Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE)/SEM-6/CE-605/2011

2011

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 : $10 \times 1 = 10$

   i) The duty is

      a) largest at the head of watercourse

      b) largest on the field

      c) largest at the head of a main canal

      d) same at all places.

   ii) As per Lacey's theory, silt factor is

      a) directly proportional to average particle size

      b) not related to average particle size

      c) directly proportional to square root of average particle size

      d) directly proportional to half of average particle size.

iii) In a certain irrigation project, for a given year, 54% and 75% of culturable command area remained unirrigated in Kharif and Rabi season respectively. The intensity of irrigation for that year and for that project is

a) 26% b) 46%

c) 72% d) 74%.

iv) If wheat requires 7·5 cm of water after 35 days and the base period of wheat is 140 days, what is the value of delta for wheat

a) 30 cm b) 105 cm

c) 35 cm d) 100 cm.

v) In Kennedy's theory critical velocity is given by

a) $V_0 = 0 \cdot 55\ D^{0 \cdot 64}$ b) $V_0 = 2\ D^{0 \cdot 64}$

c) $V_0 = 1 \cdot 55\ D^{0 \cdot 64}$ d) $V_0 = 1 \cdot 55\ D^2$.

vi) A hyetograph is a plot of

a) cumulative rainfall *vs* time

b) rainfall intensity *vs* time

c) rainfall depth *vs* duration

d) discharge *vs* time.

vii) The chemical that is found to be most suitable as water evaporation inhibitor is

a) ethyl alcohol b) cetyl alcohol

c) butyl alcohol d) methyl alcohol.

viii) Which of the following is not a direct stream flow determination technique ?

a) dilution method b) ultrasonic method

c) area velocity method d) slope-area method.

ix) A mean annual runoff of 1 m^3/s from a catchment of area = 31·54 km^2 represents an effective rainfall of

a) 100 cm b) 1 cm

c) 100 mm d) 3·17 cm.

x) The flow-mass curve is an integral curve of

a) the hydrograph

b) the hyetograph

c) the flow duration curve

d) the S-curve.

xi) If a 4 hr. unit hydrograph of a catchment has a peak ordinate of 60 m^3/s, the peak ordinate of an 8 hr. unit hydrograph for the same catchment will be

a) > 60 m^3/s b) = 60 m^3/s

c) < 60 m^3/s d) data inadequate.

xii) Base flow separation is performed on

a) a unit hydrograph to set the direct runoff hydrograph

b) a flood hydrograph to obtain the magnitude of effective rainfall

c) a flood hydrograph to obtain the rainfall hydrograph

d) a hydrograph of effluent streams only.

xiii) A canal which is not supposed to do any irrigation is called

a) main canal b) water course

c) major distributory d) minor distributory.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Write in brief about the various types of irrigation.

3. a) Define duty and delta.

   b) If rice requires about 10 cm depth of water at an average interval of about 10 days and the crop period for rice is 120 days, find out the delta for rice. 2 + 3

4. Calculate the optimum no. of rain gauge station for the given catchment with the following data :

Station No.	1	2	3	4
Rainfall in mm	700	500	300	440

5. A precipitation station *X* was inoperative for some time during which a storm occurred. At three stations *A*, *B* and *C* surrounding *X* the total precipitation recorded during the storm are 75, 58 and 47 mm respectively. The normal annual precipitation amounts at stations *X*, *A*, *B* and *C* are respectively 757, 826, 618 and 482 mm. Estimate the storm precipitation for station *X*.

6. Determine the field capacity of a soil for the following data :

   i) Depth of root zone = 1·8 m

   ii) Existing moisture = 8%

   iii) Dry density of soil = 1450 kg/m^3

   iv) Quantity of water applied to soil = 650 m^3

   v) Water lost due to deep percolation and evaporation = 10%

   vi) Area to be irrigated = 1000 m^2 .

7. Write short notes on any *two* of the following :

   a) Optimum utilization of irrigation water

   b) Crop rotation

   c) Net Irrigation Requirements (NIR)

   d) Estimating depth and frequency of irrigation on the basis of soil moisture concept.

8. The culturable commanded area of a water course is 1200 hectares. Intensities of sugarcane and wheat crops are 20% and 40% respectively. The duties for the crops at the head of the water course are 730 hectares/cumec and 1800 hectares/cumec, respectively. Find

   a) the discharge required at the head of the water course

   b) design discharge at the outlet, assuming time factor equal to 0·8.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

9. a) A channel section has to be designed for the following data :

Discharge Q = 50 cumecs side slope $\frac{1}{2}:1$

Silt factor f = 1. Use Lacey's theory

b) Write down the procedure for designing a channel using Kennedy's theory for given discharge, bed slope, critical velocity ratio and side slope.

10. a) An irrigation channel has a Gross Command area of 80,000 hectares out of which 75% is culturabe irrigable. The intensity of irrigation for Kharif season is 40% and for Rabi season is 50%. Find the discharge required at the head of the canal if the duty at its head is 800 hectares/cumec for Kharif season and 1700 hectares/cumec for Rabi season.

b) What do you understand by crop rotation ? What are its advantages ?

11. a) Area and perimeter of a river basin is 300 sq km and 24 km. Length of the river in the basin is 20 km. Calculate the form factor and compactness co-efficient of the basin. 4

b) With a sketch explain the hydrological cycle. 6

c) Explain with sketch "rainfall mass curve". How is it drawn ? 5

12. Describe the three methods of determining mean rainfall over a drainage basin with merits and demerits of them.

13. a) Following are the rates of rainfall for successive 20 minutes for a period of 140 minutes storm (in cm/hr)

2·5, 2·5, 10·0, 7·5, 1·25, 1·25, 5·0

Taking ∅ index as 3·2 cm/hr, find net runoff in cm, total rainfall and Windex. 9

b) Explain the concept of unit hydrograph. What are the assumptions in unit hydrograph theory, its advantages and limitations ? 6

14. a) What are the advantages of lining canals ? 5

b) The following are the data obtained in a stream-gauging operation. A current meter with a calibration equation $V = 0{\cdot}32\ N + 0{\cdot}032$ m/s where N = revolution per sec. was used to measure the velocity at 0·6 meter depth. Using the Area-Velocity method calculate the discharge in the stream.

Distance from the right bank (m)	– 0	2	4	6	9	12	15	18	20	22	23	24
Depth (m)	– 0	0·5	1·1	1·95	2·25	1·85	1·75	1·65	1·5	1·25	0·75	0
No. of revolutions	– 0	80	83	131	139	121	114	109	92	85	70	0
Time in sec.	– 0	180	120	120	120	120	120	120	120	120	150	0

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