DETAILED SOLUTIONS

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UPPSC-AE : 2021
ASSISTANT ENGINEER

CIVIL ENGINEERING

Test 6

Full Syllabus Test : Civil Engineering Paper-II + General Studies

ANSWER KEY

1.	(b)	26.	(c)	51.	(d)	76.	(d)	101.	(b)
2.	(b)	27.	(a)	52.	(a)	77.	(c)	102.	(a)
3.	(a)	28.	(d)	53.	(b)	78.	(d)	103.	(d)
4.	(d)	29.	(a)	54.	(b)	79.	(d)	104.	(b)
5.	(b)	30.	(c)	55.	(c)	80.	(c)	105.	(c)
6.	(b)	31.	(d)	56.	(b)	81.	(d)	106.	(c)
7.	(c)	32.	(d)	57.	(b)	82.	(a)	107.	(c)
8.	(d)	33.	(a)	58.	(d)	83.	(c)	108.	(c)
9.	(a)	34.	(b)	59.	(c)	84.	(b)	109.	(a)
10.	(c)	35.	(a)	60.	(d)	85.	(a)	110.	(b)
11.	(a)	36.	(b)	61.	(c)	86.	(b)	111.	(a)
12.	(a)	37.	(b)	62.	(a)	87.	(a)	112.	(a)
13.	(c)	38.	(c)	63.	(b)	88.	(c)	113.	(b)
14.	(c)	39.	(c)	64.	(d)	89.	(d)	114.	(c)
15.	(d)	40.	(d)	65.	(c)	90.	(c)	115.	(b)
16.	(c)	41.	(b)	66.	(c)	91.	(b)	116.	(a)
17.	(c)	42.	(a)	67.	(a)	92.	(a)	117.	(b)
18.	(c)	43.	(c)	68.	(d)	93.	(b)	118.	(b)
19.	(a)	44.	(c)	69.	(b)	94.	(b)	119.	(a)
20.	(d)	45.	(a)	70.	(a)	95.	(b)	120.	(a)
21.	(b)	46.	(a)	71.	(a)	96.	(b)	121.	(b)
22.	(b)	47.	(b)	72.	(b)	97.	(c)	122.	(d)
23.	(d)	48.	(b)	73.	(d)	98.	(c)	123	(d)
24	(a)	49.	(d)	74.	(b)	99.	(c)	124.	(d)
25.	(c)	50.	(c)	75.	(a)	100.	(c)	125.	(a)

DETAILED EXPLANATIONS

1. (b)

$$\sigma_c = 0.15 = \frac{(NPSH)_{min}}{H}$$

$$(NPSH)_{min} = 0.15 \times 30 = 4.5 \text{ m}$$

$$NPSH = \frac{(P_{atm})_{abs}}{\rho g} - \frac{P_v}{\rho g} - Z_s - h_L$$

$$4.5 = \frac{102}{10} - \frac{3}{10} - Z_s - 0.3$$

$$4.5 = 10.2 - 0.3 - Z_s - 0.3$$

$$Z_s = 5.1 \text{ m}$$

2. (b)

For geometrically similar turbines of fixed diameter ratio, the unit speed

$$N_u = \frac{N}{\sqrt{H}}$$

$$\frac{N_1}{\sqrt{H_1}} = \frac{N_2}{\sqrt{H_2}}$$

$$\frac{100}{\sqrt{30}} = \frac{N_2}{\sqrt{18}}$$

$$N_2 = 100\sqrt{\frac{18}{30}}$$

$$N_2 = 100\sqrt{\frac{3}{5}}$$

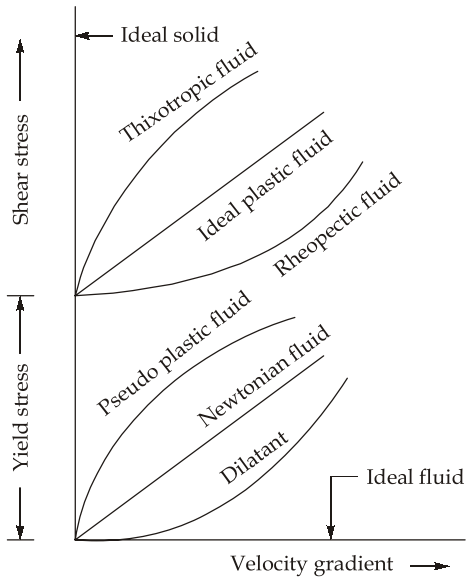
$$= 100 \times \frac{1.732}{2.236} = 77.5 \text{ rpm}$$

