ACE Engineering Academy
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ESE- 2020 (Prelims) - Offline Test Series Test- 11

CIVIL ENGINEERING

SUBJECT: Hydrology and Water Resources Engg. + Environmental Engineering

01. Ans: (b)

02. Ans: (a)

Sol: Average sewage = 80×10^6 *l*/day

Average 5-day BOD = 250 mg/*l*

Domestic sewage quantity

= 0.08 kg/person/day

Total BOD in sewage = $250 \times 80 \times 10^6$

= 2×10^{10} mg/day

= 20000 kg/day

Population equivalent = $\frac{\text{Total BOD}}{0.1}$

$= \frac{20000}{0.1} = 200000$

03. Ans: (b) **04. Ans: (b)**

05. Ans: (c) **06. Ans: (a)**

07. Ans: (c)

08. Ans: (b)

Sol: Disinfection by UV light is very different from the mechanisms of chemical disinfection using chlorine, chloramines, or ozone. Chemical disinfectants destroy microorganisms by damaging cellular structures, interfering with metabolism, and hindering growth. UV light destroys microorganisms by damaging their nucleic acid and preventing them from replicating.

09. Ans: (d)

Sol: Total hardness = $\frac{\left[Mg^{2+}\right]}{12} \times 50$

$= \frac{24}{12} \times 50$

= 100 mg/*l* of $CaCO_3$

10. Ans: (d)

Sol: Positive Combination = 2-1-0

MPN Index for this combination is 7

MPN Value = MPN Index Value × DF

= 7 × 10

= 70 per 100ml

11. Ans: (d)

12. Ans: (d)

SSC-JE (Paper-II) MAINS 2018

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FULL LENGTH MOCK TEST-1

Exam Date: **01.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

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Exam Date: **15.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

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13. Ans: (d)

Sol: $G = \sqrt{\frac{P}{V\mu}}$

$$V = \frac{P}{G^2\mu} = \frac{245}{(700)^2 \times 1 \times 10^{-3}}$$

$$= \frac{245}{490 \times 10^3 \times 10^{-3}}$$

$$V = 0.5\ m^3$$

$$D.T = \frac{V}{Q}$$

$$= \frac{0.5 \times 24 \times 60}{0.4 \times 10^3}$$

$$D.T = 1.8\ min$$

14. Ans: (d)

15. Ans: (d)

Sol: During filtration influent and effluent valves are open and remaining values are closed.

16. Ans: (d)

17. Ans: (a)

Sol: $\frac{F}{M}\text{ratio} = \frac{Qy_i}{VX}$

$$= \frac{1000 \times 300}{300 \times 2000}$$

$$= 0.5\ day^{-1}$$

18. Ans: (a) **19. Ans: (c)**

20. Ans: (a)

21. Ans: (c)

Sol: Full Flow Condition:

$$A = \frac{\pi}{4}D^2$$

$$P = \pi D$$

$$R = \frac{A}{P} = \frac{D}{4}$$

Partial Flow Condition:

$$a = \frac{\alpha}{360}\left(\frac{\pi}{4}D^2\right) - \frac{1}{2} \times r\cos\frac{\alpha}{2}\left(2r\sin\frac{\alpha}{2}\right)$$

$$= \frac{D^2}{4}\left[\frac{\pi\alpha}{360} - \frac{\sin\alpha}{2}\right]$$

$$r = \frac{a}{P} = \frac{\frac{D^2}{4}\left(\frac{\pi\alpha}{360} - \frac{\sin\alpha}{2}\right)}{\frac{\alpha}{360}\pi D}$$

$$\frac{r}{R} = \frac{\frac{D}{4}\left(1 - \frac{360\sin\alpha}{2\pi\alpha}\right)}{\frac{D}{4}} = 1 - \frac{360\sin\alpha}{2\pi\alpha}$$

22. Ans: (b)

23. Ans: (b)

Sol: $V_1 (100 - P_1) = V_2 (100 - P_2)$

$\Rightarrow x (100 - 98) = V_2 (100 - 94)$

$\Rightarrow V_2 = x/3$

24. Ans: (a) **25. Ans: (d)**

26. Ans: (a) **27. Ans: (c)**

28. Ans: (c)

29. Ans: (a)

Sol: $y_m = \frac{\sum y_i}{n} = 1.76$ m

$y_d = \frac{\sum |y_i - y_m|}{n} = 0.168$ m

$\eta_d = \left(1 - \frac{y_d}{y_m}\right)100 = 90.45\%$

30. Ans: (d)

Sol: $d_w = \frac{65 \times 10^4 \times 10^{-3}}{0.1 \times 10^4} \times 0.9 = 0.585$ m

$d_w = S \times d\,[FC - mc]$

$0.585 = 1.45 \times 1.8\left[\frac{30 - mc}{100}\right]$

$\Rightarrow$ mc = 8%

31. Ans: (d)

Sol: Q = 0.7 (10) = 7 cumec

$D = \frac{A}{Q} \Rightarrow A = DQ$

= 125 (7) = 875 ha

32. Ans: (a)

Sol: FC – OMC : RAM

SMT will be $\frac{1}{3}$ to $\frac{1}{6}$th atm pressure

= 16.66 – 33.33 kPa

33. Ans: (d)

Sol: $q = \frac{S_\ell S_m I}{360} = \frac{12 \times 20 \times 1.5}{360} = 1$ *l*ps per sprinkler

Q = n q = 40 q = 40 *l*ps

= 2400 *l*pm

34. Ans: (a)

Sol:

$$\bar{y} = \frac{\sum M}{\sum H} = \frac{\frac{W}{6}\left[H_1^3 - H_2^3\right]}{\frac{W}{2}\left[H_1^2 - H_2^2\right]} = \frac{H_1^2 + H_1H_2 + H_2^2}{3(H_1 + H_2)} > \frac{H_1}{3}$$

35. Ans: (a)

Sol: $\sigma = P_n \sec^2\phi - P \tan^2\phi = P_n \sec^2\phi = 2.25$

$\tan\phi = 0.707 = \frac{1}{\sqrt{2}}$

$\sec^2\phi = 1 + \frac{1}{2} = \frac{3}{2}$

$P_n \frac{3}{2} = 2.25$

$P_n = 1.5$ MPa

$\tau = (P_n - P)\tan\phi = 1.5\frac{1}{\sqrt{2}} = 1.06$ MPa

$\simeq 1.1$ MPa

36. Ans: (d)

Sol: $H_L = \frac{f}{w(s+1)} = \frac{7.5 \times 10^6}{10^4(2.4+1)}$

= 220.5 (nearest answer is 225)

37. Ans: (a)

Sol: $C = \frac{2}{3}C_d\sqrt{2g} = \frac{2}{3} \times 0.7 \times \sqrt{2 \times 9.81}$

$= 2.07 \simeq 2.1$

$H_e = H_d + H_a = H_d + \frac{V_a^2}{2g}$

$H_e = 2 + \frac{0.8^2}{2(9.81)} = 2.033$ m

$Q = CL_e\ H_e^{3/2}$

$= 2.1(100)(2.033)^{3/2}$

$= 609\ m^3/s \simeq 610\ m^3/sec$

38. Ans: (d)

Sol: Flow in spillway buckets will always be at positive hydrostatic pressure or at atm pressure. In all other cases, pressure may fall to a value less than atmospheric.

39. Ans: (d)

Sol: $A = BD + mD^2 = BD + D^2 = 50$

$P = B + 2D\sqrt{1+m^2} = B + 2\sqrt{2}D = 29.5\ m$

Solving, $D = 1.96\ m \simeq 2\ m$

40. Ans: (b)

Sol: $h_w = 0.032\sqrt{VF} = 2.88\ m$

$F_B = \frac{3}{2}h_w = \frac{3}{2}(2.88) = 4.32\ m$

RL of NPL = RL of Crest – F_B

= + 195.68 m

41. Ans: (b)

Sol: $Q_M > Q_N \Rightarrow S_M < S_N$

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

42. Ans: (b)

Sol: $\phi_P = 30\ \% \Rightarrow \phi_c = 100 - 30 = 70\%$

$h_c = H\ \phi_c = 6\ (0.7) = 4.2\ m$

$u_c = wh_c = 42\ kPa$

43. Ans: (d)

Sol: $Q_d < Q_{canal}$ type II

$MFL_{canal} = 253.00\ m$

$BL_{drain} = 252.20\ m$

$\therefore$ siphonic action takesplace

$\therefore$ canal siphon i.e, Siphon

44. Ans: (b)

Sol: Uplift is due to pore water pressure, option (b) is correct

45. Ans: (b)

Sol: $L_R = \frac{E_{ci}}{E_{cd}} \times 100 = \frac{1.5}{20} \times 100 = 7.5\%$

Depth of water required

$= D_i = \frac{D_c}{1 - L_R} = \frac{55.5}{1 - \frac{7.5}{100}} = 60\ mm$

46. Ans: (c)

Sol: $SAR = \frac{Na^+}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}} = \frac{20}{\sqrt{\frac{10+5}{2}}} = 7.30$

47. Ans: (c)

Sol: $b = 5\ m$

$k = 23\ m/day$

$r_2 = 100\ m;\ r_1 = 10\ m$

yield from the aquifer = ?

