CLASS TEST

Sl. : 03SKCE_MKNL_13102024

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IRRIGATION ENGINEERING

CIVIL ENGINEERING

Date of Test : 13/10/2024

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (b)

2. (b)

$$P = 4.75\sqrt{Q} = 4.75\sqrt{6400} = 380 \text{ m}$$

3. (a)

4. (b)

$$\text{SAR} = \frac{Na^{+}}{\sqrt{\dfrac{Ca^{+2} + Mg^{2+}}{2}}} = \frac{30}{\sqrt{\dfrac{4+3}{2}}}$$

$$= 16.04$$

Since SAR is in between 10 - 18 and so it can be classified as medium sodium water (S_2).

5. (d)

Bligh's coefficient is different for different type of soils.

6. (d)

7. (b)

$$\text{Thickness of floor, } t = \frac{h}{G-1} = \frac{4.8}{3.4-1} = 2 \text{ m}$$

8. (b)

$$\text{Design discharge} = \frac{\text{Discharge required in the field}}{\text{Time factor} \times \text{Capacity factor}}$$

$$= \frac{0.5}{0.5 \times 0.6} = 1.67 \text{ cumecs}$$

9. (c)

10. (b)

11. (d)

The ratio of Meander Belt to Meander Length is known as Meander Ratio.

12. (c)

13. (c)

$$\text{Sensitivity, } (s) = \frac{dq/q}{dy/y} = \frac{50}{70} = 0.714$$

14. (b)

$$\text{Length of creep} = 2 \times 5 + 5 + 2 + 2 \times 4 + 5 + 10 + 2 \times 5 = 50 \text{ m}$$

$$\therefore \quad \text{Hydraulic gradient} = \frac{5}{50} = \frac{1}{10}$$

Now, length of creep upto point $A = 2 \times 5 + 5 + 2 + 2 \times 4 + 5 = 30$ m

$$\therefore \text{Unbalanced head at } A,\ h = 5\left(1 - \frac{30}{50}\right) = 2 \text{ m}$$

$$\therefore \quad \text{Uplift pressure at } A, = \gamma_w h = 10 \times 2 = 20 \text{ kN/m}^2$$

15. (a)

$$\text{Mean depth, } D = \frac{2.0 + 1.9 + 1.8 + 1.6 + 1.5}{5}$$

$$= \frac{8.8}{5} = 1.76 \text{ m}$$

The average of absolute values of deviations,

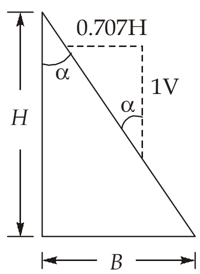
$$d = \frac{|2 - 1.76| + |1.9 - 1.76| + |1.8 - 1.76| + |1.6 - 1.76| + |1.5 - 1.76|}{5}$$

$$d = 0.168 \text{ m}$$

$$\text{Water distribution efficiency} = \left(1 - \frac{d}{D}\right)$$

$$= \left(1 - \frac{0.168}{1.76}\right) = 0.905 = 90.5\%$$

16. (d)



$$\tan\alpha = \frac{B}{H} = 0.707$$

$$\tan^2\alpha = 0.5$$

$$(p_{max})_{toe} = 3.6 \text{ MPa}$$

$$\sigma_{max} = (p_{max})_{toe} \times \sec^2\alpha = (p_{max})_{toe}(1 + \tan^2\alpha) = 3.6(1 + 0.5) = 5.4 \text{ MPa}$$

17. (c)

$$\because \qquad S = \frac{4k\left(b^2 - a^2\right)}{Q_D}$$

$$\Rightarrow \qquad Q_D = \frac{4k\left(b^2 - a^2\right)}{S}$$

$$\therefore \qquad \frac{(Q_D)_A}{(Q_D)_B} = \frac{4k_A\left(b^2 - a^2\right)_A \times S_B}{4k_B\left(b^2 - a^2\right)_B \times S_A} = \frac{2}{1}\times\frac{5}{6}\times 1.5$$

$$= 2.5$$

18. (a)

As per Kennedy's

Critical velocity, $V_0 = 0.55\ my^{0.64}$

m = critical velocity ratio = 0.90

y = depth of flow = 1.2 m

$\therefore \qquad V_0 = 0.55 \times 0.9 \times (1.2)^{0.64} = 0.556$ m/sec

Also, discharge through channel, $Q = 4\ m^3/sec$

∴ Required cross-section area of channel

$$A = \frac{Q}{V_0} = \frac{4}{0.556} \simeq 7.20\ m^2$$

19. (c)

