	6	9	12	15	18	21	24	27
Outflow (m^3/s)	5.5	7.5	15	21	30	25	20	5.5	5	5

(Assume base flow is constant at the rate of 5 m^3/s) 8

(b) Write short notes on:(i) Hyetograph (ii) ϕ index, and (iii) Effective rainfall 6

8. (a) Describe the different methods for base flow separation in a hydrograph. 7

(b) Describe the factors affecting the shape of hydrograph. 7

UNIT-V

9. (a) The peak of a flood hydrograph due to a 6-h storm is 470 m^3/s. The mean depth of rainfall is 8.0 cm. Assuming an average infiltration loss of 0.25 cm/h and a constant base flow of 15 m^3/s, estimate the peak discharge of a 6-h unit hydrograph for this catchment. 7

(b) Define unit hydrograph and what is role of unit hydrograph to predict the flood. 7

10. (a) The peak of a flood hydrograph due to a 5-h storm is 670 m^3/s. The total depth of rainfall is 9 cm. Assuming an average infiltration loss of 0.2 cm/h and a constant baseflow of 30 m^3/h, calculate the peak discharge of the 5-h unit hydrograph for this catchment. 7

(b) Discuss the applications and limitations of the Unit Hydrograph. 7

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B.Tech Even Semester Examination, May, 2025

Agricultural Engineering

(4th Semester)

Course No: AGPC-253

(Watershed Hyrdology)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

Note:

1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. (a) Define watershed. Explain the major river basins in India 2+3=5

(b) What is a cyclone? Classify it as per IMD guidelines 2+3=5

(c) Wind velocity at 1.0 m above ground surface is 16 km/h. What will be the wind velocity (km/h) at 9.0 m above the ground surface. 4

2. (a) Write the short notes on(a)Pan Coefficient (b) ISIStandard pan (c) Rohwer's Formula (d) Infiltration 1.5×4=6

(b) Explain the hydrological cycle in the Earth's system with a neat and well-labelled diagram. 8

UNIT-II

3. (a) Describe the various types of rainfall and the processes involved in each. 7

   (b) A catchment has a network of four rain gauges. The rainfall recorded by these rain gauges in a month is 40, 52, 54, and 64 mm, respectively. Calculate the optimum number of rain gauges required for the catchment for a 5% error in the mean areal rainfall. 7

4. (a) One day rainfall of 200 mm at a place X was found to have a return period of 100 years. Calculate the probability that a one-day rainfall magnitude equal to or greater than 200 mm

   i) will not occur at station X during the next 50 years

   ii) will occur once in next 30 years.4+3=7

   (b) Rain Gauge X was not operational during a Storm. The Rainfall amount at three adjacent stations A, B and C during the storm were 37, 42 and 49 mm. The normal annual rainfall for the gauges is tabulated below. Estimate the amount of rainfall at gauge X during the storm. 7

Stations	Rainfall (mm)	Normal Annual Rainfall (mm)
A	37	726
B	42	752
C	49	760
X	---	694

UNIT-III

5. (a) List the factors affecting runoff and describe each in detail. 9

   (b) What are the different methods used for the estimation of runoff? Describe any one of them. 2+3=5

6. (a) A watershed has 1.8 km^2 of cultivated area, 2.2 km^2 of forest land and 1.4 km^2 of grassed area. The runoff coefficients of cultivated area, forest land and grassed area are 0.25, 0.15 and 0.3 respectively. The main drainage channel has a fall of 25 m in a total length of 2.5 km. The intensity -duration -frequency relationship for the watershed watershed is expressed as: 5

$$i = \frac{700T^{0.25}}{(T_c+15)^{0.4}}$$

   (b) Calculate the design peak discharge expected to occur once in 25 years at a site for constructing a drop structure to handle the runoff from a watershed comprising of 20 ha of cultivated land (C = 0.5), 15 ha of hilly forest land (C = 0.3) and 8 ha of rolling grass land (C = 0.35). The maximum length of flow is 2 km and the total fall along the path is 20 m. The maximum rainfall recorded for various durations in 25 years are given below in the table 9

Duration (min)	5	10	15	20	40	60
Depth of rainfall (mm)	20	30	40	50	90	120

UNIT-IV

7. (a) Two rainfalls in magnitude of 3.5 and 1.75 cm have occurred consecutively at 6-h interval on a catchment area of 25 km^2. Compute the effective rainfall amount and ϕ index, if outflow hydrograph of catchment is as follows: