ZONE TECH

Best Institute For Assistant & Junior Engineer

Civil Engineering

Test - 3

RSSB (JE) Diploma Test Series - 2024

Answer key & Detailed Solution

Test ID : 903 Date:- 06/10/2024

Duration : 80 Minutes Maximum Marks : 80

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

The time period that elapses from the instant of its sowing to the instant of its harvesting is called the crop period.

The time between the first watering of a crop just before the sowing to its last watering just before harvesting is called the base period or the base of the crop.

The kor period is the time period when the first watering of a crop, called kor watering, takes place.

Kor watering is done when the crop has grown to a height of about few centimeters. The depth of water applied during kor watering is known as the kor depth.

32. (b)

The classification of irrigation water based on salt concentration is as follows:

Electical conductivity at 25°C in micromhos per centimeter	Class	Uses
<250	Low salinity water	Can be used for all crops
250-750	Medium salinity water	Can be used if leaching is done
750-2250	High salinity water	High salt-tolerant plant can be grown with special measures to control salinity
>2250	Very high salinity water	Not suitable for irrigation

33. (d)

(i) Sodium concentration is measured in terms of sodium absorption ratio (SAR).

$$SAR = \frac{[Na^+]}{\sqrt{\frac{[Ca^{++}]+[Mg^{++}]}{2}}}$$

All the concentration in terms of milli-equivalent per liter and it also expressed as epm (equivalant per million)

SAR	Water classified
0-10	Low sodium water
10-18	Medium sodium water
18-26	High sodium water
>26	Very high sodium water

(ii) The SAR can be reduced by adding gypsum either to the soil or to the water.

34. (a)

Readily available moisture-

It is that portion of the available moisture which is most easily extracted by the plants, and is approximately 75 to 80% of the available moisture.

Field Capacity-

Immediately after a rain or irrigation water application, when all the gravity water has drained down to water table, a certain amount of water is retained on the surfaces of soil grains by molecular attraction and by loose chemical bonds. This water cannot be easily drained under gravity and this is called field capacity

Permanent wilting point-

It is that water content at which plant can no longer extract sufficient water for its growth, and wilts up.

35. (b)

Orographic- Due to rise of air found by mountain barrier

Cyclonic- Due to convergence of hot and cold air mass

Rainfall in India mainly occurs in the months of July, August and September.

The Indian rains are chiefly orographic in nature. As a result, the regions situated on the windward side receive greater rainfall than the regions located on the leeward side.

A less amount of rainfall is received from cyclones and convectional rainfall.

36. (d)

Based upon the rainfall records available all over the world, a list of world's greatest recorded rainfalls of various duration can be assembled.

When this data is plotted upon a log-log paper, an enveloping straight line drawn to the plotted points obeys the equation

$$Pm = 42.16\ D^{0.475}$$

where, Pm = extreme rainfall depth in cm and D = duration in hours. The values obtained from this equation are of use in probable maximum precipitation (PMP) estimations.

37. (b)

Transpiration → Phytometer

Evaporation → Atmometer

Hydraulic conductivity → Permeameter

Infiltration capacity → Infiltrometer

Humidity → Hygrometer

Relative Humidity → Pschyrometer

Wind speed → Anemometer

Evapotranspiration → Lysimeter

Tensiometer → Capillary potential

38. (a)

Cetyl alcohol is found to be the most suitable chemical for use as an evaporation inhibitor. It is crystalline solid and available in lumps, flakes or powder form. It can be applied to the water surface in the form of powder, emulsion or solution in mineral turpentine.

39. (a)

The departure of AI from its corresponding normal value is known as AI anomaly, represents moisture shortage.

Based on AI anomaly, the intensity of agricultural drought is classified as follows:

AI anomaly	Severity class
1-25	mild arid
26-50	moderate arid
>75	severe arid

40. (d)

It is defined by Robert E. Horton as the maximum rate at which rain can be absorbed by the soil in the given condition.

The relationship between rainfall intensity and infiltration capacity determines how much falling rain will flow directly over the ground surface and how much will enter the soil to be retained as net moisture storage for some period of time before being either pass downwards as percolation or returned to the atmosphere by the process of evaporation.

Horton expressed the decay of infiltration capacity with time as an exponential decay

$$f(t) = f_c + (f_0 - f_c)e^{-kt} \text{ for } 0 < t < t_c$$

where,

$f(t)$ = Infiltration capacity at any time t from the start of rainfall

f_0 = Initial infiltration capacity at t = 0

f_c = Final infiltration capacity occurring at t = t_c

k = Horton's decay constant which depends upon soil characteristic and vegetation cover

41. (b)

Rainfall intensity = Hyetograph (intensity versus time curve)

Rainfall excess = Direct runoff hydrograph

Rainfall averaging = Isohyets (it is the line of having equal rainfall depth and used to measure the average rainfall over an catchment)

Mass curve = Cumulative rainfall

42. (d)

In this type of method, it involves laying a system of the head, mains, sub-mains, laterals, and drip nozzles. From these nozzles, water oozes or trickles out at a small rate into the plant roots area. Hence the name trickle irrigation method.

43. (d)

Conjunctive use is a catch-phrase for coordinated use of surface water and groundwater— literally going with the flow to maximize sufficient yield.

44. (a)

Bisalpur project - upstream and downstream coffer dam by using an rcc diaphragm wall with post-tension anchors and it has t-shaped frame structure.

45. (a)

A carrier canal is a canal used for both direct irrigation and for feeding water to another canal. Thus, it acts as an irrigation canal as well as a feeder canal.

Upper Chenab Canal is an example of this type of canal.

46. (a)

Crop ratio can be defined as the ratio of areas under the crops of two main seasons. The Kharif area is one-half of the rabi area as this value is generally 1:2.

47. (c)

Triangular weir is shaped like a reverse triangle that is the shape of V. Hence, it is also called V-notch weir. These can be used to measure discharge over small flows with greater accuracy.

48. (c)

Structural methods of flood control involve the prevention of entry of flood into an area by building structures or modifying existing features to reduce the possibility of flood. These include flood ways, channel improvement, embankments, etc.

49. (b)

Culturable Command Area is the basis for the design of watercourse and the basis for the design of an irrigation project. The irrigation schemes in India are classified into three parts viz. Minor, Medium and Major Irrigation schemes depending upon the areas involved. Major irrigation scheme is the one where CCA involved in the project is greater than 10,000 hectares.

50. (b)

The cultivation operation becomes impossible if the free water may rise above the surface of the land in extreme cases, such land is called swampy land.

51. (c)

The normal cultivation operations such as tilling, ploughing is difficult in wet soils.

Tile drainage requires less labour and time in tilling and harvesting the soils as these do not obstruct farming. Planting in wet soils may decrease crop yields. So, therefore the delay in planting and decrease in crop yields in wet soils can be improved by using tile drainage.

52. (b)

If lining is not provided in the canal then irrigation water is lost in the form of percolation and absorption as seepage losses. This loss is very significant as it reduces the potential of the irrigation water, which is a costly commodity. So, in order to reduce seepage losses the lining of the canal is needed.

53. (b)

Strainer type tubewell is a bored hole in which a metal pipe with suitable perforations is inserted. A strainer type tubewell is suitable when water-bearing stratum is available at less depth and there is a possibility of tapping water through sides. It is generally unsuitable for fine sandy strata.

54. (d)

In the case of Symon's rain gauge, the rainfall is measured at a specific time every day to maintain uniformity. Every day at 8:30 AM(IST) the rainfall is measured and that is recorded as the value of rainfall for that day.

55. (c)

Optimum density of gauges helps in providing information about the storms.

From practical considerations of Indian conditions, IS:4987 gives the sufficient densities of the gauges.

56. (d)

Duty: hectare/cumec

Base period: Days

Delta: meter

57. (d)

Dickens formula is given by

$$Q_P = C_D A^{3/4}$$

Where, A = Catchment area in km^2

C_D = Dicken's constant

$$6 \le C_D \le 30$$

$$\therefore \quad n = \frac{3}{4} = 0.75$$

58. (a)

The Standard Project Flood (SPF) is the most severe flood that could occur in a region due to a combination of meteorological and hydrological conditions.

59. (d)

In India the Kharif season is considered to start in June and end in October.Kharif crops are usually sown at the beginning of the first rains during the advancement of south west monsoon season and are harvested at the end of monsoon season(October-November)

60. (b)

Given : Area of field, A = 2600 ha

Kor depth (Δ) 17 cm = 0.17 m

Kor period (B) = 30 days

Discharge capacity required at the outlet to irrigation

$$Q = \frac{\text{Area}}{\text{duty}}$$

$$Q = \frac{A \times \Delta}{B \times 8.64} = \frac{2600 \times 0.17}{30 \times 8.64}$$

$$Q = 1.705 \approx 1.71 \ m^3/s$$

61. (d)

- Isoneph: A line that joins points with equal cloud cover
- Isobar: A line that joins points with equal pressure
- Isobath: A line that joins points with equal depth in the sea
- Isobront: A line that joins points where thunderstorms occur at the same time
- Isochron: A line that joins points with equal travel time from a common center
- Isohalines: A line that joins points with equal salinity
- Isohelles: A line that joins points with equal sunshine.

62. (b)

Type of Pan	Average value of pan coefficient (Cp)
1. For Calss A Evaporation Pan	0.70
2. For standard ISI Pan	0.80
3. Colorado sunken Pan	0.80
4. US geological survey Pan	0.80

Note:
The actual/Lake evaporation = Cp × Pan evaporation

63. (a)
Sprinkler irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground.

64. (c)
Specific Capacity: Specific Capacity of a well is defined as the rate of flow through the well per unit drawdown.
Specific storage: It is the amount of water that a portion of an aquifer releases from storage per unit mass or volume of the aquifer per unit change in hydraulic head while remaining fully saturated.
Specific yield: It is defined as the volume of water released from storage by an unconfined aquifer per unit surface area of the aquifer per unit decline of the water table.

65. (c)
For decrease in storage, the total inflow must be lesser than the total outflow.
Since, the sign convention for change in storage is given as plus for increase and minus for decrease.
The correct representation will be (I – O = -S) or (I + S = O).

66. (d)
The rate of evaporation can be estimated using empirical formulae like Fitzgerald's Meyer's, Rohwer's and Lake Mead's equations.

67. (b)
Root zone depth is the depth within the soil profile that commodity crop effectively extract water and nutrients for growth

Item	Crop Name	Root Zone depth d (cm)
1	Cabbage	50
2	Rice, Potato, Small vegetables	60
3	Green Beans	70
4	Groundnut Rabi, Pasture Sweet peppers, Tobacco	80
5	Artichoke, Dry Beans, Banana	90

68. (d)
Siltation or the deposit of silt in waterways can be caused by soil erosion from water and land activity.

69. (b)
In Lacey's regime channel

$$f = 1.76\sqrt{dmm}$$

$$S = f^{5/3} / 3340 Q^{1/6}$$

f = silt factor, Q = discharge, d = silt size

Hence

The bed slope is a function of the full supply discharge and the silt size.

70. (b)
Lacey's scour depth is given by:

$$R = 1.35\left(\frac{q^2}{f}\right)^{\frac{1}{3}}$$

Where,

q = Discharge per meter width

f = silt factor

Calculations:

Given, q = 3 cumec per meter width, f = 1.2

$$R = 1.35\left(\frac{3^2}{1.2}\right)^{\frac{1}{3}} = 2.64\,m$$

71. (a)

Divide wall:

- A divide wall is a long masonry or concrete wall or groyne (an embankment protected on all sides by stone or concrete blocks) which is constructed at right angles to the axis of the weir to separate the under sluices from the rest of the weir.

