3 CHAPTER

Water Requirements of Crops

Q.1 Match List-I (Efficiency term) with List-II (Definition) and select the correct answer using the codes given below the lists:

List-I

A. Water conveyance efficiency
B. Water application efficiency
C. Water use efficiency
D. Water storage efficiency

List-II

1. Water stored beneficially to water delivered
2. Water stored in the root zone during irrigation to water needed to bring moisture content to field capacity
3. Water actually stored in the root zone to the water delivered to the field
4. Water delivered to the field to the water diverted in to the canal system at the head works

Codes:

	A	B	C	D
(a)	4	1	3	2
(b)	4	3	1	2
(c)	3	4	1	2
(d)	4	3	2	1

Q.2 Net irrigation requirement of a crop is equal to
(a) consumptive use
(b) consumptive use-effective rainfall
(c) consumptive use-effective rainfall + leaching and other requirements
(d) percolation loss + effective rainfall

Q.3 The capacity factor of a canal is
(a) the duty based on the discharge at the canal head works
(b) the ratio of the number of days the canal has actually run to the number of days of the irrigation period
(c) the ratio of mean supply discharge to the design discharge of the canal
(d) the ratio of kharif season and rabi season

Q.4 The efficiency of water application does not depend upon
(a) climatic conditions.
(b) type of the soil.
(c) method of application.
(d) geometry of the conveyance system.

Q.5 The outlet discharge factor is
(a) the ratio of the actual discharge of an outlet to its designed value.
(b) the ratio of the discharge out of an outlet to the discharge in the parent channel.
(c) the duty based on the discharge passing through the outlet.
(d) the flow loss at the outlet.

Q.6 Which of the following are properly matched?
1. Watering done prior to sowing of a crop—Pateo irrigation
2. Duty at head of main canal—Gross quantity
3. Duty at head of field—Net quantity
4. Time factor $= \frac{\text{Estimated irrigation period}}{\text{No. of days canal has run}}$

(a) 1 and 2 (b) 1, 2 and 3
(c) 2, 3 and 4 (d) 1, 2 and 4

Q.7 If duty (D) is 1428 hectares/cumec and base period (B) is 120 days for an irrigated crop, then delta (D) in meters is given by
(a) 102.8 (b) 0.73
(c) 1.38 (d) 0.01

Q.8 A field was supplied water from an irrigation tank at a rate of 120 lit/sec to irrigate an area of 2.5 hectares. The duration of irrigation is 8 hours. It was found that the actual delivery at the field, which is about 4 km from the tank, was 100 lit/sec. The runoff loss in the field was estimated as 600 m³. The application efficiency in this situation is
(a) 62% (b) 72%
(c) 49% (d) 80%

Q.9 A canal was designed to supply the irrigation needs of 1200 hectares of land growing rice of 140 days base period having a delta of 134 cms. If this canal water is used to irrigate wheat of base period 120 days having a delta of 52 cm, the area (in hectares) that can be irrigated is
(a) 2650 (b) 3608
(c) 543 (d) None of the above

Q.10 A canal irrigates a portion of a culturable command area to grow sugarcane and wheat. The average discharges required to grow sugarcane and wheat are, respectively, 0.36 and 0.27 cumecs. The time factor is 0.9. The design capacity of the canal is
(a) 0.36 cumecs (b) 0.40 cumecs
(c) 0.63 cumecs (d) 0.70 cumecs

Q.11 The culturable command area for a distributary is 2×10^8 m². The intensity of irrigation for a crop is 40%. If kor water depth and kor period for the crop are 14 cm and 4 weeks, respectively, the peak demand discharge is
(a) 2.63 m³/s (b) 4.63 m³/s
(c) 8.58 m³/s (d) 11.58 m³/s

Q.12 A canal was designed to supply the irrigation needs of 1000 ha of land growing rice of 140 days base period and having a delta of 130 cm. If the canal water is used to irrigate wheat of base period 119 days and having a delta of 50 cm, the area that can be irrigated is
(a) 452 ha (b) 904 ha
(c) 1105 ha (d) 3059 ha

