BYJU'S EXAM PREP

AE/JE Foundation

Civil Engineering

Irrigation Engineering + Hydrology

Top 100 Most Expected Questions

1. Method of applying water directly to the root zone of the plant is called

A. Check flooding
B. Furrow irrigation
C. Drip irrigation
D. Sprinkler irrigation

Ans. C

Sol. Drip irrigation is the latest method of irrigation. In this method water and fertilizer is supplied slowly and directly to the rootzone of the plants in order to minimize the losses due to evaporation and percolation.

Note:

Different methods of irrigation

* free flooding
* Border flooding
* Check flooding
* Basin flooding
* Furrow method
* Sprinkler method

2. Soil becomes, practically infertile if its pH value is

A. 1
B. 4
C. 11
D. 14

Ans. C

Sol. Soil becomes, practically infertile if its pH value is 11

3. Check flooding method of irrigation can be used for

A. Less permeable soils.
B. More permeable soils.
C. Both more permeable and less permeable soils.
D. Rolling lands only.

Ans. C

Sol. Check flooding is suitable for both more permeable and less permeable soils. Deep homogenous loam or clay soils with medium infiltration rates are more preferred for this method.

4. A sprinkler irrigation system is suitable when

A. the land gradient is steep and the soil is easily erodible
B. the soil is having low permeability
C. the water table is low
D. the crops to be grown have deep roots

Ans. A

Sol. On steep gradients frequent flow irrigation can not be provided, here sprinkler irrigation best suited.

5. The intensity of irrigation means

A. percentage of culturable command area to be irrigated annually
B. percentage of gross command area to be irrigated annually

C. percentage of the mean of culturable command area and the gross commanded area to be irrigated annually

D. total depth of water supplied by the number of waterings

Ans. A

Sol. Intensity of irrigation is defined as the percentage of the irrigation proposed to be irrigated annually. Usually the areas irrigated during each crop season (Rabi, Kharif, etc) is expressed as a percentage of the CCA which represents the intensity of irrigation for the crop season.

6. The method of irrigation adopted at places where there exists acute scarcity of irrigation water is:

A. Sprinkler irrigation method
B. furrow irrigation method
C. drip irrigation method
D. basin flooding

Ans. C

Sol. In drip irrigation method water is slowly and directly applied to the root zone of plants thereby minimizing the losses by evaporation and percolation.

7. The method of growing crops on rides, running on the sides of water ditches, is known as

A. Flood irrigation
B. Furrow irrigation
C. Check irrigation
D. None of them

Ans. B

Sol. Flood irrigation is the method in which soil is submerged and thoroughly flooded with water, so as to cause through saturation of the land.

Furrow irrigation is a type of surface irrigation in which trenches or "furrows" are dug between crop rows in a field.

8. In an irrigation project, in a certain year, 60% and 46% of the cultivable command area in Kharif and Rabi respectively, remained without water and rest of the area got irrigation water. The intensity of irrigation in that year for the project was

A. 126%
B. 80%
C. 124%
D. 94%

Ans. D

Sol. Intensity of irrigation = Area under Rabi crop + Area under Kharif crop

$= (100 - 60) + (100 - 46)$

$= 40 + 54 = 94\%$

9. An agricultural land of 437 ha is to irrigate for a particular crop. The base period of the crop is 90 days and the total depth of water required by crop is 105 cm, if a rainfall of 15 cm occurs during the base period, the duty of irrigation water is

A. 437 ha/cumec
B. 487 ha/cumec
C. 741 ha/cumec
D. 864 ha/cumec

Ans. D

Sol. Duty is given as

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

$$D = \frac{8.64 \times 90}{(0.9)} = 864\,\text{ha / cumec}$$

$$\Delta = 105 - 15 = 90\,\text{cm} = 0.9\,\text{m}$$

10. A crop requires a total water depth of 90 cm for a base period of 120 days. The discharge required to irrigate the crop in 2880 hectares is

A. 0.25 m^3/s
B. 1.0 m^3/s
C. 2.5 m^3/s
D. 10.0 m^3/s

Ans. C

Sol. Δ = 90 cm = 0.9 m

B = 120 days

$$\text{Duty} = \frac{8.64B}{\Delta} = \frac{8.64 \times 120}{0.9}$$

= 1152 hac/cumec

For 2880 hac,

Qrequired

$$= \frac{2280}{1152} = 2.5\text{cumec}$$

11. Gram crop has a kor period of 18 days and kor depth of 12 cm. The duty of the gram is

A. 520 ha/cumec
B. 790 ha/cumec
C. 960 ha/cumec
D. 1296 ha/cumec

Ans. D

Sol. $$D = \frac{8.64B}{D} = \frac{8.64 \times 18}{0.12}$$

$$= 1296\,\text{ha / cumec}$$

12. When an oven dried sample of soil is kept open in the atmosphere, it absorbs some amount of water. This water is known as

A. Capillary water
B. Gravity water
C. Hygroscopic water
D. Available water

Ans. C

Sol. When an oven dried sample of soil is kept open in the atmosphere, it absorbs some amount of water. This water is known as hygroscopic water. Hygroscopic water cannot be extracted or absorbed by the root plants. So, at this stage, growth of plants is stopped and ultimately the plants are dead.

13. The moisture content of the soil, after free drainage has removed most of the gravity water is known as

A. Permanent wilting point
B. Available moisture
C. Field capacity
D. Saturation capacity

Ans. C

Sol. The moisture content of the soil, after free drainage has removed most of the gravity water is known as Field capacity. Field capacity of soil depends upon capillary tension in soil and porosity of soil.

14. The duty of a crop is 216 hectares per cumecs, when the base period of crop is 50 days. Find the delta for the crop

A. 1m
B. 2m
C. 4m
D. 2.16 m

Ans. B

Sol. Delta for the crop in meter, Δ = 8.64B/D

B= Base period in days

D= Duty of water in hectares per cumecs

$\therefore \Delta = \frac{8.64 \ X \ 50}{216} = 2\text{m}$

15. The irrigation water gas following characteristics: Concentration of Na, Ca, Mg are 25, 6, 2 m-eq/lit respectively. The SAR value is

A. 7.5
B. 10.5
C. 12.5
D. 25

Ans. C

Sol. $\text{SAR} = \frac{Na}{\sqrt{\frac{Ca+Mg}{2}}} = \frac{25}{\sqrt{\frac{6+2}{2}}} = 12.5$

16. What is water use efficiency ?

A. $\frac{\text{consumptive use}}{\text{water given to field}} \times 100$

B. $\frac{\text{consumptive use}}{\text{water stored in field}} \times 100$

C. $\frac{\text{consumptive use}}{\text{water released from reservoir}} \times 100$

D. None of the above

Ans. A

Sol. water use efficiency= $\frac{\text{consumptive use}}{\text{water given to field}} \times 100$

17. A Clayey soil has field capacity = 25% and PWP = 20%. If the dry weight of soil is 15kN/m^3. The available moisture capacity in 100 cm depth of soil, constituting the root zone depth of crop is. (Take g = 10 m/s^2).

A. 0.075cm
B. 0.75cm
C. 7.5cm
D. 75cm

Ans. C

Sol. $D = \frac{\gamma_d}{\gamma_w}(FC - PWP)d$

$D = \frac{15}{10} \times (0.25 - 0.20) \times 100$

D = 7.5 cm

18. If the consumptive water requirement at a field is found out to be 1.5 m^3/s then find out the discharge required at the inlet of the canal to just fulfil this demand. Water conveyance efficiency = 0.9, Water application efficiency = 0.8, Water use efficiency = 0.75.

A. 2.5 m^3/s B. 2.08 m^3/s

C. 2 m^3/s D. 2.22 m^3/s

Ans. D

Sol. $\text{Water use eff} = \dfrac{\text{Consumptive water reqd}}{\text{Water reqd in feild}}$

$\text{Water reqd in feild} = \dfrac{1.5}{0.75} = 2$

$\text{Water conveyance eff} = \dfrac{\text{Water reqd in feild}}{\text{Water supplied from inlet}}$

$\text{Water supplied from inlet} = \dfrac{2}{0.9} = 2.22$

19. Irrigation water through a canal is supplied to a field having Na^+, Ca^{2+} and Mg^{2+} concentration as 450 mg/l , 70 mg/l and 18 mg/l respectively. What is the SAR value of the irrigation water?

A. 12.37 B. 10.23

C. 7.82 D. 12.07

Ans. A

Sol. Sodium-absorption ratio, SAR = Na^+ / √ ((Ca^{2+} + Mg^{2+}) /2)

Milli-equivalents of Na^+ per litre = concentration of Na^+ in (mg/l) / equivalent weight of Na^+

= 450/23 = 19.56

Similarly, milli-equivalent weight of Ca^{2+} = 70/20 = 3.5

& milli-equivalent of Mg^{2+} = 18/12 = 1.5

SAR = 19.56 / √ ((3.5 + 1.5) /2)

= 12.37

20. In case of siphon aqueduct, the High flood level of the drain is

A. Above the canal bed B. Below the bottom of channel

C. In level with the canal bed D. None of the above

Ans. A

Sol. When the high flood level of drainage is higher bed level of the canal, then it is called siphon aqueduct.

Note:

When the bed level of canal is higher than the highest flood level of the drainage, then it is called aqueduct.

21. Which of the following is not a cause of water logging?

A. Impervious obstruction B. Inadequate surface drainage

C. Inadequate natural drainage D. Optimum use of water

Ans. D

Sol. Water logging can be controlled by optimum use of water.

22. Which one is the best method of reclamation of the alkaline soil?

A. Addition of gypsum to soil.

B. Addition of gypsum to soil and leaching.

C. Leaching.

D. Providing good drainage system.

Ans. B

Sol. Alkali soils are best reclaimed by this chemical method:

By cationic exchange (replacement of alkali from soil colloids by calcium ions).

Application of calcium sulphate (gypsum) in the soil reduces alkalinity to a great extent and makes the soil fertile.

The reaction proceeds in the way,

2Na-clay + $CaSO_4 \rightarrow Na_2SO_4$ + Calcium-clay

$Na_2CO_3 + CaSO_4 = CaCO_3, + Na_2SO_4$.

Good drainage leaches away Na_2SO_4.

23. A launching apron is to be designed at downstream weir for discharge intensity of 8 cumec/meter. For the design of launching aprons the scour depth is taken two times of lacey scour depth. The silt factor of bed material is unity. If the tail water depth is 4.8 m, the length of launching apron in the launched position is

A. 12 m

B. 6 m

C. 3 m

D. 1.5 m

Ans. B

Sol. Silt factor, f = 1

Discharge, Q = 8 m^3/s

Tail water depth, y = 4.8 m

Pond level = d

Maximum scour depth = 2 x Lacey's Scour depth

Lacey's Scour depth, $R = 1.35\left(\frac{Q^2}{f}\right)^{1/3} = 1.35\left(\frac{8^2}{1}\right)^{1/3} = 5.4\ \mathrm{m}$

Maximum Scour depth from high flood line, $R_{max} = 2x5.4 = 10.8\ \mathrm{m}$

$\therefore 10.8 = 4.8 + d$

d = 6 m

Therefore length of launching apron is 1xd to 1.5 d

i.e. 6 m to 9 m

Take least value, Length of launching apron = 6 m

24. The earthen embankments constructed parallel to the river at some suitable distance for protection from flooding are called:

A. Guide banks

B. Levees

C. Terraces

D. gryones

Ans. B

Sol. A levee, dike, dyke, embankment, floodbank or stopbank is an elongated naturally occurring ridge or artificially constructed fill or wall that regulates water levels. It is usually earthen and often parallel to the course of a river in its floodplain or along low-lying coastlines.

25. If the sensitivity of an irrigation module is 0.25 and the variation in canal water depth is 60%. The rate of change of outlet discharge is

A. 0.05 B. 0.5

C. 0.15 D. 0.3

Ans. C

Sol. Sensitivity is defined as the ratio of rate of change of discharge through the outlet to the rate of change of water level of distributary, referred to the normal depth channel.

Sensitivity, S = 0.25

Variation in canal depth, $\frac{dy}{y} = 0.6 \text{ or } 60\%$

Rate of change of outlet discharge = dq/q

Sensitivity, $S = \frac{dq/q}{dy/y}$

$$0.25 = \frac{dq/q}{0.6}$$

$$\frac{dq}{q} = 0.15$$

26. The river training work is generally required when the river is

A. Meandering type B. Aggrading type

C. Degrading type D. Sub critical type

Ans. A

Sol. In order to **limit the movement of the bank of a meandering river**, certain structures are constructed on the riverbank, which are called riverbank protection works. Sometimes, an embankment like structure, called a Groyne or a Spur, is constructed at right angles to the riverbank and projected into the river for attracting or deflecting the flow of the river towards or away from the riverbank.

27. A structure constructed in an irrigation canal for the purpose of escaping excess water from the canal into some natural drainage are called

A. Fall B. Escape

C. Modules D. Regulator

Ans. B

Sol. A structure constructed in an irrigation canal for the purpose of escaping excess water from the canal into some natural drainage is called escape. Minimum capacity of escape is generally kept as 50% of the canal capacity at the point of escape.

28. Tortuosity of meandering river is always

A. 1

B. Less than one

C. Greater than one

D. None of the above

Ans. C

Sol. The ratio of curved length along the river to the direct axial length of river is called tortuosity. It is always greater than one.

29. The ratio of rate of change of discharge of an outlet to the rate of change of discharge of distributing channel is termed as

A. Proportionality

B. Sensitivity

C. Flexibility

D. Efficiency

Ans. C

Sol. The ratio of rate of change of discharge of an outlet to the rate of change of discharge of distributing channel is termed as Flexibility.

For proportional outlet it is 1

Note

Sensitivity: The ratio of rate of change of discharge of an outlet to the rate of change in level of the distributing surface, referred to normal depth of the channel.

30. Which of the following is NOT a flood proofing measure for houses?

A. Elevation

B. Flood walls

C. Dry flood proofing

D. Detention basins

Ans. D

Sol. A flood wall (or floodwall) is a primarily vertical artificial barrierdesigned to temporarily contain the waters of a river or other waterway which may rise to unusual levels during seasonal or extreme weather events.

A dry floodproofed structure is made watertight below the level that needs flood protection to prevent floodwaters fromentering.

Detention basins are surface storage basins or facilities that provide flow control through attenuation of stormwater runoff. They also facilitate some settling of particulate pollutants. From above definition we can say thatdetention basins are not used for flood proofing measure for houses

31. The heading up of water above its normal level while passing under the bridge is known as

A. Afflux

B. Clearance

C. Free board

D. Scour

Ans. A

Sol. Due to construction of the bridge there is a contraction in waterway. This results in rise of water level above its normal level while passing under the bridge. The rise is known as afflux.

32. What is the difference between weir and Barrage

A. In barrage, crest is kept at a low level

B. In barrage, crest is kept at a higher level

C. In weir, controlling of flow can be done more effectively as compared to barrage

D. None of the above

Ans. A

Sol. In barrage, crest is kept at a low level so that controlling of flow can be done more effectively.

33. A canal is designed to run with a constant discharge of 10 m^3/s. Which of the following type of outlets should be used?

A. Flexible outlet

B. Non modular outlet

C. Rigid outlet

D. None of these

Ans. C

Sol. Rigid outlet is used to maintain a constant discharge, irrespective of the discharge given.

34. At a certain point in the floor of weir, the uplift pressure head due to seepage is 5 m. If the relative density of concrete is 2.5, the minimum thickness of floor required at this point to counteract the uplift pressure

A. 2 m

B. 3.33 m

C. 4.5 m

D. 2.5 m

Ans. B

Sol. Head of uplift pressure, h' = 3 m

Specific gravity of floor concrete material, G = 2.5

Minimum thickness of the base required to counter act uplift pressure, $t = \frac{h'}{G-1}$

$$t = \frac{5}{2.5-1} = 3.33\ \text{m}$$

35. For a discharge of 2.01 m^3/s and silt factor f = 0.85 using Lacey's theory, the velocity is

A. 0.467 m/s

B. 2.567 m/s

C. 4.667 m/s

D. 6.777 m/s

Ans. A

Sol. According the Lacey's theory

$$V = \left(\frac{Qf^2}{140}\right)^{1/6} = \left(\frac{2.01 \times (0.85)^2}{140}\right)^{1/6}$$
$$= 0.467\ m/s$$

36. According to Koshla's theory of independent variables for seepage below hydraulic structure,

The exit gradient in the absence of downstream sheet pile is

A. Zero

B. 1

C. 2

D. ∞

Ans. D

Sol. Exit gradient G_e = H/d × 1 / π √(λ)

In absence downstream sheet pile, d = 0

So, $G_e = \infty$

37. Water shed canal is also known as

A. Side slope canal B. Contour canal

C. Ridge canal D. All the above

Ans. C

Sol. Ridge canal or water shed canal

A canal which is aligned along the water shed line is known as watershed canal. This canal can irrigate the areas on both sides.

Note:

Contour canal

A canal which is aligned parallel to the contours of a country is called contour canal.it can irrigate only on one side of the canal

Side slope canal.

A canal which is aligned perpendicular to the contours of a country is called side slope canal. In side slope canal cross drainage works are completely eliminated.

38. Wetted perimeter of a regime Channel for a discharge of 121 cumecs as per Lacey's theory will be

A. 40.75 m B. 52.25 m

C. 55 m D. 50 m

Ans. B

Sol. As per Lacey's theory, Wetted perimeter = 4.75 √Q Q= Discharge in cumecs

=4.75× √121

=52.25 m

Note:

Design steps of Lacey's theory

I. Calculate Silt factor, f = 1.76√d d in mm

II. Find out Velocity $V=\left(\frac{Qf^2}{140}\right)^{\frac{1}{6}}$

III. Find out Hydraulic radius $R = \frac{5}{2}\frac{v^2}{f}$

IV. Find out Area A=Q/V

V. Find out Perimeter, P = 4.75√Q

VI. Slope, $S=\frac{f^{\frac{5}{3}}}{3340\ Q^{\frac{1}{6}}}$

39. For the repairing of an old but sound concrete lining, the lining preferred is

A. Concrete lining B. Shot crete lining

C. Brick lining D. Asphalt lining

Ans. B

Sol. * Laying of the impervious layer which protects the bed and sides of the canal is called canal lining.

* Shot crete is a mixture of cement and sand in the ratio of 1:4. This lining is preferred for the repairing of an old but sound concrete lining.

40. The limitation of Bligh's creep theory is

A. there is no distinction between horizontal and vertical creep

B. There is no significance of exit gradient

C. The loss of head does not take place in the same proportion as the creep length

D. All options are correct

Ans. D

Sol. Limitations of Bligh's creep theory

* There is no distinction between horizontal and vertical creep

* There is no significance of exit gradient

* The loss of head does not take place in the same proportion as the creep length

* The uplift pressure distribution is not linear, but follows a sine curve.

41. Wetted perimeter of a regime channel is found out with the help of Lacey's theory. If the design discharge for the channel was 16m^3/s, then the wetted perimeter will be

A. 15 m B. 16.5 m

C. 19 m D. 19.5 m

Ans. C

Sol. By Lacey's theory,

$$P = 4.75\sqrt{Q} = 4.75\sqrt{16} = 19\ \text{m}$$

42. The base width of an elementary profile of a

gravity dam of height H is b. The specificgravity of the material of the dam is G and uplift pressure coefficient is K. The correct relation tor no tension at the heel is given by

A. $\frac{b}{H} = \frac{1}{\sqrt{G-K}}$ B. $\frac{b}{H} = \sqrt{G-K}$

C. $\frac{b}{H} = \frac{1}{G-K}$ D. $\frac{b}{H} = \frac{1}{K\sqrt{G-K}}$

Ans. A

Sol. For an elementary profile of dam, width B is given as

$\frac{b}{H} = \frac{1}{\sqrt{G-K}}$where C is the uplift coefficient (from no tension criteria)

43. If an earth dam having negligible tail water depth is provided with a drainage gallery, then the uplift pressure at a point where drainage gallery is provided is _____ of the upstream pressure

A. 1/2 B. 2/3

C. 1/3 D. 3/4

Ans. C

Sol. Uplift pressure at drainage gallery = Downstream pressure + 1/3 (Upstream Pressure – Downstream Pressure)

Since Tail water depth = 0 (approx),

Hence, Downstream Pressure = 0 (approx)

So, Uplift pressure at gallery = 1/3 (U/s Pressure)

44. The load on a hydel plant varies from a minimum of 10,000 kW to a maximum of 33,000 Kw. Two turbo-generators of capacities 22,000 kW each have been installed. The Utilization factor will be

A. 0.65 B. 0.44

C. 0.75 D. 0.33

Ans. C

Sol. Minimum power utilized = 10,000 kW

Maximum power utilized = 33,000 Kw

Maximum power available with 2 turbo-generators = 2 x 22,000= 44000

$$\text{Utilisation factor} = \frac{\text{Maximum power utilized}}{\text{Maximum power available}} = \frac{33000}{44000} = 0.75$$

45. Find the width of elementary gravity dam whose height is 100 m. specific gravity of dam material is 2.7. And seepage coefficient at the base C = 0.7.

A. 141 m B. 70.5 m

C. 173 m D. 86.5 m

Ans. B

Sol. Height of the elementary dam, H = 100 m

Specific Gravity of dam material, S = 2.7

Seepage coefficient at the base of dam, C = 0.7

The width of elementary gravity dam,

$$B = \frac{H}{\sqrt{s-c}} = \frac{100}{\sqrt{2.7-0.7}} = \frac{100}{\sqrt{2}} = \frac{100\sqrt{2}}{2} = 70.5\text{ m}$$

46. An elementary gravity dam is constructed of concrete having density of 24380 N/m^3. The limiting height of low dam without considering the uplift was turned to be h_0& with consideration of full uplift it was h_1. The ratio of h_1 to the h_0 is _______.

A. 0.70 B. 1.40

C. 1.00 D. 1.18

Ans. B

Sol. $h_1 = \dfrac{f}{\gamma_w(G-c+1)}$

$$h_0 = \frac{f}{\gamma_w(G+1)}$$

$$\frac{h_1}{h_0} = \frac{G+1}{G-C+1} = \frac{2.485+1}{2.485-1+1}$$

= 1.40

C = 1 as per U.S.B.R

47. Following data were obtained from the stability analysis of a concrete gravity dam.
Total overturning moment about toe = 3×10^5 ton-m.
Total resisting moment about toe = 4×10^5 ton–m.
Total downward weight of the dam = 6000 tones
Total uplift force = 1000 tones,
Base width of dam = 50m
Calculate maximum and minimum pressure on the soil.
A. 120 t/m^2, 0 respectively
B. 100 t/m^2, 50t/m^2 respectively
C. 160t/m^2, 40t/m^2 respectively
D. 320 t/m^2, 80t/m^2 respectively

Ans. C

Sol. $\sum M = M_R - M_O = 1\times10^5$ ton – m

$$d = \frac{\Sigma M}{\Sigma V} = \frac{1\times10^5}{6000-1000} m = 20m$$

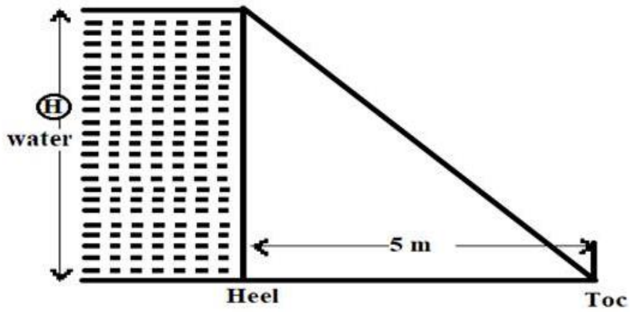
$$e = \frac{b}{2} - d = \frac{50}{2} - 20 = 5m$$

$$P_{max/min} = \frac{\Sigma V}{b}\left(1 \pm \frac{6e}{b}\right)$$

$$= \frac{5000}{50}\left(1 \pm \frac{6\times5}{50}\right)$$

= 160 t/m^2 and 40 t/m^2

48. For the retaining wall shown in the given figure, if the stress at the heel is zero, then the maximum storage 'H' will be



Specific gravity of the material of the wall = 2.25
A. 7.5 m
B. 5 m
C. 4 m
D. 3 m

Ans. A

Sol. The resultant of the hydrostatic pressure and weight of the dam should pass through the outer third point

$$B = \frac{H}{\sqrt{S-C}}$$

Considering zero uplift

$H_{max} = B\sqrt{S}$ = 5 x $\sqrt{2.25}$ = 7.5 m

49. The probability that a 100 year flood is equalled or exceeded at once in 100 year is

A. 0.99 B. 0.64

C. 0.36 D. 0.1

Ans. C

Sol. Given, return period (T) = 100 yr

Design life (n) = 100 yr

∴ Probability of occurrence

$(p) = \frac{1}{T} = \frac{1}{100} = 0.01$

∴ Probability of non-occurrence

Q = 1−0.01 = 0.99

We know that,

Probability of occurrence of event r times in n successive years,

$= {}^{n}C_{r} \cdot P^{r} \cdot q^{n-r}$

∴ Probability of occurrence of flood once in 100 yrs is

$= {}^{100}C_1 \times (0.01)^1 \times (0.99)^{99}$

$= 0.3697 \simeq 0.36$

50. The probable maximum flood is

A. The standard project flood of an extremely large river

B. A flood adopted in the design of all kinds of spillways

C. A flood adopted in all hydraulic structures

D. An extremely large but physically possible flood in the region

Ans. D

Sol. The probable maximum flood is the extremely large but physically possible flood in the region.

51. Depth area duration curve would seem to resemble

A. Arcs of circle concave up words with duration increasing outward

B. Third quadrant limbs of hyperbola with duration decreasing outward

C. Hyperbolic

D. None of the above

Ans. A

Sol. The development of relationship, between maximum depth area-duration for a region is known as Depth area duration (DAD. analysis and forms an important aspect of hydro-meteorological study.

Depth area duration curve would seem to resemble arcs of circle concave up words with duration increasing outward

52. Which among the following is correct about Ryve's formula for maximum flood estimation?

A. Q= $C_R\ A^{\frac{2}{3}}$

B. Q= $C_R\ A^{\frac{4}{3}}$

C. Q= $C_R\ A^{\frac{3}{2}}$

D. Q= $C_R\ A^{\frac{3}{4}}$

Ans. A

Sol. According to Ryve's formula , Q= $C_R\ A^{\frac{2}{3}}$

According to Dike's formula , Q= $C_D\ A^{\frac{3}{4}}$

53. Which one of the following is a linear reservoir?

A. In which storage volume varies linearly with time since initiation of rainfall excess

B. In which outflow rate varies linearly with storage

C. In which release varies linearly with inflow rate

D. In which storage volume varies linearly with water surface elevation

Ans. B

Sol. For a linear reservoir storage is a function of outflow discharge only S = kθ

For this weightage factor x = 0 in the Muskingum equation

54. On an extreme value probability paper (Gumbel) how do annual rainfall extremes get plotted?

A. Hyperbola

B. Parabola

C. Straight line

D. Circle

Ans. C

Sol. Gumbel's equation for any hydrological parameter is

$\Gamma_T = x + K\ \sigma_{n-1}$

Thus the annual extremes will be straight line.

55. A 1 hr rainfall of 10 cm magnitude at a certain station has a return period of 50 years. The probability that a 1 hr rainfall of magnitude 10 cm or more will occur in each two successive years is:

A. 0.0004

B. 0.04

C. 0.025

D. 0.0025

Ans. A

Sol. Duration of rainfall = 1 hr

Magnitude of rainfall = 10 cm

Return period, T = 50 years

Probability of occurrence, $P = \frac{1}{T}$

$$P = \frac{1}{50} = 0.02$$

Probability of non-occurrence, q = 1-P

q = 1 – 0.02 = 0.98

The probability of occurrence of an event, r=2 times in n = 2 successive years,

$X = {}^nC_r P^r q^{n-r}$

$X = {}^2C_2 \times 0.02^2 \times 0.98^{2-2}$

X = 1 x 0.0004 x 1

X = 0.0004

56. Probability of exceedance (P) of a event is

A. Proportional to T_r.

B. Inversely proportional to T_r.

C. Proportional to $\sqrt{T_r}$.

D. Inversely proportional to $\sqrt{T_r}$.

Ans. B

Sol. Probability of exceedance (P) of a event = $1/T_r$

Here, T_r is return period in yr.

57. At Delhi, a maximum rainfall depth of 15 cm in 12 h has a return period of 50 years. The probability of a 12 h rainfall of magnitude equal to or greater than 15 cm will occur in the next year

A. 0.50

B. 0.33

C. 0.98

D. 0.02

Ans. D

Sol. Return period is the average time period after which the particular rainfall value is likely to be equaled or exceeded.

Return period, T = 50 years

Probability of occurrence next year, $P = \frac{1}{T}$

$P = \frac{1}{50} = 0.02$

58. The Goodrich method of routing is a

A. Hydraulic reservoir-routing method.

B. Hydrologic reservoir-routing method.

C. Hydrologic channel-routing method.

D. Method of solving Saint Venant equation.

Ans. B

Sol. The Goodrich method of routing is a hydrologic reservoir-routing method.

The Muskingum method of routing is a hydrologic channel-routing method.

Hydraulic routing is solution of Saint Venant equation.

59. A hydraulic structure is designed for 20 years of flood. The probability that flow will be exceeded in next two years in this structure is

A. 10%

B. 12%

C. 15%

D. 20%

Ans. A

Sol. Probability that flow will be exceeded = $\frac{1}{T} = \frac{1}{20}$ = 0.05

Probability that flow will not be exceeded q = 1 – 0.05 = 0.95

Risk that flow will be exceeded in 2 years = 1 – q^2 = 1 – $(0.95)^2$ = 1 – 0.90 = 0.1

60. If the specific capacity of a well is 1.166 L/s, then discharge from this well under a depression head of 2.5 m will be

A. 1.166 L/s
B. 2.915 L/s
C. 3.5 L/s
D. 11.66 L/s

Ans. B

Sol. Given,

Specific capacity of well = 1.166 L/s/m

& depression head = 2.5 m

So, Discharge, Q = specific capacity × depression head

= 1.166 L/s/m × 2.5 m

= 2.915 L/s

61. Geological formations that do not contain ground water at all are called

A. Aquifuges
B. Aquitrads
C. Aquicludes
D. Aquifers

Ans. A

Sol. Geological formations that do not contain ground water at all are called aquifuges

62. A 400g/L solution of common salt was discharge into a stream at a constant rate of 48l/s. At a d/s section where salt solution is known to have completely mixed with the stream flow equilibrium concentration was read as 100 ppm. If a background concentration of 18ppm is applicable, then, the discharge in the stream in m^3/s is

A. 214
B. 234
C. 254
D. 204

Ans. B

Sol. By constant rate injection method,

$$Q = \frac{Q_t(C_1 - C_2)}{C_2 - C_0}$$

Q_t = 48l/s = 0.048 m^3/s.

C_1 = 0.4

C_2 = 0.0001

C_0 = 0.000018

$$\therefore Q = \frac{0.048\,(0.4-0.0001)}{0.0001-0.000018} = 234.08 m^3/s.$$

63. An aquifer confined at the bottom but not at the top is known as

A. Perched aquifer
B. Unconfined aquifer
C. Confined aquifer
D. Semi-confined aquifer

Ans. B

Sol. An aquifer confined at the bottom as well as at the top is known as Confined aquifer.

64. If specific yield of an aquifer is 50% than the porosity of sand contained in this aquifer will be

A. Less than 50%
B. Less than or equal to 50%
C. More than or equal to 50%
D. Equal to 50%

Ans. C

Sol. As, Porosity = Specific yield + Specific retention

So if sp. Yield = 50%

Porosity = 50% + Sp. Retention

Now if specific retention is zero than porosity can be equal to 50% or if specific retention is more than zero than porosity will be more than 50%.

65. The yield of a well depends upon

A. Porosity of soil
B. Area of aquifer opening into wells
C. Actual flow velocity
D. All of above

Ans. D

Sol. Yield means discharge of well.

Discharge Q = n V_a A= K i A

Here, n= porosity

V_a = actual flow of velocity of ground water

A = area of the aquifer opening into the wells

K = permeability of soil

i = hydraulic gradient

66. The pan evaporation for a particular month is 4 cm and the lake evaporation is 3 cm. Then the pan coefficient is

A. 0.75
B. 0.5625
C. 1
D. 0.25

Ans. A

Sol. Pan evaporation, E_p= 4 cm

Lake evaporation, E = 3 cm

Pan coefficient = C_p

Lake evaporation, $E = C_{p\times}E_p$

$$3 = C_p x4$$

C_p= 0.75

67. If the specific retention is 10 % and the specific yield of the 100 km^2 alluvial basin is 0.15. What is the porosity of the soil?

A. 0.25
B. 0.35
C. 0.15
D. 0.10

Ans. A

Sol. Specific retention, S_r = 0.10

Specific yield, S_y = 0.15

Porosity, $n = S_r + S_y$

$$n = 0.10 + 0.15 = 0.25$$

68. In a certain alluvial basin of 100 km^2, 90 Mm^3 of ground water was pumped in a year and the ground water table dropped by about 5 m during the year. Assuming no replenishment, estimate the specific yield of the aquifer.

A. 0.2
B. 0.18
C. 0.14
D. 0.27

Ans. B

Sol. Change in ground storage, $\Delta_s = 90 \text{ x } 10^6 \text{ m}^3$

Area of the alluvial basin, $A = 100 \text{ km}^2 = 100 \text{ x } 10^6 \text{ m}^2$

Drop in the ground water table, d = 5 m

Specific yield of the aquifer = S_y

Change in ground storage, $\Delta_s = \text{AxdxS}_y$

$90 \text{ x } 10^6 = 100 \text{ x } 10^6 \text{ x } 5 \text{ x } S_y$

$S_y = 0.18$

69. In a field test of a formation having a porosity of 20%, the hydraulic gradient was found to be 0.04, and the velocity of a tracer added to the groundwater was 2 mm/s. The permeability of the aquifer is

A. 1 cm/s
B. 4 cm/s
C. 0.1 cm /s
D. 0.4 cm /s

Ans. A

Sol. Apparent or discharge velocity = V

Actual speed of travel in the pores, V_a = 2 mm/s

Porosity of formation, n = 0.20

Hydraulic gradient, I = 0.04

$V = nV_a$

$V = 0.20\text{x}2 = 0.4 \text{ mm/s}$

Permeability, $K = \frac{V}{i}$

$K = \frac{0.4}{0.04}$

$K = 10 \text{mm/s or } 1 \text{ cm/s}$

70. For a catchment area of 120 km^2, the equilibrium discharge in m^3/hour of an S-curve obtained by the summation of 6 hour unit hydrograph is

A. 0.2 $\times 10^6$
B. 0.6 $\times 10^6$
C. 2.4 $\times 10^6$
D. 7.2 $\times 10^6$

Ans. A

Sol. $Q_{equilibrium}$ = C i A

$= 1 \times \frac{1\text{cm}}{6\text{hr}} \times 120\text{km}^2$

$= \frac{120}{6} \times \frac{1}{100} \times \frac{10^6 m^3}{hr}$

$= 20 \times 10^4 m^3/hr$

$= 0.2 \times 10^6 m^3/hr$

71. The basic assumptions of the unit-hydrograph theory are

A. Nonlinear response and linear invariance

B. Time invariance and linear response

C. Linear response and linear time variance

D. Nonlinear time variance and linear response.

Ans. B

Sol. A unit hydrograph is defined as the direct runoff hydrograph resulting due to unit depth (I cm) of rainfall excess occurring uniformly over the basin and uniform rate for a specified duration (1 hours).

The basic assumptions of the unit-hydrograph theory are

* Time invariance and linear response

* Effective rainfall should be uniformly distributed over the catchment

* Effective rainfall intensity is constant.

72. Hydrograph produced by a continuous effective rainfall at a constant rate for an infinite period is known as

A. Synthetic unit hydrograph

B. S hydrograph

C. Instantaneous unit hydrograph

D. None of the above

Ans. B

Sol. S hydrograph

* Hydrograph produced by a continuous effective rainfall at a constant rate for an infinite period is known as S hydrograph (also known as s curve)

* Each s curve is to be specified by the duration of unit hydrograph from which it is to be derived

Note:

Synthetic unit hydrograph- It is a unit hydrograph derived from empirical equations

Instantaneous unit hydrograph - It is a unit hydrograph of very small duration.

73. For a catchment with an area of 600 km^2 the equilibrium discharge of an S-curve obtained by 6-hour unit hydrograph in m^3/sec is

A. 277.8

B. 377.8

C. 177.8

D. None of the above

Ans. A

Sol. Catchment area, A = 600 km^2

Duration of rainfall, D = 6 hours

Equilibrium discharge in m^3/sec, $Q = \frac{2.778\ A}{D}$

$$= \frac{2.778 \times 600}{6}$$

= 277.8 m^3/sec

74. A direct runoff hydrograph due to an isolated storm was triangular in shape with a base of 60 hours and a peak of 100 m^3/s. If the catchment area is 600 km^2, the effective rainfall of the storm is

A. 1.2 cm
B. 1.8 cm
C. 2.4 cm
D. 3.6 cm

Ans. B

Sol. Effective rainfall is that portion of the rainfall which causes direct runoff.

Catchment area = 600 km^2 = 600x10^6 m^2

Duration of rainfall = 60 hour = 60x60x60 seconds = 216000 seconds

Peak value of runoff volume rate = 100 m^3/s

Volume of direct runoff for triangular shape hydrograph = Area of the triangular shape hydrograph

$$= \frac{1}{2} \text{x}100\text{x}216000 = 10.8\text{x}10^6 \text{ m}^3$$

$$\text{Effective rainfall} = \frac{\text{Volume of direct runoff}}{\text{catchment area}}$$

$$\text{Effective raifall} = \frac{10.8\text{x}10^6}{600\text{x}10^6} = 0.018 \text{ m} = 1.8 \text{ cm}$$

75. Clark's method aims at which one of the following?

A. Developing an IUH due to an instantaneous rainfall excess over catchment
B. Developing stage discharge relationship
C. Measurement of infiltration
D. Flood routing through channels

Ans. A

Sol. In IUH the effective precipitation is applied to the drainage basin in zero time. Clark's method requires estimation of three basin parameters for the derivation of IUH, time of concentration (Tc), storage attenuation coefficient (K) and time-area histogram of the basin.

76. A triangular DRH due to a storm has a time base of 100h and a peak flow of 100 m^3/s, occurring at 20h from the start. If the catchment area is 360 km^2, the rainfall excess in the storm was

A. 10 cm
B. 0.1 cm
C. 5 cm
D. 0.05cm

Ans. C

Sol. Excess rainfall depth = $\frac{\text{Volume of runoff}}{\text{Catchment area}} = \frac{\text{Area of DRH}}{\text{Catchment area}}$

$$= \frac{\frac{1}{2} \times 100 \times 3600 \times 100}{360 \times 10^6} = 0.05\text{m} = 5\text{cm}$$

77. The number of unit hydrographs needed to produce S-curve is

A. 1/D | B. T_B/D
C. D/T_B | D. T_B/D

Ans. B

Sol. Number of unit hydrographs needed to produce S-curve is T_B/D. Here, T_B is base period and D is duration of each unit hydrograph.

78. Discharge at any time in recession limb of a hydrograph is

A. Proportional to square of storage remaining at that time.

B. Inversely proportional to square of storage remaining at that time.

C. Inversely proportional to storage remaining at that time.

D. Proportional to storage remaining at that time.

Ans. D

Sol. The recession limb extends from the point of inflection at the end of crest segment to the start of the natural groundwater flow. Discharge at any time in recession limb of a hydrograph is proportional to storage remaining at that time.

79. The peak of flood hydrograph due to a 3 h duration isolated storm in a catchment is 270 m^3/s. The total depth of rainfall is 5.9 cm. Assuming an average infiltration loss of 0.3 cm/h and a constant base flow of 20 m^3/s, estimate the peak of the 3 h unit hydrograph of this catchment?

A. 70 m^3/s | B. 50 m^3/s
C. 30 m^3/s | D. 10 m^3/s

Ans. B

Sol. Duration of rainfall excess = 3 hr

Loss at the rate of 0.3 cm/hr for 3 hr = 0.9 cm

Total depth of rainfall = 5.9 cm

Rainfall excess = 5.9 – 0.9 = 5.0 cm

Peak of flood hydrograph = 270 m^3/s

Peak of DRH = 250 m^3/s

Base flow = 20 m^3/s

Peak of 3 h unit hydrograph = $\frac{Peak\ of\ DRH}{Rainfall\ excess} = \frac{250}{5} = 50$ m^3/s

80. A unit hydrograph for a watershed is triangular in shape with base period of 20 hours. The area of the watershed is 500 ha. What is the peak discharge in m^3/hour?

A. 4000 | B. 5000
C. 6000 | D. 7000

Ans. B

Sol. Area of watershed, $A = 500\ \text{ha} = 500\text{x}\ 10^4\ \text{m}^2$

Base period, T = 20 hours

1 cm = 0.01 m

Peak discharge = Q_P

For unit hydrograph,

Area under Unit hydrograph = Direct runoff volume due to 1 cm effective rainfall

$$\frac{1}{2} x Q_p x T = (1 \text{ cm}) x A$$

$$\frac{1}{2} x Q_p x 20 = 0.01 x 500 x\ 10^4$$

$$Q_p = 5000 \text{ m}^3$$

81. For a catchment with an area of 400 km^2 and the equilibrium discharge of S-curve obtained by 4 h unit hydrograph in (m^3/s)

A. 178
B. 228
C. 278
D. 378

Ans. C

Sol. When due to continuous effective rainfall the hydrograph forms the shape of letter S till the constant discharge. In that condition equilibrium is reached and discharge at that point is called equilibrium discharge.

Area of catchment, A = 400 km^2

Time duration, T = 4 hour

Equilibrium discharge, $Q_{eq} = 2.78 \frac{A}{T}$ (A is in km^2 and T in hours)

$$= 2.78 x \frac{400}{4} = 278 \text{ m}^3/\text{s}$$

82. The rainfall on five successive days were measured as 100 mm, 80 mm, 60 mm, 40 mm and 20 mm respectively. If the infiltration index or the storm loss rate for the catchment area is earlier estimated as 50 mm/day, the total surface run off will be:

A. 50 mm
B. 60 mm
C. 90 mm
D. 140 mm

Ans. B

Sol. Surface runoff is the amount of water which contributes into effective rainfall after infiltration losses.

Total surface runoff = (100–50) + (80–50) + (60–50) + (40–50) + (20–50)

= 50 + 30 + 10 + 0 + 0 = 90 mm

83. A raingauge recorded hourly rainfall as 5 cm, 2 cm, 4 cm and 3 cm for a four hour storm respectively. If the φ index was 3 cm/hour, the total direct runoff from a catchment for the storm was

A. 14 cm
B. 12 cm
C. 3 cm
D. 2 cm

Ans. C

Sol. Direct surface runoff

= (5 – 3) + (2 – 3) + (4 – 3)+(3 – 3)

= 2 + 0 + 1 + 0 = 3cm

84. A catchment of area 100 ha received a rainfall of 10 cm in 2 h due to storm. At the outlet of the catchment, the stream draining the catchment was dry before the storm and experienced a runoff lasting for 8 h with an average discharge value of 2 m^3/s. the stream was again dry after the runoff event. What is the loss of water?

A. 57600 m^3

B. 42400 m^3

C. 14400 m^3

D. 10^5 m^3

Ans. B

Sol. From basic equation,

$P - (R+G+E+T) = \Delta S$

Since, before & after storm event the stream remains dry,

i.e change in storage, $\Delta S = 0$

Loss of water will be due to groundwater storage, evaporation and transportation.

Loss, $L = G+E+T$

Or, $P - R - L = 0$

Or, $L = P - R$

Precipitation, P = area × rainfall depth

$= (100 \times 10^4) \times (10 \times 10^{-2})$

$= 10^5$

And runoff, R = discharge × time

$= 2 \times (8 \times 3600)$

$= 57600\ m^3$

Hence, loss $L = 100000 - 57600$

$= 42400\ m^3$

85. The rainfall in four successive 12 hours period on a catchment are 50,70, 80 and 100. If the infiltration index for the storm is 6mm/hr , then the total surface runoff will be

A. 32

B. 36

C. 40

D. 44

Ans. B

Sol. The infiltration index for the storm is 6mm/hr., ie at 1-hour 6mm water is infiltrated into soil.

Infiltration for 12 hours = 6mm/hr X 12 hr.

= 72 mm

So, rainfall < 72mm are infiltrated completely.

Total runoff = (80-72) +(100-72)

=36 mm

86. A 3 hr storm on a small discharge basin produce rainfall intensities of 4.0 cm/hr, 4.2 cm/hr and 3.4cm/hr in successive hours. If the surface runoff due to storm is 3.5 cm, the value of φindex will be

A. 2.3 cm/hr   B. 2.5 cm/hr

C. 2.7 cm/hr   D. 3.2 cm/hr

Ans. C

Sol. $\varphi = \frac{(4+4.2+3.4)-3.5}{3}$ = 2.7cm/hr

87. If the initial infiltration capacity was 10 mm/hr and ultimate capacity was 1.2 mm/hr. The total of 33 mm of water infiltrated during 10 h interval. Find infiltration constant rate. (Assume steady state is attained)

A. 0.42 h^{-1} B. 0.36 h^{-1}

C. 0.32 h^{-1} D. 0.27 h^{-1}

Ans. A

Sol. f_o = 10 mm/hr

f_c = 1.2 mm/hr

F = 33 mm

F = f_c x t + $\frac{f_0 - f_c}{k}$

33 = 1.2 x 10 + $\frac{10-1.2}{k}$

K = 0.42 h^{-1}

88. Calculate the runoff (cm) from a rainfall of 3 hours. The intensity of the rainfall is 2 cm/hr. The evaporation and infiltration losses are 8 mm and 16 mm respectively.

A. 1.2   B. 2.8

C. 3.6   D. 6.8

Ans. C

Sol. $Runoff = Total\ rainfall - Evaporation - Infiltraion\ losses$

$Total\ rainfall = 2 \times 3 = 6cm, Evaporation = .8cm, Infiltartion = 1.6cm$

$Therefore, Runoff = 3.6cm$

89. A catchment has an area of 150 ha and a runoff/rainfall ratio of 0.40. If 10cm is the rainfall over the catchment, then runoff volume will be

A. 600 m^3 B. 1200 m^3

C. 120000 m^3 D. 60000 m^3

Ans. D

Sol. Catchment area, $A = 150\ \mathrm{ha} = 150\mathrm{x}10^4\ \mathrm{m}^2$

Rainfall = 10 cm

$\frac{\mathrm{Runoff}}{\mathrm{Rainfall}} = 0.4$

Runoff = 0.4x10 = 4 cm = 0.04 m

Runoff volume, $V = A\ \mathrm{x}\ \mathrm{Runoff} = 150\mathrm{x}10^4\mathrm{x}0.04 = 60000\ \mathrm{m}^3$

90. The following rainfall data refers to station P and R which are equidistant from station:

	Station P	Station Q	Station R
Long term normal annual rainfall in mm	150	240	200
Annual rainfall for the year 1980 in mm	105	X	180

The value of X will be

A. 180 mm

B. 192 mm

C. 216 mm

D. 204 mm

Ans. B

Sol. As the normal precipitation of other stations P and R are not within 10% of normal precipitation Q.

