IRRIGATION

Irrigation may be defined as the process of supplying water to soil for rising crops, *or* is generally defined as the application of water to soil for supplying the moisture essential for plant growth.

TYPES OF IRRIGATION

(1) **Flow Irrigation :** In this irrigation supply of irrigation water available is at such a level that it is conveyed on to the land by the gravity flow.

(2) **Lift Irrigation :** In lift irrigation, the water is lifted up by mechanical means. e.g. : Irrigation from well in which sub soil water is lifted up to the surface and is then conveyed to the agricultural field.

CLASSIFICATION OF WATER PRESENT IN SOIL.

(1) **Hygroscopic water :** It is not capable of movement by the action of gravity or capillary forces.

(2) **Capillary water :** It is the part in excess of the hygroscopic water which exists in the pore spaces of the soil by molecular attraction.

(3) **Gravitational water :** It is that part in excess of hygroscopic and capillary water which will move out of the soil if favourable drainage is provided.

SATURATION CAPACITY (or Maximum holding capacity/Total capacity)

It is the amount of water required to fill all the pore spaces between soil particles by replacing all air held in pore spaces.

Field Capacity (F.C.) .

It is the moisture content of the soil after free drainage has removed most of the gravity water.

Permanent Wilting Point/Wilting co-efficient (PWP)

It is the water content at which plants can no longer extract sufficient water from the soil for its growth.

$$PWP \approx \frac{F.C.}{2.0 to 2.4}$$

Readily available water.

It is that portion of available moisture that is most easily extracted by plants and is approximately 75% of the available moisture.

DUTY (D)

Irrigation capacity of a unit of water, or it is the area irrigated in hectares by 1cumec of discharge flowing throughout the base period. {hect/comec.}

Delta (Δ)

It is total depth of water required by a crop during the entire period, the crop is in the field. {cm or m}

Base period (B) .

It is the time interval in days between the first watering given prior to sowing and the last watering before harvesting (Days).

Crop period .

It is the time interval between sowing and harvesting of crop (Days)

Relation between Duty and Delta.

$$\Delta = \frac{8.64\,B}{D}\ m$$

FACTOR AFFECTING DUTY.

(1) Method and system of irrigation

(2) Mode of applying water

(3) Method of cultivation

(4) Time and Frequency of tilling

(5) Type of crop

(6) Base Period of crop

(7) Climatic condition of the area : Temperature, wind, humidity, rainfall etc.

(8) Quality of water

(9) Method of assessment

(10) Canal condition : Earthen canal, Lined canal.

(11) Character of soil and Sub soil of the canal

(12) Character of soil and sub soil of the irrigation field

IMPROVING DUTY

(1) Suitable method of applying water to the crop should be used.

(2) Land should be properly ploughed and levelled before sowing the crop. It should be given good filth. (structure)

(3) Land should be cultivated frequently since frequent cultivation reduces loss of moisture, specially when the ground water is within capillary reach of ground surface.

(4) Canal should be lined. This reduces seepage, percolation losses and evaporation losses also.

(5) Parallel canal should be constructed so that F.S.L. will be lowered and thus losses will also be reduced.

(6) Idle length of canal should be reduced.

(7) Alignment of the canal either in sandy soil or in fissured rock should be avoided.

(8) Canal should be so aligned that the areas to be cultivated are concentrated along it.

(9) Source of water should be such that it gives good quality of water.

(10) Rotation of crops must be practiced.

(11) Volumetric method of assessment should be used.

(12) Farmers must be trained in the proper use of water so that they apply correct quality of water at correct timing.

(13) The land should be redistributed to the farmers so that they get only as much land as they are capable of managing it.

(14) Research stations should be established to study the soil, the seed and conservation of moisture.

(15) The canal staff should be efficient, responsible and honest.

SOME IMPORTANT TERMS

Outlet factor : It is defined as the duty at the outlet.

Kor depth : It is the depth of water applying in first watering which is given to a crop.

Kor period : Portion of the base period in which kor watering is needed is called *kor period*.

Time factor : Time factor

$$= \frac{\text{Number of days canal actually runs}}{\text{Number of days of irrigation period}}$$

Capacity factor : Capacity factor

$$= \frac{\text{Mean supply (Average discharge)}}{\text{Full supply of a canal}}$$

Cumec day : It is the quality of water flowing for one day at the rate of perpendicular cumec. (= 8.64 hectare meter)

Paleo : It is the first watering before sowing the crop.

Full supply co-efficient :

$$\text{Duty on capacity} = \frac{\text{Area estimated to be irrigated during base period}}{\text{Design full supply discharge of channel at its head during maximum demand}}$$

Nominal duty : $\text{Nominal duty} = \frac{\text{Area of which permit has been granted for the period}}{\text{Mean supply for the base period}}$

Open discharge : $\text{Open discharge} = \frac{\text{Number of cumec days}}{\text{Number of days the canal has actually been used}}$

Root-zone depth .

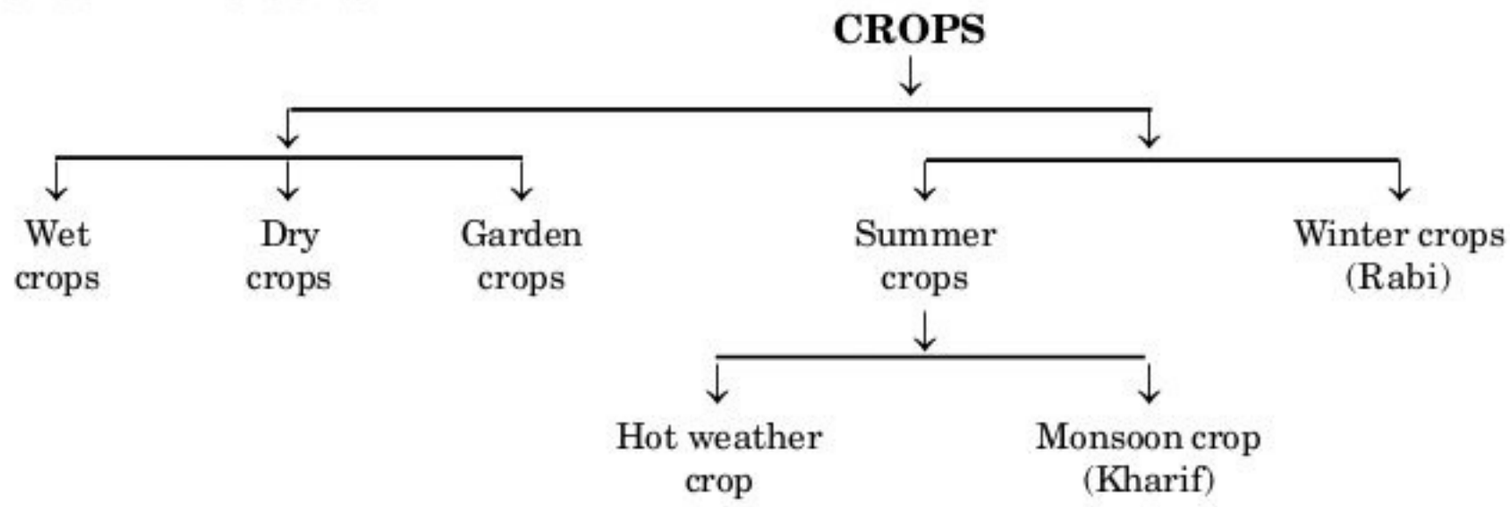
It is the maximum depth in soil strata in which the crop spreads its roots system and derives water from the soil.

CONSUMPTIVE USE OF WATER (EVAPO-TRANSPIRATION)

It is the total depth of water consumed by transpiration from crop, evaporation from soil and water surface area, including the transpiration from accompanying weed growth.

The rain water and dew intercepted by leaves of plants and subsequently evaporating without entering the plant system also from part of consumption use.

PRINCIPLE CROPS



Kharif : Sown by the beginning of south west monsoon and are harvested in autumn.

Rabi : Sown in autumn and are harvested in springs

Wet crop : Requires water for irrigation.

Dry crops : Does not require water for irrigation

Garden crops : Requires irrigation throughout the year.

Crop ratio : Crop Ratio

$$= \frac{\text{Area irrigated in Rabi Season}}{\text{Area irrigated in Kharif Season}}$$

Crop rotation : It implies that nature of crop sown in a particular field is changed year after year.

Gross Commanded Area (G.C.A.) : It is the total area lying between drainage boundaries which can be commanded or irrigated by a canal system.

Culturable Commanded Area (C.C.A.) : It is the remaining area on which crops can be grown satisfactorily

G.C.A. = C.C.A. + unculturable area.

Unculturable area : Unfertile barren land, alkaline soil, local ponds, village and other areas as habitation.

WATER LOGGING .

An agricultural land is said to be water-logged, when its productivity gets affected by the high watertable. The productivity of land may become affected when the root zone of plant gets flooded with water and thus become ill-aerated. Oxygen present in the air is not only needed by human beings, but is also needed by plants. The life of plants depend upon the nutrients like nitrates. The form in which the nitrates are consumed by the plants is produced by the bacteria, under a process called nitrification. These bacteria need oxygen for their survival. The supply of oxygen gets cut-off when the land becomes water-logged. Resulting in the death of these bacteria and fall in production of plants food (i.e. nitrates) and consequent reduction in plant growth, and hence, reducing crop yields.

CAUSES OF WATER-LOGGING.

(i) Over and intensive irrigation.

(ii) Seepage of water from the adjoining high lands.

(iii) Seepage of water through the canals.

(iv) Impervious obstruction.

(v) Inadequate natural drainage.

(vi) Inadequate surface drainage.

(vii) Excessive rains.

(viii) Submergence due to floods.

(ix) Irregular or flat topography.

Water-Logging control .

(*i*) Lining of canals and water courses.

(*ii*) Reducing the intensity of irrigation.

(*iii*) By Introducing crop-rotation.

(*iv*) Optimum use of water.

(*v*) Providing intercepting drains

(*vi*) Provision of an efficient drainage system.

(*vii*) Improving natural drainage of the area.

(*viii*) Introduction of lift irrigation.

EXERCISE - I

1. Factor which affect the evapo-transpiration are

(*a*) crop factors like type of crops and stage of its growth

(*b*) a climate factors like mean temperature, hours of bright sunshine, wind velocity, humidity etc.

(*c*) the moisture level in the soil

(*d*) all of these

2. Lands of climate that lack sufficient water for agriculture without artificial irrigation, are called

(*a*) dry zone (*b*) arid zone

(*c*) semi arid zone (*d*) hybrid arid zone

3. Water found on the surface of the soil which is not capable of movement either by gravity or capillary and can only be driven off by heat, is called

(*a*) water vapour

(*b*) moisture

(*c*) hygrosopic water

(*d*) none of these

4. The consumptive use of water of a crop is

(*a*) measured in terms of depth of water on the irrigated area

(*b*) measured by volume of water per unit area

(*c*) partly supplied by precipitaion

(*d*) all of these

5. The effective precipitation for a crop is the water which is equal to the

(*a*) water stored in the soil within the root zone of the crop

(*b*) total precipitation during the crop period

(*c*) total precipitation minus the loss due to infiltration

(*d*) none of these

6. Intensity of irrigation is

(*a*) percentage of culturable commanded area proposed to be irrigated annually

(*b*) always more than 100 %

(*c*) the percentage that could be ideally irrigated

(*d*) all of these

7. On rolling land, the method of applying water is

(*a*) check flooding (*b*) free flooding

(*c*) border flooding (*d*) furrow flooding

8. In case of cereal crop, the irrigation is done by

(*a*) check flooding (*b*) free flooding

(*c*) border flooding (*d*) furrow flooding

9. Method of irrigation, in which land surrounded by natural or artificial banks is flooded is called

(*a*) broad irrigation (*b*) natural irrigation

(*c*) basin irrigation (*d*) none of these

10. For standing crops in undulating sandy fields, the best method of irrigation is

(*a*) free flooding (*b*) natural irrigation

(*c*) basin irrigation (*d*) none of these

11. Water logging may result from

(*a*) over irrigation

(*b*) inadequate drainage

(*c*) seepage from adjoining reservoirs etc

(*d*) all of these

12. A land is called water logged

(*a*) when the permanent wilting point is reached

(*b*) when gravity drainage has ceased

(*c*) capillary fringe reaches the root zone of plants

(*d*) all of these

13. Disadvantage of water logging of fields is

(*a*) plant diseases

(*b*) growth of water weeds

(*c*) rise of salt in the surface layer

(*d*) all of these

14. Water logging of fields can be reduced by

(*a*) providing canal lining

(*b*) providing intercepting drains

(*c*) controlling intensity of irrigation

(*d*) all of these

15. In water logged lands soil pores are

(*a*) within a depth of 1 metre

(*b*) saturated up to the root zone of the crop

(*c*) saturated up to the depth of 40 cm

(*d*) saturated up to the top

16. Ratio of the total volume of water delivered to a crop to area on which it has been spread, is called

(*a*) duty (*b*) delta

(*c*) critical depth (*d*) none of these

17. Relation between the duty D in hectares/cumec, depth of water Δ in metres and base period B in days is given by

(*a*) $\Delta = 8.64\ B/D$ (*b*) $\Delta = 8.64\ D/B$

(*c*) $\Delta = 8.64\ B$ (*d*) none of these

18. The duty is largest

(*a*) at the head of main canal

(*b*) at the head of water course

(*c*) on the field

(*d*) same at all places

19. The fertility of soil is adversely affected, when the pH value is more than

(*a*) 7 (*b*) 9

(*c*) 11 (*d*) 14

20. The average delta of rice crop is nearly

(*a*) 30 cm (*b*) 60 cm

(*c*) 120 cm (*d*) 150 cm

21. In rice crop, the depth of root zone is generally

(*a*) 30 cm (*b*) 60 cm

(*c*) 90 cm (*d*) 120 cm

22. A crop that takes more than 4 months to mature is called

(*a*) solid crop (*b*) long crop

(*c*) hard crop (*d*) cash crop

23. Optimum depth of kor watering for rice crop is

(*a*) 13.5 cm (*b*) 16.5 cm

(*c*) 19 cm (*d*) 21 cm

24. Crop ratio is the ratio of area irrigated

(*a*) in rabi season to kharif season

(*b*) in kharif season to rabi season

(*c*) under perennial crop to total crop

(*d*) under perennial crop to non-perennial crop

25. The operation, which washes out salts from the upper zone of the soil is called

(*a*) washing

(*b*) leaching

(*c*) separation

(*d*) none of these

26. Water requirement in terms of delta is maximum for

(*a*) Rice (*b*) Tobacco

(*c*) Patatoes (*d*) Sugarcane

27. Maximum irrigation requirement of rice crop is exhibited by its

(*a*) maximum delta value

(*b*) maximum duty value

(*c*) minimum duty value

(*d*) none of these

28. As compared to gravity dam, earthen dams

(*a*) require sound rock foundation

(*b*) require less skilled labour

(*c*) require skilled labour

(*d*) require more cost

29. Water that moves through soil under the force of gravity is called

(*a*) infiltrated water (*b*) percolated water

(*c*) gravity water (*d*) capillary water

30. The soil moisture useful for the plant growth is

(*a*) hygroscopic water

(*b*) chemical water

(*c*) gravity water

(*d*) capillary water

31. A condition of soil when the crop fails to extract sufficient water is called

(*a*) saturation stage

(*b*) supersaturation stage

(*c*) permanent wilting state

(*d*) ultimate utilisation stage

32. The field capacity of a soil depends upon

(*a*) capillary tension of soil

(*b*) porosity of soil

(*c*) both (*a*) and (*b*)

(*d*) none of these

33. Hygroscopicity is

(*a*) ability to absorb moisture

(*b*) ability to give off mosture

(*c*) ability to absorb and retain moisture without necesarily becoming liquid

(*d*) none of these

34. Soils formed by deposition by water borne material are

(*a*) residual soils (*b*) alluvial soils

(*c*) colluvial soils (*d*) eolian soils

35. Depth of the root zone of rice is

(*a*) 60 cm (*b*) 70 cm

(*c*) 80 cm (*d*) 90 cm

36. Which of the following is considered as heavy crop ?

(*a*) Sugar cane (*b*) Tobacco

(*c*) Hemp (*d*) Cotton

37. Which of the following is not considered as light crop ?

(*a*) Maize (*b*) Potatoes

(*c*) Rice (*d*) Mecca

38. The process of washing out of the salts from the upper zone of the soil by flooding, is called

(*a*) separation (*b*) leaching

(*c*) desaltation (*d*) saturation

39. Available mositure is equal to

(*a*) saturation capacity

(*b*) field capacity

(*c*) permanent wilting coefficient

(*d*) difference between the field capacity and the permanent wilting coefficient

40. The flow of water through the particles of soil (porous .substance) due to the force of gravity or pressure of head, is called.

(*a*) seepage (*b*) creeping

(*c*) percolation (*d*) penetration

41. Consumptive use of water for a crop is the depth of water

(*a*) evaporated from the plant

(*b*) transpired from the plant

(*c*) evaporated and transpired by the plant

(*d*) consumed by evaporation, and transpiration from plant and that evaporated from the adjacent soil.

42. Which of the following is" not a Rabi crop?

(*a*) Ground nut (*b*) Wheat

(c) Barley (*d*) Potato

43. Basin irrigation is a method of irrigation in which

(*a*) land surrounded by natural or artificial banks is flooded and when the water dries up crops are sown

(*b*) sewage effluents are used to irrigate the land

(*c*) water is lifted from lower height to higher by means of pumps

(*d*) entirely depends on rain water

44. Command area is

(*a*) Mea under control

(*b*) area under cultivation

(*c*) total area under the canal system

(*d*) total area less drains, ravines, etc.

45. A channel which is designed to irrigate all the year round is called

(*a*) all weather channel (*b*) green channel

(*c*) perennial channel (*d*) permanent channel

46. A canal constructed by the side of and generally parallel to the parent channel, with different bed slopes, is called

(*a*) balance canal

(*b*) side canal

(*c*) ditch canal

(*d*) balance canal

47. Best location for the canal headworks is

(*a*) trough of river

(*b*) delta of river

(*c*) turning of river

(*d*) rock of the river

48. Depth of water table which may adversely affect the growth of wheat is

(*a*) 5 to 6 metres

(*b*) 4 to 5 metres

(*c*) 0.9 to 0.2 metres

(*d*) 0.1 to 0.2 metres

49. A feeder canal

(*a*) carries water for irrigation purposes only

(*b*) carries water for irrigation as well as navigation

(*c*) feeds two or more canals

(*d*) is exclusively used for power production

50. Which of the following canal does not classified on the basis of functions?

(*a*) feeder canal (*b*) power canal

(*c*) navigation canal (*d*) none of these

51. Which of the following canal does not classified on the basis of canal alignment?

(*a*) contour canal

(*b*) water shed canal

(*c*) side slope canal

(*d*) water couise

52. Weed growth in a canal

(*a*) reduces silting

(*b*) increases contamination of water

(*c*) increases velocity of flow

(*d*) reduces disharge through canal is

53. Weed growth in the canal

(*a*) is a health hazard

(*b*) reduces the discharging capacity of the canal

(*c*) purifies water

(*d*) reduces pH value of water.

EXERCISE - II

(Questions From Previous SSC CPWD Exams)

2010

1. The detention period for oxidation ponds is usually kept as:

(*a*) 4-8 hours (*b*) 24 hours

(*c*) 10 to 15 days (*d*) 3 months

2011

2. The discharge capacity required at the outlet to irrigate 2600 ha of sugarcane having a kor depth of 17 cm and a kor period of 30 days is

(*a*) 2.3 m^3/s (*b*) 1.71 m^3/s

(*c*) 14.7 m^3/s (*d*) 0.18 m^3/s

3. Lining of irrigation canals

(*a*) decreases the waterlogging area

(*b*) increases the waterlogging area

(*c*) does not change the waterlogging area

(*d*) increases evaporation

2012

4. The best alignment for a canal is when it is aligned along

(*a*) Valley line

(*b*) Stream line

(*c*) Contour line

(*d*) Ridge line

2014

5. For lined canals, the freeboard is measured from the :

(*a*) full supply level to the top of the lining

(*b*) full supply level to the top of the bank

(*c*) top of the bank to the top of the lining

(*d*) full supply level to the top of the dowel

6. Irrigation efficiency of an irrigation system is the ratio of

(*a*) Water reaching the farm to water delivered from the source

(*b*) Crop yield to total amount of water used in a field

(*c*) Water actually stored in root zone to water delivered to the farm

(*d*) Water actually utilised by growing crops to water delivered from the source

2015

7. The most desirable alignment of an irrigation canal is along

(*a*) the contour line

(*b*) the ridge line

(*c*) normal to contour line

(*d*) the valley line

ANSWERS

EXERCISE - I

1. (*d*)	**2.** (*b*)	**3.** (*c*)	**4.** (*d*)	**5.** (*a*)	**6.** (*a*)	**7.** (*b*)	**8.** (*a*)	**9.** (*c*)	**10.** (*c*)
11. (*d*)	**12.** (*c*)	**13.** (*d*)	**14.** (*d*)	**15.** (*b*)	**16.** (*b*)	**17.** (*a*)	**18.** (*c*)	**19.** (*c*)	**20.** (*c*)
21. (*c*)	**22.** (*b*)	**23.** (*c*)	**24.** (*a*)	**25S.** (*b*)	**26.** (*a*)	**27.** (*a*)	**28.** (*b*)	**29.** (*c*)	**30.** (*a*)
31. (*d*)	**32.** (*a*)	**33.** (*a*)	**34.** (*c*)	**35.** (*d*)	**36.** (*c*)	**37.** (*d*)	**38.** (*d*)	**39.** (*d*)	**40.** (*c*)
41. (*d*)	**42.** (*a*)	**43.** (*a*)	**44.** (*c*)	**45.** (*c*)	**46.** (*c*)	**47.** (*a*)	**48.** (*c*)	**49.** (*c*)	**50.** (*b*)
51. (*d*)	**52.** (*d*)	**53.** (*b*)							

EXERCISE - II

1. (*c*)	**2.** (*b*)	**3.** (*a*)	**4.** (*d*)	**5.** (*a*)	**6.** (*d*)	**7.** (*b*)

EXPLANATIONS

EXERCISE - II

2. Fineness Modulus of an aggregate is an index number which is roughly proportional to average size of the particles in the aggregate. The coarser the aggregates the higher the fineness modules.

3. Flank index = 0.6 mean dimension.

4. Because black soil has high plasticity index.

5. Francis Turbine is a inward reaction turbine.

6. As per IS : 456

$\Rightarrow 0.8 f_y$ or $\frac{f_y}{1.15} \Rightarrow$ for steel

7. Ridge line is cut to collect water in that area.

■■