Q.13 The kor depth for rice is 190 mm and kor period is 14 days. The outlet factor for this will be
(a) 637 hectares/m³/sec
(b) 837 hectares/m³/sec
(c) 972 hectares/m³/sec
(d) 1172 hectares/m³/sec

Q.14 The table given below shows the details for a particular crop, with a crop factor 0.5. The consumptive water requirement of the crop will be,

Month	January	February
Monthly average temperature (in °C)	20	8
Monthly % of day time hours of the year	20	8

(a) 27.2 cm (b) 13.6 cm
(c) 32 cm (d) 1 cm

Q.15 The GCA of an irrigation canal is 50,000 hectares out of which 60% is CCA. The intensity of irrigation for Rabi season is 60% and for Kharif season of 20%. Then crop ratio will be
(a) 1.33 (b) 4.00
(c) 3.00 (d) 0.33

Q.16 In the average numerical deviation, if the depth of water stored is 8 cm and the average depth of water stored in root zone is 24 cm, then water distribution efficiency is
(a) 33.333% (b) 50%
(c) 75% (d) 66.67%

Q.17 In an irrigated plot, during a season the consumptive need is 10 cm. The effective rainfall is 3.0 cm, losses in the plot is 20% of applied water and losses during conveyance is 12.5% of the water input to the conveyance system. Match List-I (Parameter) with List-II (Value) and select the correct answer using the codes given below the lists:

List-I

A. Net irrigation requirement
B. Field irrigation requirement
C. Gross irrigation requirement

List-II
1. 5.00 cm
2. 7.00 cm
3. 8.75 cm
4. 10.00 cm
5. 12.5 cm

Codes:

	A	B	C
(a)	2	4	5
(b)	1	3	4
(c)	2	3	5
(d)	2	3	4

Q.18 For a culturable command area of 1000 hectare with intensity of irrigation 50%, the duty on field for a certain crop is 2000 hectare/cumec. What is the discharge required at head of water course with 25% losses?
(a) 3/16 cumec (b) 1/4 cumec
(c) 1/3 cumec (d) 1/2 cumec

Q.19 Which of the following statements are correct?
1. Mixed cropping involves sowing a different crop after a particular crop has been grown.
2. Crop rotation enhances the productivity of soil.
3. Mixed cropping is not desirable as field preparation cannot be done to meet requirements of different crops simultaneously.
4. Wheat-Jawar-Gram is a crop rotation scheme generally adopted.

(a) 1, 2 and 3 (b) 2, 3 and 4
(c) 1, 2 and 4 (d) 1, 2, 3 and 4

Q.20 Which of the statement given below is/are correct?
1. Rabi crops needs relatively cool climate during growth period.
2. Rabi crops are harvested at the end of Southwest monsoon.

(a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) None of these

Q.21 Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I
A. Lysimeter
B. Phytometer
C. Blaney criddle equation
D. Penman's equation

List-II
1. Percentage day time hours
2. Transpiration
3. Albedo value
4. Evapotranspiration

Codes:

	A	B	C	D
(a)	2	4	3	1
(b)	4	2	3	1
(c)	2	4	1	3
(d)	4	2	1	3

Q.22 A water course has a culturable command area of 2500 hectares, out of which intensity of irrigation for perennial sugarcane and rice crops are 20% and 40% respectively. The duty for these crops at the head of water course is 1000 hectare/cumecs and 2500 hectare/cumecs respectively. The discharge required at the head of water course is
(a) 0.4 cumecs (b) 0.5 cumecs
(c) 0.9 cumecs (d) 1.2 cumecs

Q.23 An irrigation channel has to irrigate a 100 sq. km area with the following pattern:
Intensity of irrigation for Rabi and Kharif crops are 30% and 15% respectively. The duty at canal head for Rabi and Kharif crops are 1790 ha/cumec and 955 ha/cumec respectively. The required channel capacity is
(a) 1.5 cumecs
(b) 1.6 cumecs
(c) 1.7 cumecs
(d) 3.3 cumecs

Q.24 Match List-I (Season) with List-II (Crop) and select the correct answer using the codes given below the lists:

List-I
A. Rabi
B. Kharif
C. Zaid
D. Perennial

List-II
1. Rice
2. Sugarcane
3. Gram
4. Vegetables

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	3	2	4	1
(c)	3	1	4	2
(d)	1	3	2	4

Q.25 Tho factors affecting consumptive use of water are
1. Climate condition
2. Mean monthly temperature
3. Irrigation technique
4. Wind velocity

(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 1, 3 and 4 (d) 1, 2, 3 and 4

Q.26 The duty (ha/cumecs) and Δ(in cm) of rice are respectively:
(a) 775 and 30 (b) 775 and 120
(c) 1600 and 120 (d) 1600 and 30

Q.27 Which of the following statement/s is/are true?
1. The duty of rice and wheat are 775 ha/cumecs and 1600 ha/cumecs respectively.
2. Wheat requires more amount of total irrigation water.

(a) Only 1 (b) 1 and 2
(c) Only 2 (d) None of these

Q.28 The optimum depth of kor watering for rice is about
(a) 25 cm (b) 19 cm
(c) 13.5 cm (d) 9 cm

Q.29 The crop among the following, which is expected to have the maximum duty, is
(a) Wheat (b) Rice
(c) Sugarcane (d) Cotton

Q.30 Assertion (A): At the head of main canal, duty of irrigation water is maximum.
Reason (R): As irrigation water flows through canal, loss of water occurs.
(a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Q.31 Assertion (A): Potential evapotranspiration is the hypothetical rate of use of moisture.
Reason (R): PET is amount of evaporation when an unlimited amount of water is available
(a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Q.32 Assertion (A): Smoother surface has low Albedo value.
Reason (R): Albedo represents the part of solar radiation reflected back to atmosphere.
(a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

■■■■

Answers — Water Requirements of Crops

1. (b)	2. (c)	3. (c)	4. (d)	5. (c)	6. (b)	7. (b)	8. (b)	9. (b)	10. (d)
11. (b)	12. (d)	13. (a)	14. (b)	15. (b)	16. (d)	17. (d)	18. (c)	19. (b)	20. (a)
21. (d)	22. (c)	23. (c)	24. (c)	25. (d)	26. (b)	27. (a)	28. (b)	29. (a)	30. (d)
31. (a)	32. (d)								

Explanations: Water Requirements of Crops

2. (c)
Net irrigation requirement is the amount of water required in order to meet the evapotranspiration need of crop as well as other needs such as percolation, leaching etc.

3. (c)
Capacity factor is the ratio of mean supply discharge to the full supply discharge.

5. (c)
Duty of water, varies from one place to another, and increases as one moves downstream from the head of the main canal towards the head of the branches or water courses. The duty at the head of water course is called the outlet discharge factor.

7. (b)

$$D = 1428 \text{ ha/cumec}$$
$$B = 120 \text{ day}$$
$$\Delta = \frac{8.64\,B}{D}$$
$$= \frac{8.64 \times 120}{1428}$$
$$= 0.73 \text{ m}$$

8. (b)
Water supplied to field during 8 hours @ 100 l/s

$$= 100 \times 8 \times \frac{3600}{1000} = 2880 \text{ m}^3$$

Runoff loss in the field = 800 m^3
Water stored in the zone

$$= 2880 - 800 = 2080 \text{ m}^3$$
$$\eta_a = \frac{2080}{2880} \times 100 = 72.2\%$$

9. (b)

$$Q = 1200 \times 10^{-4} \times \frac{134}{100} \times 140$$
$$= A \times 120 \times \frac{52}{100}$$

$$\text{Area} = 3607.7 \text{ ha} \simeq 3608 \text{ ha}$$

10. (d)

$$\text{Design capacity} = (0.36 + 0.27)/0.9$$
$$= 0.70 \text{ cumecs}$$

11. (b)
Peak Demand Discharge
= Area × (% Irrigation) × Depth/Time (in second)
$= 2 \times 10^8 \times (0.4 \times 0.14) / (4 \times 7 \times 24 \times 3600)$
$= 4.63 \text{ m}^3/\text{s}$