Annual precipitation at station P in year 1980, $P_P = 105\text{ mm}$

Normal precipitation at station P, $N_P = 150\text{ mm}$

Annual precipitation at station R in year 1980, $P_R = 180\text{ mm}$

Normal precipitation at station R, $N_R = 200\text{ mm}$

Annual precipitation at station Q in year 1980, $P_Q = X$

Normal precipitation at station Q, $N_Q = 240\text{ mm}$

Number of additional station chosen, m = 2

Then by Normal ratio method

$$X = P_Q = \frac{N_Q}{m}\left(\frac{P_P}{N_P} + \frac{P_R}{N_R}\right)$$

$$X = \frac{240}{2}\left(\frac{105}{150} + \frac{180}{200}\right)$$

$$X = 192\text{ mm}$$

91. Field capacity and optimum moisture content of a soil of density 1.3 g/cc are 28% and 16% respectively. If effective depth of root zone is 70 cm, water available for e evapotranspiration is

A. 25.4 cm

B. 22.29 cm

C. 14.56 cm

D. 10.92 cm

Ans. D

Sol. Available depth for evapotranspiration is given as

$$d_a = d_r \times \frac{\gamma_d}{\gamma_w}[FC - (OMC)]$$

Where, d_a = available depth

d_r = root zone depth

$$d_a = 70 \times \frac{1.3}{1}\frac{[28 - 16]}{100} = 10.92\text{ cm}$$

92. A catchment has 4 non-recording raingauges installed. The allowable error of this catchment is 10% and coefficient of variation is 30, then find out the additional no of non-recording raingauges that are needed to be installed.

A. 3 B. 4

C. 5 D. 6

Ans. B

Sol. $N = \left(\frac{C_v}{\epsilon}\right)^2 = \left(\frac{30}{10}\right)^2 = 9$

At least 10% raingauges should be of recording type.

Total number of raingauges required = 9

Number of recording rain gauges = 10% of 9 = 0.9 ~ 1

Total additional required = 9 - 4 = 5

One of these additional raingauges will be of recording type.

Additional non recording raingauges = 5 – 1 = 4

93. The pan coefficient of Colarado Sunken Pan is

A. 0.7 B. 0.78

C. 0.8 D. 0.9

Ans. B

Sol. The evaporation observed from a pan has to be corrected to get the evaporation from a lake under similar climatic and exposure conditions. Thus a coefficient is introduced as lake evaporation= C_p × pan evaporation

where, C_p= pan coefficient. The values of CP in use for different pans are given below

Type of pan	Pan coefficient
Class A Land Pan	0.7
Colarado Sunken Pan	0.78
ISI Pan (modified Class A)	0.8

94. Evapo transportation is measured by

A. Atmo meter B. Lysi meter

C. Tensio meter D. Permea meter

Ans. B

Sol. Lysi meter – Evapo transpiration

Atmo meter—Evaporation

Tensio meter—Capillary potential

Permea meter—Hydraulic conductivity

95. The highest value of annual evapotranspiration in India is at Rajkot, Gujarat. Here the value of PET is

A. 150 B. 180

C. 210 D. 300

Ans. C

Sol. * The annual PET is highest at Rajkot, Gujarat with a value of 214.5 cm.

* Extreme south-east of Tamil Nadu also show high average values greater than 180 cm.

* The highest PET for southern peninsula is at thiruchirapalli, Tamil Nadu with a value of 209 cm.

96. The science which deals with the physical features and conditions of water on the earth surface is called

A. Hydraulics
B. Hydrosphere
C. Hydrometry
D. Hydrography

Ans. D

Sol. Hydrography: The science which deals with the physical features and conditions of water on the earth surface

Hydrometry- The science which deals with the measurement of water is called Hydrometry.

97. In India, the standard recoding rain gauge adopted is

A. Symons rain gauge
B. Tipping bucket rain gauge
C. Weighing bucket rain gauge
D. Natural syphon rain gauge

Ans. D

Sol. Natural syphon rain gauge

Natural syphon type also known as Float type rain gauge. Here the rainfall collected by a funnel-shaped collector is led into a float chamber, causing float to rise.

As the float rises, a pen attached to the float through a lever system records the rainfall on a rotating drum driven by a clockwork mechanism. A syphon arrangement empties the float chamber when the float has reached a present maximum level. This type of rain gauge is adopted as the standard recording-type rain gauge in India and its details are described in Indian standard IS:5235- 1969.

98. In a catchment there are 6 rain gauges. The rainfall data collected by them in year 2020 are as follows:

Station	1	2	3	4	5	6
Rainfall (cm)	40	38	43	39	40	41

Find the average rainfall in the catchment by the arithmetic mean method?

A. 40.17 cm
B. 42.15 cm
C. 44.33 cm
D. 45 cm

Ans. A

Sol. In the arithmetic mean method, the average rainfall is calculated as

$$P_m = \frac{P_1+P_2+P_3+P_4+P_5+P_6}{6}$$

$$P_m = \frac{40+38+43+39+40+41}{6} = 40.17 \text{ cm}$$

99. Determine the optimum number of rain gauge stations in the catchment for an admissible error of 10% in the estimation of mean rainfall. The coefficient of variation of the rainfall for 4 rain gauge stations in the catchment is 30%.

A. 8 B. 4

C. 3 D. 9

Ans. D

Sol. Coefficient of variation, C_v=30%

Percentage allowable error, e = 10%

Optimum number of rain gauge stations, $n = \left(\frac{C_v}{e}\right)^2$

$= \left(\frac{30}{10}\right)^2$

$= 9$

100. At a particular area, pan evaporation for the January month is 9.5 cm. For a stage growth of 40% of the wheat crop, the consumptive use is 0.52. Then the daily consumptive use of the wheat crop corresponding to the 40% of stage growth for the January month:

A. 1.6 mm/day B. 0.40 mm/day

C. 0.637 mm/day D. 4 mm/day

Ans. A

Sol. January = 31 days

E_p = 9.5 cm

K = 0.52

C_u = E_t = Consumptive use

E_T = kE_p = 0.52 x 9.5

E_T = 4.94 cm/month

E_T in mm/day = $\frac{4.94}{31} x\ 10$ = 1.6 mm/day

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