The main functions of a divide wall:

- It separates the turbulent floodwaters from the pocket in front of the canal head.
- It helps in checking parallel flow (to the axis of the barrage) which would be caused by the formation of deep channels leading from the river to the pocket in front of the sluices.

72. (d)

As per Kennedy's theory, critical velocity (V_c) in a channel is the mean velocity that is sufficient to prevent the channel from scouring and silting. Any velocity greater than critical velocity causes scouring in the channel and any velocity less than critical velocity causes silting in the channel.

$V_c = 0.55\ m\ D^{0.64}$

Where m is the Critical Velocity ratio and D is the depth of flow

Further, the Critical Velocity ratio (CVR) is the ratio of actual velocity (V_a) to critical velocity (V_c) in the channel.

Now If,

CVR > 1 i.e. $V_a > V_c$ Scouring will occur.

CVR < 1 i.e. $V_a < V_c$ Silting will occur

CVR = 1 i.e. $V_a = V_c$ There will be no silting and scouring.

73. (d)

Causes of Waterlogging

- Excessive irrigation and poor drainage system by farmers.
- Natural causes such as prolonged rainfall or flood.
- Interflows and seepage from nearby water bodies like lakes, shallow aquifers, etc.
- Soil type like clay holds water due to low permeability.
- An impervious stratum below the topsoil, obstructs the infiltration of rainfall, causing a false water table or perched water table.

Effects of Waterlogging

1. Poor aeration.
2. Alters pH.
3. Changes in soil temperature.
4. Retard cultivation.
5. Affects soil nutrients.
6. Affects human health due to mosquito breeding and disease vectors.

74. (c)

A level crossing is used when the canal water and drain water are allowed to mix and when high flood drainage discharge is short-lived.

Other types of cross drainage works include:

- Aqueduct: A type of cross drainage work that carries the canal over a natural drain or river
- Super passage: A type of cross drainage work that carries the natural drain over the canal

75. (b)

Vegetation cover plays very important role on protecting the soil surface from raindrop splashing, increasing soil organic matter, soil aggregate stability, water holding capacity, hydraulic conductivity, retarding and reducing surface water runoff etc.

76. (d)

The rate of infiltration at which the volume of runoff equals the volume of rainfall. The ϕ_{index} includes the initial loss in its calculation.

77. (c)

Independent equations that form the lacey's regime theory

(i) $v = \left(\frac{Qf^2}{140}\right)^{1/6}\ m/sec$

(ii) $R = \frac{5v^2}{2f}$ or $P = 4.75\sqrt{Q}$

(iii) $S = \frac{f^{5/3}}{3340Q^{1/6}}$

78. **(d)**

Garret's diagram

- It is graphical representation on design of canal dimensions based on Kennedy theory.
- Garret's diagram is applicable only for side slope of the channel of 0.5 : 1
- The diagrams are specified for manning's coefficient (N) of 0.0225.

  However these charts can be extended to any value of N using a nomogram at the top of each diagram.

79. **(d)**

(i) Bank Storage:

When the reservoir is filled, a certain amount of water seeps into the permeable reservoir bank. This water comes out when the reservoir gets depleted. This volume of water is known as bank storage.

(ii) Useful storage:

The volume of water stored in the reservoir between normal and minimum pool level is called useful storage.

(iii) Surcharge Storage:

The volume of water stored between the maximum pool level and normal pool level is called surcharge storage.

(iv) Valley Storage:

Before the construction of the dam, a variable amount of water is stored in the stream channel is called valley storage. After construction of the dam, storage increases and there is a net increase in the storage is equal to the storage capacity of a reservoir minus natural valley storage.

80. **(c)**

Actual evapotranspiration (AET):

The evapotranspiration actually occurring in a specific situation.

Potential evapotranspiration (PET):

It is defined as the evapotranspiration from a large vegetation covered land surface with adequate moisture availability at all times.