3. (a)

$$H = 5.5 \text{ m}, x = 1.5 \text{ m}, y = 0.12 \text{ m}$$

$$C_v = \frac{x}{\sqrt{4yH}} = \frac{1.5}{\sqrt{4 \times 0.12 \times 5.5}} = 0.923$$

4. (d)



5. (b)

At the verge of tipping, centre of pressure must coincide with pivot.

$$h^* = \frac{2}{3}\times 4.8$$

$$h = 4.8 - \frac{2}{3}\times 4.8$$

$$= \frac{1}{3}\times 4.8$$

$$h = 1.6 \text{ m}$$

6. (b)

At stagnation point, $u = 0$

$$v = 0$$

$$x + y + 1 = 0 \quad \text{...(i)}$$

and $x - y - 2 = 0 \quad \text{...(ii)}$

Using eq. (i) and (ii)

$$2x - 1 = 0$$

$$x = \frac{1}{2} = 0.5$$

7. (c)

Euler's equation

$$\frac{\partial v}{\partial t} + \frac{1}{\rho}\frac{\partial p}{\partial s} + g\frac{dz}{ds} + v\frac{\partial v}{\partial s} = 0$$

Consider the standard units of all the terms,

We find, $\frac{L}{T^2}$

Therefore, acceleration.

8. (d)

For a turbulent flow through a pipe, KE correction factor value varies from 0.01 to 1.2.

9. (a)

$$\text{TEL} = \frac{P}{\rho g} + Z + \frac{V^2}{2g}$$

$$\text{HGL} = \frac{P}{\rho g} + Z$$

$$\text{TEL} - \text{HGL} = \frac{V^2}{2g} = \text{Velocity head}$$

10. (c)

$$\eta = \frac{\text{Power transfer}}{\text{KE}_{\text{initial}}} \times 100$$

$$\text{Power transfer} = \rho A (v-u)^2 \times u$$

$$= 1000 \times \frac{1}{4} \times \frac{22}{7} \times 7^2 (10-5)^2 \times 5$$

$$= 1000 \times \frac{1}{4} \times 22 \times 7 \times 5^2 \times 5$$

$$\text{KE}_i = \frac{1}{2}\rho\left(\frac{\pi}{4}d^2\right)V^3 = \frac{1}{2} \times 1000 \times \frac{1}{4} \times \frac{22}{7} \times 7^2 \times 10^3$$

$$\text{KE}_i = 500 \times \frac{1}{4} \times 22 \times 7 \times 10^3$$

$$\eta = \frac{1000 \times \frac{1}{4} \times 22 \times 7 \times 5^2 \times 5}{500 \times \frac{1}{4} \times 22 \times 7 \times 10^3} \times 100$$

$$\eta = \frac{250}{1000} \times 100 = 25\%$$

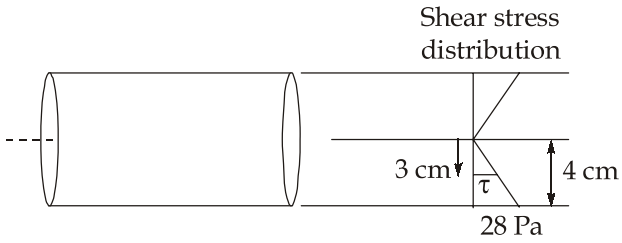
11. (a)

$$V_r = \sqrt{L_r}$$

$$\frac{V_m}{V_p} = \sqrt{\frac{1}{25}}$$

$$V_m = \frac{V_p}{5} = \frac{10}{5} = 2 \text{ m/s}$$

12. (a)



$$\frac{28}{4} = \frac{\tau}{3}$$

$$\tau = 21 \text{ Pa}$$

13. (c)

For laminar flow over a flat plate:

$$C_{fan} = \frac{0.664}{\sqrt{\text{Re}_x}}$$

14. (c)

$$\frac{Q^2T}{gA^3} = 1$$

$$\frac{Q^2}{g} = \text{Constant}$$

$$\frac{A^3}{T} = \text{Constant}$$

$$\frac{\left[f(b,y)\right]^3}{g(b,y)} = \text{Constant}$$

b, y = Channel geometry

15. (d)

$$E = y + \frac{V^2}{2g}$$

$$E = 1.5 + \frac{(2)^2}{2\times 10}$$

$$E = 1.5 + \frac{4}{20} = 1.5 + 0.2$$

$$E = 1.7 \text{ m}$$

16. (c)

$$q = 10 \text{ m}^3/\text{s/m}$$

$$V = 20 \text{ m/s}$$

$$q = V \times y$$

$$10 = 20 \times y$$

$$y = 0.5 \text{ m} = y_1$$

$$\frac{y_2}{y_1} = \frac{1}{2}\left(-1+\sqrt{1+8F_1^2}\right) \quad \text{...(i)}$$

$$F_1 = \frac{q}{y_1\sqrt{g \times y_1}} = \frac{10}{0.5\sqrt{10 \times 0.5}}$$

$$F_1 = 4\sqrt{5} \quad \text{...(ii)}$$

Using eq. (i) and (ii)

$$\frac{y_2}{y_1} = \frac{1}{2}\left(-1+\sqrt{1+8\times16\times5}\right)$$

$$y_2 = 6.08 \text{ m} \simeq 6 \text{ m}$$

17. (c)

$$L_{NH} = \frac{\text{Area}\left(\text{km}^2\right)}{50} = \frac{100000}{50} = 2000 \text{ km}$$

$$L_{SH} = \text{maximum}\begin{cases}\dfrac{\text{Area}\left(\text{km}^2\right)}{25} \\ 62.5\ (\text{No. of town}) - L_{NH}\end{cases}$$

$$= \text{maximum}\begin{cases}\dfrac{100000}{25} = 4000 \text{ km} \\ 62.5(150) - 2000 = 7375 \text{ km}\end{cases}$$

$\therefore$ $L_{SH} = 7375$ km

18. (c)

Assuming $L_{vc} >$ SD,

$$L_{\text{valley curve}} = \frac{NS^2}{1.5+0.035(S)}$$

$$= \frac{\left|-\frac{1}{40}-\left(+\frac{1}{25}\right)\right| \times 80^2}{1.5+0.035(80)}$$

$$= \frac{416}{4.3} = 96.74 \text{ m}$$

19. (a)

Extra widening

$$W_e = \frac{nl^2}{2R} + \frac{V}{9.5\sqrt{R}}$$

$$= \frac{2\times6^2}{2\times256} + \frac{95}{9.5\sqrt{256}}$$

$$= \frac{36}{256} + \frac{10}{16}$$

$$= \frac{196}{256} = 0.7656 \text{ m} \simeq 0.765 \text{ m}$$

20. (d)

$$R_{\text{ruling}} = \frac{V^2}{(e+f)127}$$ For e = 0.07, f = 0.15

$$R_{\text{ruling}} = \frac{V^2}{27.94} = \frac{90^2}{27.94} = 289.90 \text{ m} \simeq 290 \text{ m}$$

22. (b)

$$\text{Braking distance} = \frac{V^2}{2gf\eta_b} = \frac{(25)^2}{2\times 10\times 0.35\times 0.70} = 127.55 \text{ m}$$

23. (d)

$$\lambda = \text{Rate of arrival} = \frac{120}{3600} = \frac{1}{30} \text{ veh/sec}$$

Probability that vehicle will come within 60 sec

i.e., $$P = 1 - e^{-\frac{1}{30}\times 60} = 1 - e^{-2} = 1 - \frac{1}{e^2}$$

24 (a)

We know that, density of vehicle at time of maximum flow, is given by

Given, $$K_0 = \frac{K_J}{2} = 50 \text{ veh/hr}$$

$\therefore$ $$K_J = 100 \text{ veh/km}$$

$$q_{\max} = \frac{V_{sf}}{2} \times \frac{K_J}{2}$$

$$2250 = \frac{V_{sf}}{2} \times 50$$

$$V_{sf} = 90 \text{ kmph}$$

$\therefore$ $$V = V_{sf}\left(1 - \frac{K}{K_J}\right)$$

$$V = 90\left(1 - \frac{75}{100}\right)$$

$$V = 22.5 \text{ kmph}$$

25. (c)

$$V_1 = 60 \text{ kmph}, \; n_1 = 60$$
$$V_2 = 80 \text{ kmph}, \; n_2 = 30$$

$$V_3 = 100 \text{ kmph}, n_3 = 10$$

$$\text{Time mean speed} = \frac{n_1V_1 + n_2V_2 + n_2V_3}{n_1 + n_2 + n_3}$$

$$= \frac{60(60) + 80(30) + 100(10)}{60 + 30 + 10}$$

$$= 70 \text{ kmph}$$

27. (a)

$$l = \left[\frac{Eh^3}{12k\left(1-\mu^2\right)}\right]^{1/4}$$

where
E = Modulus of elasticity of concrete
h = Slab thickness
μ = Poisson's ratio of concrete
k = Modulus of subgrade reaction of soil

28. (d)

$$\frac{1000V}{S} = \frac{3600}{h_t}$$

$$\frac{1000 \times \left(\frac{90}{3.6}\right)}{S} = \frac{3600}{3}$$

$$S = 20.83 \text{ m} \simeq 21 \text{ m}$$

30. (c)

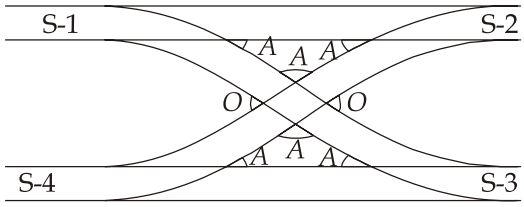
$$G_t = \frac{w_1 + w_2}{\frac{w_1}{G_1} + \frac{w_2}{G_2}} = \frac{100}{\frac{5}{1} + \frac{95}{2.5}} = 2.32$$

$$\%V_a = \frac{G_t - G_m}{G_t} \times 100 = \frac{2.32 - 2.23}{2.32} \times 100 = 4.12\%$$

31. (d)

Hard bitumen are highly viscous and require higher temperature to became soft.

32. (d)



33. (a)

$$l = 4GN + (D - G)N - G\sqrt{1+N^2}$$

$$= 4 \times 1.676 \times 12 + (8 - 1.676) \times 12 - 1.676\sqrt{1+12^2}$$

$$= 136.15 \text{ m}$$

Alternatively, $l \simeq 2GN + DN$

l = 2 (1.676) (12) + 8 (12) = 136.22 m $\simeq$ 136 m

35. (a)

$$\text{Compensated grade} = \frac{1}{200} - \frac{0.04}{100}(4) = 1 \text{ in } 294.11 \simeq 1 \text{ in } 295$$

36. (b)

Hauling capacity, H.C. = μWN

$$= 0.25 \times (11 \times 2) \times \frac{8}{2} = 22t$$

37. (b)

Standard Atmospheric Temperature,

SRT = 15 – 0.0065 (Elevation over MSL)

= 15 – 0.0065 (1000)

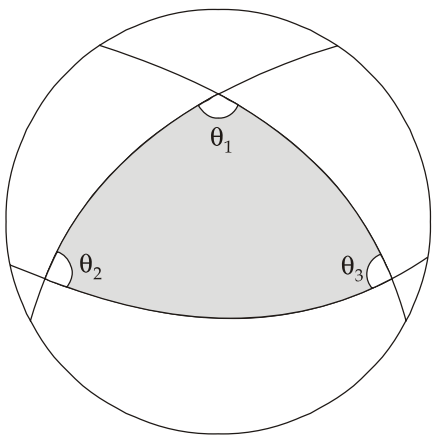
= 8.5°C

Airport Reference Temperature,

$$\text{ART} = T_a + \frac{T_m - T_a}{3} = 25 + \frac{40 - 25}{3} = 30°C$$

ΔT = 30 – 8.5 = 21.5°C

39. (c)



If shaded area > 195.5 km^2, then $\theta_1 + \theta_2 + \theta_3 = 180° \, 0' \, 1''$

40. (d)

Type of map	Numerical scale
Building	1 cm = 10 m
Cadastral	1 cm = 10 m to 50 m
Forest	1 cm = 250 m
Topographical	1 cm = 2.5 km

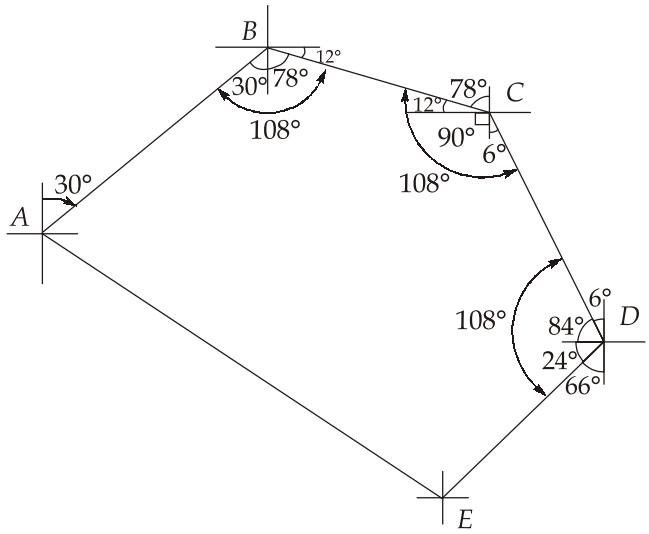
41. (b)

Low temperature at time of measurement and sag in chain/tape require –ve correction.

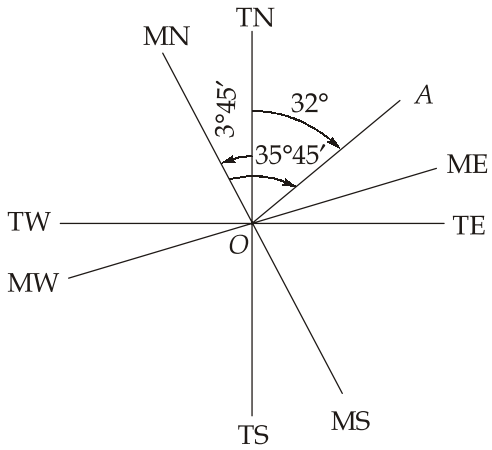
42. (a)

For a pentagon, the interior angle is = 108°

Bearing of $CD = S\ 6°E$



43. (c)



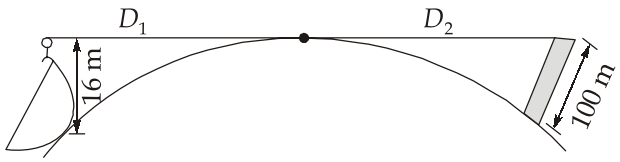
True fore bearing = 32°

∴ True back bearing = 180° + 32° = 212°

46. (a)

$$a_1 = 1.700 \text{ m}, \quad b_1 = 2.250 \text{ m}$$
$$a_2 = 0.900 \text{ m}, \quad b_2 = 1.500 \text{ m}$$
$$\Delta h = \frac{(a_1 - b_1) + (a_2 - b_2)}{2}$$
$$= \frac{1.7 - 2.250 + 0.9 - 1.5}{2} = 0.575 \text{ m}$$

47. (b)



$$D_1 = 3.8547\sqrt{h_1} = 15.4188 \text{ km}$$
$$D_2 = 3.8547\sqrt{h_2} = 38.547 \text{ km}$$
$$D_1 + D_2 = 53.9658 \text{ km} \simeq 54 \text{ km}$$

48. (b)

Back sight	Intermediate sight	Fore sight	Remarks
1.565			
1.250		0.900	Change station
	2.450		
1.870		3.500	Change station
	1.980		
	0.865		
		1.285	

49. (d)

$$l \sin\alpha = \frac{l}{r}$$
$$l \sin 30° = \frac{l}{r}$$
$$r = \text{cosec } 30° \text{ i.e. } 2 \text{ m}$$

Means, offset must be measured with an accuracy of 1 in 2 m.

50. (c)

$$\text{Area visible lengthwise} = 30 \times 0.4 \times 100 \times 10^{-3} = 1.2 \text{ km}$$
$$\text{Number of photo required} = \frac{30}{1.2} + 1 = 25 + 1 = 26$$
$$\text{Area visible widthwise} = 30 \times 0.7 \times 100 \times 10^{-3} = 2.1 \text{ km}$$

$$\text{Number of photo required} = \frac{10}{2.1} + 1 = 4.76 + 1 = 5.76 \simeq 6$$

Total number of photograph required = 26 × 6 = 156

51. (d)

Microwave has wavelength of 0.1 – 30 cm which is longer wavelength which can penetrate cloud.

52. (a)

Residence time, $T_r = \frac{S}{Q}$

$$= \frac{13000\,\text{km}^3}{260000\,\text{km}^3/\text{year}} = 0.05\,\text{year}$$

$$= 18.25 \text{ days}$$

53. (b)

- Symon's raingauge is a standard non-recording type of raingauge.
- 10% of total raingauge should be of self recording type.

55. (c)

Cetyl alcohol (hexadecanal) and stearyl alcohol (octadecanal) form monomolecular layers on the water surface and hence, reduce the evaporation.

56. (b)

$$\frac{V_1}{V_{128}} = \left(\frac{1}{128}\right)^{1/7}$$

$$V_1 = \frac{1}{2} \times 60 = 30 \text{ kmph}$$

59. (c)

$$Q_e = 2.778 \frac{A}{D}\ \text{m}^3/\text{sec}$$

$$Q_e = 2.778 \times \frac{270}{3}\ \text{m}^3/\text{sec}$$

$$Q_e = 250.02\ \text{m}^3/\text{s} \simeq 250\ \text{m}^3/\text{s}$$

60. (d)

Whereas hydraulic flood-routing method use both continuity and momentum equation.

61. (c)

Basin lag (t_p) is the time interval from mid-point of unit rainfall excess to the peak of unit hydrograph.

$\therefore$ $T_p = t_p + \frac{t_r}{2}$

$$T_p = 28 + \frac{6}{2} = 31 \text{ hours}$$

63. (b)

As per Lacey's theory,

$$\therefore \quad f \propto \text{mm}^{1/2}$$

65. (c)

$$\text{Total volume of water required} = 40 \times 10^4\ \text{m}^2 \times 25 \times 10^{-3}\ \text{m}$$
$$= 10^4\ \text{m}^3$$
$$\text{Discharge required} = \frac{\text{Volume}}{\text{Time}}$$
$$= \frac{10^4 \times 10^3\, l}{20 \times 24 \times 3600\, s}$$
$$= 5.78\ \text{lps}$$

67. (a)

Lane's weighted theory gives more weightage to vertical creep than the horizontal creep whereas the Bligh's creep theory gives equal weightage to horizontal and vertical creep.

69. (b)

$$Q_{\text{dominant}} = \frac{1}{2} \text{ to } \frac{2}{3} \text{ of } Q_{\text{max.}}$$
$$Q_{\text{dominant}} = \frac{9}{16} Q_{\text{max.}} \text{(generally)}$$

70. (a)

For no overturning of elementary dam,

$$B \geq \frac{H}{\sqrt{2(G-C)}}$$
$$B \geq \frac{60}{\sqrt{2(2.4-1)}}$$
$$B \geq 35.85\ \text{m}$$

71. (a)

- Trap efficiency is a function of capacity inflow ratio.
- Trap efficiency increases with increase in capacity inflow ratio.

73. (d)

The asthenosphere is highly viscous, mechanically weak and ductile region of upper mantle of earth mainly responsible for volcanic activity.

74. (b)

Streak is an important diagnostic property of coloured and opaque minerals, especially of ore groups.

75. (a)

As per GOI manual.

Population	Peak factor
<50,000	3
50,000 - 20000	2.5
>200000	2

77. (c)

$$Q = \frac{kL\left(H^2 - h^2\right)}{2R}$$

$$\Rightarrow \quad 500 = \frac{80 \times 40 \times (49 - 9)}{2 \times R}$$

$$\Rightarrow \quad R = 128 \text{ m}$$

79. (d)

Odour can be removed by adsorbing agents such as activated carbon.

80. (c)

$$0.5\text{N } H_2SO_4 = 0.5 \text{ gm eq./lit.}$$

$$\text{in 40 ml of Solution} = \frac{0.5}{1000} \times 40 = 0.02 \,\text{gm eq. of } H_2SO_4$$

Now,

$$\underset{1\,\text{gm eq.}}{H_2SO_4} \rightleftharpoons \underset{2\,\text{gm eq.}}{2H^+} + \underset{1\,\text{gm eq.}}{SO_4^{2-}}$$

1 gm equivalent of H_2SO_4 gives 2 gm equivalent of H^+

So, gm equivalent of $H^+ = 2 \times 0.02$

$H^+ = 0.04$ gm equivalent

81. (d)

E-coli or B-coli are harmless aerobic mirco-organisms which are found residing in the intestine of all warm blooded animals.

82. (a)

- To avoid mud pall formation cleaning is done with caustic soda (NaOH).
- Air binding can be avoided by keeping water temperature below certain level.

83. (c)

$$\text{Chlorine required} = \text{Chlorine demand + residual chlorine}$$

$$= \frac{(2 + 0.2) \times 40 \times 10^6}{10^6} \text{kg/d} = 88 \text{ kg/d}$$

Available chlorine in bleaching powder = 40%

$$\text{Amount of bleaching powder} = \frac{88}{0.4} = 220 \,\text{kg/d}$$

84. (b)

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

$$\Rightarrow \quad V = \frac{P}{\mu G^2} = \frac{50 \times 10^3}{10^6 \times 10^{-3}} = 50 \text{ m}^3$$

$$\Rightarrow \quad t_d = \frac{V}{Q} = \frac{50}{72000} \times 24 \times 60 = 1 \text{ minutes}$$

85. (a)

Fire flow test is carried to determine the ability of distribution system to transmit water with adequate residual pressure.

86. (b)

$$Q_{\text{individual}} = \frac{120 \times 50,000}{10^6} MLD = 6\, MLD$$

$$Q_{\text{industry}} = 78 - 6 = 72 \text{ MLD}$$

$$\text{Population equivalent} = \frac{Q_{\text{industry}}}{Q_{\text{individual}}} = \frac{72}{6} = 12$$

87. (a)

At higher temperature k_D will be higher, and rate of BOD consumption will be higher.

88. (c)

$$\text{For discharge to be maximum: } \frac{d}{D} = 0.95$$

$$d = 0.95 \times 1.2$$

$$d = 1.14 \text{ m}$$

89. (d)

$$\text{Volume of fresh sludge} = 75 \text{ m}^3/\text{day}$$

$$\text{Volume of digested sludge} = \frac{V_A[100 - P_A]}{[100 - P_B]}$$

$$= \frac{75 \times (100 - 95)}{(100 - 75)} = 15 \text{ m}^3/\text{day}$$

$$t_D = 30 \text{ days}$$

$$\text{Volume of digester} = \left[v_1 - \frac{2}{3}(v_1 - v_2)\right] t_D$$

$$= \left[75 - \frac{2}{3}(75 - 15)\right] 30$$

$$= 1050 \text{ m}^3$$

91. **(b)**

Detention period for septic tank = 12 – 36 hrs.

Cleaning period for septic tank = 6 – 12 months

92. **(a)**

Putrescible waste are those which can degraded by the micro-organism, i.e. they are organic in nature.

94. **(b)**

$$Q = 15\ m^3/s$$

$$B = 3\ m,\ y = 1.2\ m$$

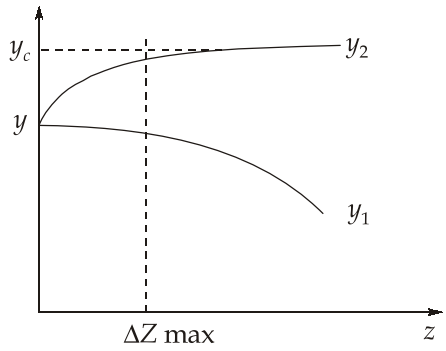
$$F_r^2 = \frac{Q^2T}{A^3g} = 1.45$$

$$F_r = 1.203$$

Since, $F_r > 1$

Hence super critical flow.

For channel with a hump and supercritical flow, variation of y_1 and y_2 w.r.t z is given as



95. **(b)**

For a given specific energy the discharge is maximum when flow is critical.

96. **(b)**

$$\%\text{Slip} = \frac{Q_{th} - Q_{act}}{Q_{th}} \times 100 = \left(1 - \frac{Q_{act}}{Q_{th}}\right) \times 100$$

$$\Rightarrow \quad \frac{5}{100} = \left(1 - \frac{9.5}{Q_{th}}\right)$$

$$\Rightarrow \quad Q_{th} = 10\ \text{lps}$$

$$P_{th} = \rho Q_{th} g H$$

$$P_{th} = 1000 \times 10 \times 10^{-3} \times 9.81 \times 20$$

$$= 1962\ \text{Watt}$$

97. **(c)**

$$\text{Speed ratio} = \frac{\text{Wheel velocity}}{\sqrt{2gH}} = \frac{25}{\sqrt{2\times10\times100}} = 0.56$$

98. **(c)**

- Governor maintain constant speed while load fluctuates.
- For Pelton wheel inlet angle is 0°.

99. **(c)**

Streaking is surface defect of pavement. It occurs when alternate heavy and lean line of bitumen in longitudinal and transverse direction.

100. **(c)**

As per greenshield stream model, $q_{max} = \frac{K_J U_{SF}}{4}$

As per greenberg's logarithmic model, $q_{max} = \frac{K_J U_{SF}}{2e}$

As per underwood's exponential model, $q_{max} = \frac{K_J U_{SF}}{2e}$

101. **(b)**

Tawa project is on the Narmada river not on the Krishna River.

102. **(a)**

Lake Tanganyika is the second deepest lake (1470 meters) after Lake Baikal and the longest freshwater lake in the world (660 km).

103. **(d)**

- According to the National Bureau of Soil Survey, India has been divided into 20 Agro-Ecological Zones (AEZs).
- AEZ is as informed as possible in terms of physiography, climate, length of growing period and soil type for macro level land-use planning and effective transfer of technology.

104. **(b)**

Uttar Pradesh ranks first in the production of Wheat and Sugarcane. U.P. also ranks first in Potatoes production during 2019-20.

107. **(c)**

The Vinaya Pitaka is a Buddhist scripture, one of the three parts that make up the Tripitaka. The other two parts of the Tripitaka are the Sutra Pitaka and the Abhidharma Pitaka. Its primary subject matter is the monastic rules of conduct for monks and nuns.

108. **(c)**

Green Rating for Integrated Habitat Assessment (GRIHA), is the national rating system of India for any completed construction. It is an assessment tool to measure and rate a building's environmental performance.

110. (b)

Sutrakritanga is the second agama of the 12 main angas of the Jain canons. According to the Svetambara tradition, it was written by Gandhara Sudharmasvami in Ardhamagadhi Prakrit.

111. (a)

- The Davos Dialogue agenda marked the launch of the World Economic Forum's Great Reset Initiative in the post-COVID world.
- The world must act jointly and swiftly to revamp all aspects of our societies and economies, from education to social contracts and working conditions. Every country must participate, and every industry, from oil and gas to tech, must be transformed. In short, there should be a 'Great Reset' of capitalism.

112. (a)

Special Protection Group (SPG) was formed in 1985 after the assassination of Prime Minister Indira Gandhi as an executive body on the recommendation of the Birbal Nath committee. The SPG Act was enacted by Parliament in 1988.

113. (b)

The PRAGYATA guidelines include eight steps of online/digital education that is, Plan- Review-Arrange- Guide- Yak(talk)- Assign- Track- Appreciate. The guidelines on Digital/Online Education provide a roadmap or pointers for carrying forward online education to enhance the quality of education.

114. (c)

Broad money is the total stock of money that is circulating in an economy. It is also called money supply.

115. (b)

- Uttar Pradesh Government launched the 'MyGov-Meri Sarkar' portal, through which, the government will receive feedback from the people.
- The portal would help the people of the state to communicate their views, suggestions and feedback to the government, leading to public participation and good governance.

116. (a)

- The concept of carbon credits emerged during the Kyoto Protocol discussions and is an integral part of today's environmental economics.
- Carbon credits basically refer to certificates giving the beholder the right to emit 1 tonne of carbon dioxide or its equivalent.

117. (b)

- Only those financial bills which contain provisions exclusively on matters listed in Article 110 of the constitution are called Money Bills.
- The question of whether a financial bill is a money bill or not is decided by the Speaker. Such a bill needs to be endorsed by the Speaker when passed by Lok Sabha and sent to Rajya Sabha.

118. (b)

Cadmium is most commonly used as a control rod in nuclear reactors. Cadmium absorbs neutrons in the reactors, preventing them from creating additional fission events.

119. (a)

- Anushilan Samiti was a Bengali organisation in the first quarter of the 20th century that supported revolutionary violence as the means for ending British rule in India.
- Barindra Kumar Ghosh, a leader of the Anushilan Samiti, was brought to trial in the so-called Alipore Conspiracy Case. The Alipur trial led to a series of arrests and raids culminating in the divisions in the Anushilan Samiti.

120. (a)

Open Market Operations (OMO) is the sale and purchase of government securities and treasury bills by RBI or the central bank of the country. The objective of OMO is to regulate the money supply in the economy.

121. (b)

$$(x+3)\left(6x^2+5x-4\right)=(x+3)(2x-1)(3x+4)$$

$$\left(2x^2+7x+3\right)(x+3)=(2x+1)(x+3)(x+3)$$

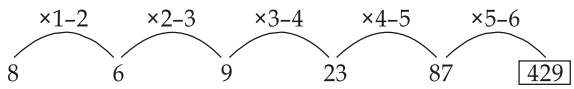
$$LCM=(2x+1)(2x-1)(x+3)^2(3x+4)$$

$$=\left(4x^2-1\right)(x+3)^2(3x+4)$$

122. (d)

This series involves multiplication and subtraction of previous term. Consider the following pattern

$8 \times 1 - 2 = 6$
$6 \times 2 - 3 = 9$
$9 \times 3 - 4 = 23$
$23 \times 4 - 5 = 87$
$87 \times 5 - 6 = 429$



123 (d)

Rekha and David drive a car. As Anil speaks Tamil and shabnam speaks Marathi, then one from the Rekha and David definitely speaks Tamil.

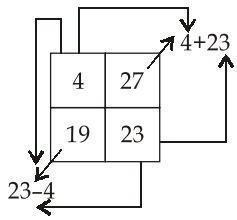
Therefore option (d) is correct.

124. (d)

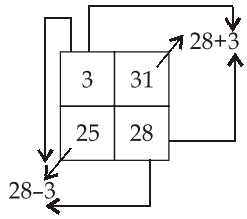
As it is given in statement 1 that only rich can afford to travel through air. Therefore, it can be concluded that all those who travel by air are rich.

125. (a)

The pattern of number in first figure is



Therefore the second figure would be



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