$h_1 = 5 - 3 = 2\ m$

$h_2 = 5 - 2 = 3\ m$

$$Q = \frac{2\pi kb(h_2 - h_1)}{\log_e\left(\frac{r_2}{r_1}\right)}$$

$$= \frac{2\pi \times 23 \times 5(3-2)}{\ell n\left(\frac{100}{10}\right)} = 100\pi$$

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48. Ans: (d)

49. Ans: (c)

Sol: $P_a = \dfrac{\left(\dfrac{P_1+P_2}{2}\right)A_1 + \ldots\ldots + \left(\dfrac{P_3+P_4}{2}\right)A_3}{A_1 + \ldots\ldots + A_3}$

$$P_a = \frac{(30\times 50)+(40\times 100)+(50\times 150)}{50+100+150}$$

$P_a = 43.33$ cm.

50. Ans: (d)

51. Ans: (a)

Sol: At high temperature since viscosity of water it low, high infiltration capacities are expected.

52. Ans: (c)

Sol: $\phi - \text{index} = \dfrac{P-R}{t} = \dfrac{10-5}{5} = 1$ cm/hr

$= 10$ mm /hr

53. Ans: (c)

Sol: $R = \dfrac{125\times 10^6}{250\times 10^6} = 0.5\,\text{m} = 50\,\text{cm}$

$P = 80$ cm

$K = \dfrac{R}{P} = \dfrac{50}{80} = 0.625$

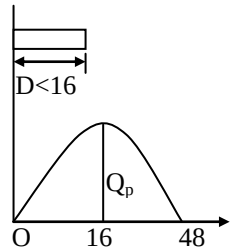
54. Ans: (c)

Sol: $Q_e = 2.778\dfrac{A}{D} = 2.778\times\dfrac{10}{5} = 5.556$ cumecs

55. Ans: (d)

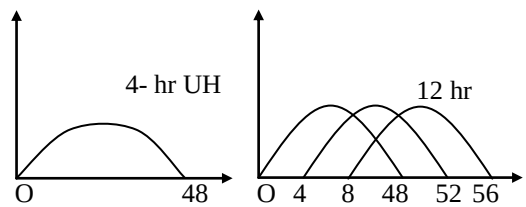
56. Ans: (a)

Sol:



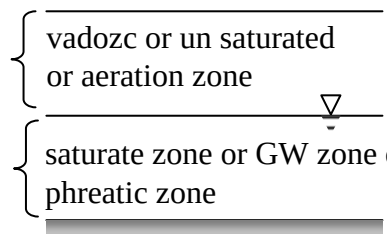
57. Ans: (c)

Sol:



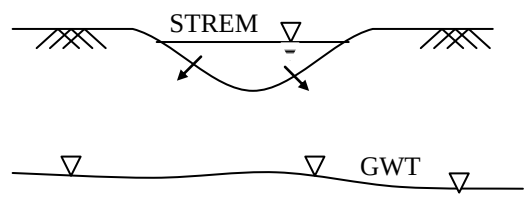
58. Ans: (d)

Sol



59. Ans: (d)

Sol:



60. Ans: (d)

Sol: Advantage of IUH over UH is that it eliminates the restriction of uniform distribution of rainfall in time.

61. Ans: (c)

Sol: Moving average curve smoothens out the extreme variations and indicate the trend on cyclic pattern if any.

62. Ans: (c) **63. Ans: (c)**

64. Ans: (a) **65. Ans: (b)**

66. Ans: (c) **67. Ans: (b)**

68. Ans: (a) **69. Ans: (d)**

70. Ans: (a)

71. Ans: (a)

Sol: From concept of sprinkler irrigation it is preferred in

(i) hot arid zones

(ii) water scarce areas

(iii) steep slopes of field

(iv) Soil has higher permeability

72. Ans: (d)

Sol: The trap efficiency of reservoir decreases with the increasing age, the capacity of reservoir decreases.

Trap efficiency is a function of

(1) Ratio of reservoir capacity to mean annual inflow

(2) Sediment characteristics

73. Ans: (a)

Sol: Both statements true and Statement -(II) is correct explanation of Statement (I).

74. Ans: (a)

Sol: Both statements true and statement-(II) is correct explanation of statement (I)

75. Ans: (d)

Sol: False Statement - (II) true

Solar radiation, light intensity, atmospheric pressure etc climatic factors affect transpiration

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