



Name :

Roll No. :

Invigilator's Signature :

**CS/B.Tech (CE-New)/SEM-6/CE-605/2010
2010**

WATER RESOURCE ENGINEERING-I

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

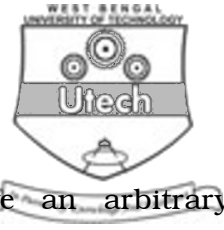
GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) Form factor of a basin is defined as the ratio of
 - a) basin area to the square of basin length
 - b) perimeter to the basin length
 - c) perimeter to the basin area
 - d) basin area to the basin length.
- ii) The chart removed from a recording type rain gauge gives
 - a) a rainfall hyetograph
 - b) an isohyetal map
 - c) a rainfall mass curve
 - d) an intensity duration curve.



- iii) The stage in the river is defined as
- elevation of water surface above an arbitrary datum
 - average depth of flow in the stream
 - hydraulic radius of stream cross-section
 - hydraulic depth of stream cross-section.
- iv) The pan coefficient is defined as
- E/E_p
 - E_p/E
 - $(E_p - E)$
 - $E_p \cdot E$
- v) In the standard notation, the Horton's infiltration equation is given by
- $f = f_c + (f_0 - f_c) e^{-kt}$
 - $f = f_0 + (f_c - f_0) e^{-kt}$
 - $f = f_c + (f_0 + f_c) e^{-kt}$
 - $f = f_c + (f_0 + f_c) e^{kt}$
- vi) The monthly runoff is estimated using Khosla's formula as $R_m = P_m - L_m$.
- the loss term L_m Here
- depends on the mean monthly temperature of the basin
 - depends on the augmentation precipitation index
 - is expressed as a function of land use and the slope of the basin
 - is a constant.



- vii) S-curve hydrograph is summation of the
- a) unit hydrograph
 - b) total runoff hydrograph
 - c) effective rainfall hyetograph
 - d) base flow recession curve.
- viii) The probable maximum depth of precipitation over a catchment is given by the relation $PMP =$
- a) $\bar{P} + kA^n$
 - b) $\bar{P} + k\delta$
 - c) $\bar{P} \exp(-kA^n)$
 - d) $m\bar{P}$.
- ix) The important government reference made to the 'duty for a crop' is usually related to its duty
- a) on the field
 - b) at the head of the main canal
 - c) at the head of the water course
 - d) none of these.
- x) If the intensity of irrigation for kharif is 45% and that of rabi is 60%, then the annual intensity is
- a) 60%
 - b) 100%
 - c) 105%
 - d) none of these.



xi) The Δ (in m) for a crop, having quantity duty D (in ha/M.cu .m) and base period B (in days) is given by

- a) $\Delta = 8 \cdot 64 B / D$ b) $\Delta = 864 B / D$
- c) $\Delta = 100 / D$ d) $\Delta = 10000 / D$.

xii) Flood irrigation method of irrigating fields, works best on

- a) level or gently rolling terrain
- b) steeply rolling terrain
- c) both (a) and (b)
- d) none of these.

xiii) For a most economical trapezoidal channel section

- a) hydraulic mean radius equals the depth of flow
- b) hydraulic mean radius equals half the depth of flow
- c) bottom width is twice the depth of flow
- d) bottom width is half the depth of flow.



GROUP – B

(Short Answer Type Questions)

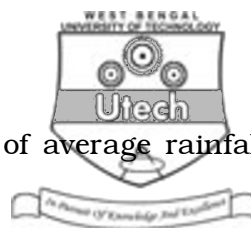
Answer any *three* of the following.

3 × 5 = 15

2. What is run-off ? What are the factors that affect the run-off from a catchment area ?
3. The following are the rates of rainfall for successive 20 min. period of a 140 min. storm : 2.5 cm/hr, 2.5 cm/hr, 10.00 cm/hr, 7.5 cm/hr, 1.25 cm/hr, 1.25 cm/hr, 5.00 cm/hr. Taking the value of ϕ -index as 3.2 cm/hr, find out total rainfall and the value of w -index.
4. Explain objective, advantages and disadvantages of canal lining.
5. Distinguish between any *two* of the following :
 - a) Infiltration capacity and infiltration rate
 - b) Actual and potential evapotranspiration
 - c) Field capacity and permanent wilting point.
6. Calculate the value of ϕ -index from the following data of storm of 8 cm precipitation that resulted in a direct run-off of 4.4 cm :

Time in hr.	1	2	3	4	5	6
Incremental Rainfall per hr. in cm	0.57	0.58	1.25	3.00	1.40	1.2

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7. Explain different methods for calculation of average rainfall over an area.
8. Explain flow duration graph.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

9. a) What is infiltration ? 2
 - b) What are the various factors that affect the infiltration capacity ? 7
 - c) A one day rainfall of 15.0 cm at a place X was found to have a return period of 100 years. Calculate the probability that one day rainfall of this or larger magnitude —
 - i) will not occur at X during the next 50 years and
 - ii) will occur in the next year. 3 + 3
10. a) Write in detail about the various methods to estimate the mean precipitation over an area. 9
 - b) A catchment area has seven rain gauge stations. In a year the annual rainfall recorded by the gauges are as follows :

Station	P	Q	R	S	T	U	V
Rainfall (cm)	130.0	142.1	118.2	108.5	165.2	102.1	146.9

For a 5% error in the estimation of the mean rainfall, calculate the minimum number of additional stations required to be established in the catchment. 6



11. a) Define unit hydrograph. 2
- b) Write down the assumptions of unit hydrograph theory. 4
- c) The ordinates of a 4 hr. U.H. of a basin of area 300 km^2 measured at 1 hr. interval are $6 \text{ m}^3/\text{s}$, $36 \text{ m}^3/\text{s}$, $66 \text{ m}^3/\text{s}$, $91 \text{ m}^3/\text{s}$, $106 \text{ m}^3/\text{s}$, $93 \text{ m}^3/\text{s}$, $79 \text{ m}^3/\text{s}$, $68 \text{ m}^3/\text{s}$, $58 \text{ m}^3/\text{s}$, $49 \text{ m}^3/\text{s}$, $41 \text{ m}^3/\text{s}$, $34 \text{ m}^3/\text{s}$, $27 \text{ m}^3/\text{s}$, $23 \text{ m}^3/\text{s}$, $17 \text{ m}^3/\text{s}$, $13 \text{ m}^3/\text{s}$, $9 \text{ m}^3/\text{s}$, $6 \text{ m}^3/\text{s}$, $3 \text{ m}^3/\text{s}$ and $1.5 \text{ m}^3/\text{s}$ respectively. Obtain the ordinates of a 3 hr. U.H. for the basin with S-curve technique. 9
12. Design an irrigation channel to carry 40 cumecs of discharge, with B/D i.e. base width to depth ratio as 2.5. The critical velocity ratio is 1.0. Assume Kutter's rugosity coefficient $n = 0.023$ and use Kennedy's method.
13. a) Compare Kennedy's theory and Lacey's theory for designing channels. 6
- b) Design a regime channel for a discharge of 50 cumecs and silt factor 1.1, using Lacey's theory. 9
14. a) What are the requirements of good canal lining? 7
- b) What are the various factors responsible for the selection of a particular type of lining? 8

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