To prevent scouring

$\gamma_\omega RS < 0.056\ \rho_w\ d(G_s - 1)$

where d = particle size (> 6 mm)

$$G_s = 2.65$$

$$\Rightarrow \qquad RS \le \frac{d}{11}$$

$$R \le \frac{d}{11S}$$

$$R_{max} = \frac{d}{11S}$$

Given, d = 6 cm (> 6 mm) ok, S = 0.01

$$R_{max} = \frac{6\times10^{-2}}{0.01\times 11} = 0.5454\ m = 54.54\ cm$$

20. (d)

Net vertical force, $\Sigma V = W - U = 1036 - 674 = 362$ kN

Net horizontal force, ΣH = Water force

$$= \frac{1}{2} \cdot \gamma_w H^2 = \frac{1}{2} \times 9.81 \times (10)^2 = 490.5 \text{ kN}$$

$\therefore$ Shear friction factor,

$$\text{SFF} = \frac{\mu . \Sigma V + B.q}{\Sigma H}$$

B = width of the base of foundation = 8.25 m; μ = 0.75; q = shear strength at the joint = 1400 kN/m^2

$$\text{SFF} = \frac{0.75 \times 362 + 8.25 \times 1400}{490.5} = 24.10$$

21. (b)

Intensity of irrigation for kharif = 100 – 65 = 35%

Intensity of irrigation for rabi = 100 – 50 = 50%

$\therefore$ Annual intensity of irrigation = sum of seasonal intensity of irrigation in a year

= 35% + 50% = 85%.

22. (c)

Given, $Q = 50$ m^3/sec

Silt factor, $f = 1.1$

As per Lacey's

$\therefore$ Velocity,

$$V = \left(\frac{Qf^2}{140}\right)^{1/6} = \left(\frac{50 \times (1.1)^2}{140}\right)^{1/6} = 0.869 \text{ m/sec}$$

Bed slope,

$$S = \frac{f^{5/3}}{3340\, Q^{1/6}} = \frac{(1.1)^{5/3}}{3340 (50)^{1/6}} = 0.0001828$$

$$S = \frac{1}{5469}$$

23. (a)

Classification	E.C in μ Mho/cm	Exchangable sodium percentage, ESP(%)	pH
1. Saline or white alkali soil	> 4000	< 15	≤ 8.5
2. Alkaline or black alkali soil	< 4000	> 15	8.5 – 10
3. Soline-Alkali soil	> 4000	> 15	< 8.5

24. (d)

As per Blaney-Criddle formula

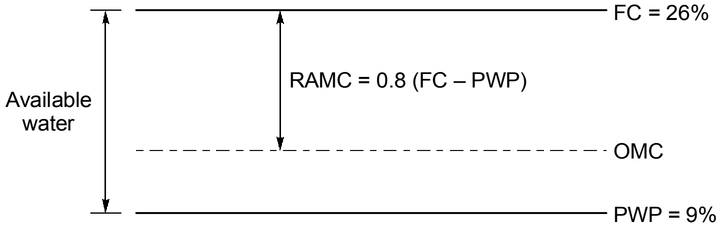
$$C_u \text{ or PET} = \Sigma \frac{kp}{40}[1.8t + 32]$$

$$= \frac{0.65 \times 9.3}{40}[1.8 \times 28 + 32] + \frac{0.72 \times 10.6}{40}[1.8 \times 25 + 32]$$

$$= 27.14 \text{ cm}$$

In above equation, k = consumptive use coefficient/crop factor; p = monthly %age of annual day light hours; t = temperature (°C).

25. (b)



$$d = \text{depth of root zone} = 75 \text{ cm}$$

$$C_u \text{ per day} = 1.58 \text{ cm/day}$$

$\therefore$ $$\text{RAMC} = \text{Readily available depth of water}$$

$$= \frac{\gamma_d}{\gamma_w}.d.(FC - OMC) = \frac{1.4}{1} \times 0.75 \times 0.8 \times (0.26 - 0.09)$$

$$= 0.1428 \text{ m}$$

$\therefore$ Frequency of irrigation, $$\text{FOI} = \frac{\text{RAMC}}{C_u} = \frac{(0.1428 \times 100)\text{cm}}{1.58 \text{ cm/day}} = 9.03 \simeq 9 \text{ days}$$

26. (b)

$$D = 0.19 \text{ m}$$

$$B = 14 \text{ days}$$

Outlet factor, $$D = \frac{8.64\,B}{\Delta} = \frac{8.64 \times 14}{0.19} = 636.6 \text{ ha/m}^3\text{/sec} \simeq 637 \text{ ha/m}^3\text{/sec}$$

27. (d)

28. (b)

29. (d)

Modular limits are extreme values of any one or more variables, beyond which an outlet becomes incapable of acting as a module or semi-module. The range between the lowest and highest limiting values of various such factors is known as modular range.

Modular limit is not a ratio.

30. (b)

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