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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

B.Tech Degree S5 (R,S) (FT/WP)(S3 PT) Examination November 2025 (2019 Scheme)

## Course Code: CET307
## Course Name: HYDROLOGY & WATER RESOURCES ENGINEERING

Max. Marks: 100 Duration: 3 Hours

### PART A
*(Answer all questions; each question carries 3 marks)*

| | | Marks |
|---|---|---|
| 1 | What are the different methods for measurement and control of evaporation? | 3 |
| 2 | In a watershed, four rain gauges I, II, III, and IV are installed. The depth of normal annual rainfall recorded at these stations are 80.0, 65.0, 75.5 and 92.0 cm, respectively. The rain gauge at station I went out of order during one of the years. The annual precipitation for that year, recorded were 90.0, 72.5 and 80.0 cm at station II, III, and IV respectively. Estimate the rainfall at station I in that year. | 3 |
| 3 | List out any three assumptions and three limitations made in the derivation of unit hydrograph. | 3 |
| 4 | Differentiate between SPF and PMF. | 3 |
| 5 | At what range the soil moisture should be maintained to get the optimum growth of the crop? Support your answer with a reason? | 3 |
| 6 | Explain the term frequency of irrigation? | 3 |
| 7 | With the help of a sketch explain any 3 river training works? | 3 |
| 8 | What is meant by dead storage of a reservoir? Why is it provided? | 3 |
| 9 | What are the various types of saturated formations from which we can extract water? | 3 |
| 10 | With the help of a sketch explain drawdown in a well. | 3 |

### PART B
*(Answer one full question from each module, each question carries 14 marks)*

**Module -1**

| | | | |
|---|---|---|---|
| 11 | a) | Explain Infiltration and infiltration indices. | 7 |

b) In a catchment area covering 100 km² , the average annual precipitation observed at five rain gauge stations is as under 7

| Station | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Precipitation(mm) | 750 | 1000 | 900 | 650 | 500 |

Find the number of additional rain gauge stations and also the rain gauge density if the permissible error is 10%.

12 a) Compare the Thiessens and the isohyet methods of computing the average rainfall and bring out the basic difference between the two approaches. 7

b) The mass curve of rainfall in a storm of total duration 270 minutes is given below. 7

| Time since start(mins) | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cumulative rainfall (mm) | 0 | 5 | 20 | 24 | 38 | 45 | 50 | 54 | 55 | 56 |

Draw the hyetograph of the storm at 30 minutes time step. ( Draw in the answer sheet itself)

**Module -2**

13 a) What is meant by base flow and what are the methods of baseflow separation? 7

b) The S curve ordinates of intensity 1 cm/hr derived from 6 -hr 1 cm UH are given below. Derive a UH of 3 hr duration and 1 cm depth. 7

| Time(hr) | S -curve Hydrograph ordinates ($m^3/s$) |
|---|---|
| 0 | 0 |
| 3 | 1200 |
| 6 | 3000 |
| 9 | 7200 |
| 12 | 12600 |
| 15 | 21600 |
| 18 | 33600 |
| 21 | 47400 |
| 24 | 62400 |
| 27 | 74400 |
| 30 | 82800 |

14 a) Describe the methods used for deriving an *n*.T hour unit hydrograph from a T hour unit hydrograph. Bring out the differences between the methods when the value of *n* is an integer, and when it is a fraction. 7

b) Ordinates of the one hour hydrograph of a catchment at one-hour intervals are 5, 8, 5, 3, and 1 $m^3/s$. Calculate the ordinates of s-curve and 2-hour unit hydrograph. 7

## Module -3

15 a) Explain the term Duty. Draw the layout of a canal system and define duty at various places. 7

b) An irrigation channel has a Gross Command Area (GCA) = $10^5$ ha, out of which 30 % is C.C.A. The average duty at the head of the channel for Kharif season is 775 hectares/cumec and for Rabi season is 1800 hectares/cumec. If the intensity of irrigation for Kharif and Rabi are 40 % and 50 % respectively, compute the discharge required at the head of the channel. 7

16 a) Explain the various methods of applying water to crops. 7

b) A canal takes off from a reservoir. Data for irrigated crops are given in table below: 7

| Sl. No | Name of crop | Base period (days) | Area under crop (ha) | Duty at the head of the canal (ha/cumec) |
|---|---|---|---|---|
| 1 | Bajra (Monsoon) | 20 | 7200 | 2800 |
| 2 | Jawar (Rabi) | 120 | 5600 | 1600 |
| 3 | Sugarcane | 280 | 500 | 630 |
| 4 | Sugarcane (Overlap) | 100 | 250 | 630 |
| 5 | Vegetable (Hot weather) | 120 | 500 | 700 |

Compute the discharge required at the head of the canal. The time factor is 0.65 and capacity factor is 0.8

## Module -4

17 a) Explain the various commonly used methods of measurement of stage of a river. 7

b) The following information is given for reservoir, find the probable life of the reservoir with an initial reservoir capacity of 30 million cubic metres, if the annual flood inflow is 60 million cubic metres and the average sediment inflow is 3600,000 kN. Assume a specific weight of sediments equal to 12 kN/m³. The useful life of the reservoir will terminate when 80% of initial capacity is filled with sediments. 7

| Capacity inflow ratio | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Trap efficiency | 87 | 93 | 95 | 95.5 | 96 | 96.5 | 97 | 97.2 | 97.3 | 97.5 |

18 a) Explain in detail with the help of a figure the various zones of a reservoir. 7

b) The following data pertains to a stream gauging station. 7

| Distance from bank(m) | 0 | 1 | 3 | 5 | 7 | 9 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0 | 1.1 | 2.0 | 2.5 | 2.0 | 1.7 | 1.0 | 0 |
| Revolutions of a current meter kept at 0.6 depth | 0 | 39 | 58 | 112 | 90 | 45 | 30 | 0 |

| Duration of observation(s) | 0 | 100 | 100 | 150 | 100 | 100 | 100 | 100 |
|---|---|---|---|---|---|---|---|---|

The velocity was obtained using a current meter with a rating equation of $v = 0.51Ns + 0.03$ m/s. Compute the discharge of the stream.

**Module -5**

19 a) Explain the different types of tube wells. 7

b) A well penetrates fully confined aquifer 10 m thick (saturated thickness) having coefficient of permeability of 0.0005 m/sec. The radius of well 10 cm. There is a drawdown of 4 m at the well face and its radius of influence is 300 m. Calculate the steady state discharge which can be withdrawn from this well. What will be the percentage increase in the discharge if the radius of the well is doubled? 7

20 a) A recuperation test was conducted on an open well 5.0 m diameter. The water table observed during the test were as follows: 7

Ground water table level = 250 m

Water level when the pumping was stopped = 243 m

Water level in the well 2 hour after pumping was stopped = 245 m

Find the safe yield of the well if the working head is 3 m.

b) Derive an equation for discharge in a steady radial flow in a confined aquifer. 7

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