14. (b)

$$C_u = k\Sigma f$$
$$= k\Sigma \frac{p}{40}(1.8t + 32)$$
$$= 0.5\left[\frac{8}{40}(1.8 \times 20 + 32) + \frac{8}{40}(1.8 \times 20 + 32)\right]$$
$$= 13.6 \text{ cm}$$

15. (b)

$$\text{Crop ratio} = \frac{50{,}000 \times 0.8 \times 0.6}{50{,}000 \times 0.8 \times 0.2} = 3$$

17. (d)

$$\text{NIR} = C_u - R_0 = 10 - 3 = 7 \text{ cm}$$
$$\text{FIR} = \frac{\text{NIR}}{0.8} = \frac{7}{0.8} = 8.75 \text{ cm}$$
$$\text{GIR} = \frac{\text{FIR}}{0.875} = \frac{8.75}{0.875} = 10 \text{ cm}$$

18. (c)
The area to be irrigated = 0.5 × 1000 = 500 ha
The discharge needed on field

$$= \frac{500}{2000} = 0.25 \text{ cumec}$$

For 25% loss of water at the head of water course, the discharge required at the head of water course

$$Q = \frac{0.25}{0.75} = \frac{1}{3} \text{ cumec}$$

19. (b)
Mixed cropping also known as inter-cropping or cultivation is a type of agriculture that involves planting two or more plants simultaneously in the same field.

20. (a)
Kharif crops are harvested at the end of Southwest monsoon.

22. (c)
Given, CCA = 2500 hectares
Intensity of irrigation,
(i) For sugarcane = 20%
(ii) For rice = 40%
Duty at the head of water course
(i) For sugarcane = 1000 ha/cumec
(ii) For rice = 2500 ha/hectare
Area of sugarcane

$$= \frac{20}{100} \times 2500 = 500 \text{ hectares}$$

$$\text{Area of rice} = \frac{40}{100} \times 2500 = 1000 \text{ hectares}$$

1. Discharge required at the head of water course for the crop of sugarcane,

$$Q_1 = \frac{\text{Area}}{\text{Duty}} = \frac{500}{1000} = 0.5 \text{ cumecs}$$

2. Discharge required at the head of water course for the crop of rice,

$$Q_2 = \frac{\text{Area}}{\text{Duty}} = \frac{1000}{2500} = 0.4 \text{ cumecs}$$

Since sugarcane requires water throughout the year. Hence total discharge required at head of water course would be

$$Q = Q_1 + Q_2$$
$$\therefore \quad Q = 0.5 + 0.4 = 0.9 \text{ cumecs}$$

Hence option (c) is correct.

23. (c)

Rabi crop (1)	Kharif crop (2)
Intensity of Irrigation	
$\eta_1 = 30\%$	$\eta_2 = 15\%$

Duty of canal
$D_1 = 1790$ ha/cumec
$D_2 = 955$ ha/cumec
Area of irrigated field,
$A = 100 \text{ km}^2$

$$D = \frac{\text{Effective area of irrigate irrigated field}}{\text{Canal discharge}}$$
$$D_1 = \frac{0.30 \times 100 \times 10^2 \text{ (Ha)}}{Q_1 \text{(cumecs)}}$$
$$\Rightarrow \quad Q_1 = \frac{0.30 \times 10^4}{D_1} = \frac{0.30 \times 10^4}{1790} = 1.68 \text{ m}^3/\text{s}$$
$$\text{and} \quad D_2 = \frac{0.15 \times 100 \times 10^2 \text{ (Ha)}}{Q_2 \text{ (cumecs)}}$$
$$\text{and} \quad Q_2 = \frac{0.15 \times 10^4}{D_2} = \frac{0.15 \times 10^4}{955} = 1.57 \text{ m}^3/\text{s}$$

Hence required canal capacity will be the maximum of D_1 and D_2.
∴ Canal capacity = 1.67 cumecs
So option (c) is correct because canal capacity cannot be less then 1.67 cumecs.

27. (a)
The total requirement of water for a crop is given by Δ.

Crop	D(ha/cumecs)	Δ (cm)
Sugarcane	730	120
Rice	775	120
Wheat	1800	30
Fodder	2000	22.5

30. (d)
As water moves from reservoir to field, duty at different place increases, with maximum duty at the field.