Branch: CIVIL ENGINEERING _MOCK-C SOLUTIONS

01. Ans: 2.44 **Range : 2.4 to 2.6**

Sol: Vehicle damage factor

$$= \left(\frac{\text{axle load}}{\text{standard axle load}}\right)$$

Vehicle damage factor $\propto$ (alxe load)^4

$$\frac{VDF_1}{VDF_2} = \left(\frac{10}{8}\right)^4 = 2.44$$

02. Ans: (B)

Sol: Marshall flow value is Deformation at failure point in units of 0.25mm. Marshall stability is the Maximum load before failure.

03. Ans: 1.22 **No range**

Sol: $\frac{dy}{dx} = y + x$

$x_o = 0,\ y_o = 1$

$x_1 = x_o + h = 0.1$

$x_2 = x_o + 2h = 0.2$

$y_1 = y_o + h f(x_o, y_o)$

$= 1 + (0.1)(1)$

$= 1.1$

$y_2 = y_1 + h f(x_1, y_1)$

$= 1.1 + 0.1 [0.1 + 1.1]$

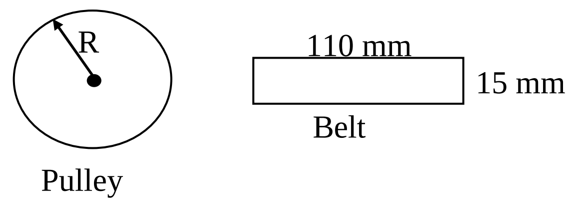
$= 1.1 + 0.12$

$= 1.22$

04. Ans: (C)

Sol: $f_{max} = 5$ MPa

E = 100 MPa



$$y_{max} = \frac{t}{2} = \frac{15}{2} = 7.5 \text{ mm}$$

$$\Rightarrow \text{we have } \frac{f_{max}}{y_{max}} = \frac{E}{R}$$

$$\Rightarrow R = \frac{E}{f_{max}} \times y_{max}$$

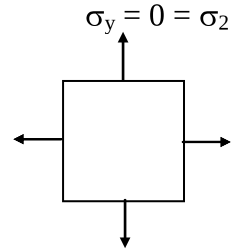
$$= \frac{100}{5} \times 7.5 = 150 \text{ mm}$$

$\therefore$ Diameter = D = 2 R = 2 (150) = 300 mm

05. Ans: (B)

Sol:

$\sigma_y = 0 = \sigma_2$



$$\sigma_x = \frac{4P}{\pi d^2} = \frac{4 \times 60 \times 10^3}{\pi \times 25^2}$$

$= 122.23$ MPa

$= \sigma_1$

$$\tau_{max} = \frac{\sigma_1 - \sigma_2}{2} = \frac{\sigma_1}{2} = \frac{\sigma_x}{2} = 61.11 \text{ MPa}$$

06. Ans: 2.12 **(Range: 2 to 2.3)**

Sol: f(x, y, z) = 2y +z

$$\text{Directional derivate} = (\nabla f)p.\frac{\bar{a}}{|\bar{a}|}$$

$$\nabla f = j\frac{\partial f}{\partial y} + k\frac{\partial f}{\partial z} = j.2 + \bar{k}.1 = 2\,\bar{j} + \bar{k}$$

$$\therefore \text{ Directional derivate} = \left(2\,\bar{j} + \bar{k}\right).\frac{\left(\bar{j} + \bar{k}\right)}{\sqrt{2}}$$

$$= \frac{2+1}{\sqrt{2}} = \frac{3}{\sqrt{2}} = 2.12$$

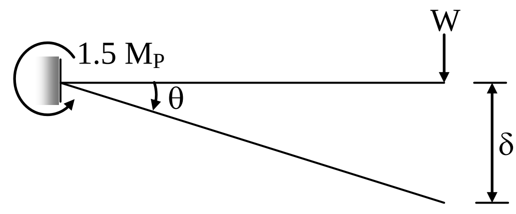
07. Ans: (A)

Sol: $D_S = 0$ [Determinate structure]

No. of possible hines N = 2 [at A & B]

No. of plastic hinges required to form a mechanism n = D_{s+1} = 1

Assume plastic hinge at 'A'



External work done

'We' = Force × Displacement

= W × δ

= W × Lθ

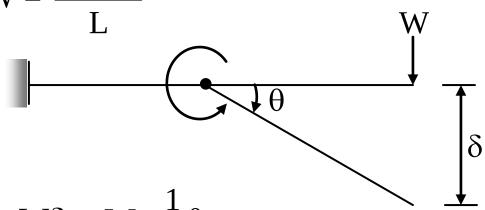
Internal workdone 'W_i' = Moment × Rotation

$= 1.5\, M_p \times \theta$

$W_e = W_i$

$WL\theta = 1.5\, M_P\, \theta$

$$W = \frac{1.5 M_P}{L}$$



$$W_e = W\delta = W \times \frac{1}{2}\theta$$

$W_i = MP\theta$

$W_e = W_i$

$$W \times \frac{L}{2}\theta = M_P\theta$$

$$W = \frac{2M_P}{L}$$

Collapse load will be minimum of two values i.e 1.5

08. Ans: (D)

09. Ans: (C)

Sol: Double mass curve is used to check the consistency of the Rainfall data.

10. Ans: (A)

Sol: $I_P = 70 - 30 = 40\%$

I_P of A-line = 0.73 (W_L – 20) = 36.5%

Since I_P of soil is > I_P of A-line and W_L is > 50%

∴ Soil is CH

11. Ans: (A)

Sol: $i_C = (G-1)(1-n) = (2.67-1)(1-0.4) = 1$

$$F = \frac{i_c}{i}$$

$$\therefore \text{ permissible gradient, } i = \frac{i_c}{F} = \frac{1}{5} = 0.20$$

12. Ans : (A)

Sol: $h_1 = 40$ cm,

$h_2 = 40 - 5 = 35$ cm ,

t = 9 min

L = 6 cm,

A = 50 cm^2,

a = 0.5 cm^2.

$$k = \frac{aL}{At}\log_e\left(\frac{h_1}{h_2}\right)$$

$$= \frac{0.5 \times 6}{50 \times 9}\log_e\left[\frac{40}{35}\right] = 8.9 \times 10^{-4} \text{ cm/min}$$

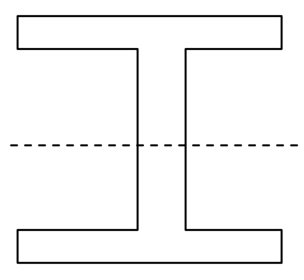
$$= \frac{8.9 \times 10^{-4}}{60} = 1.48 \times 10^{-5} \text{ cm/sec}$$

13. Ans: (A) **14. Ans: (A)**

15. Ans: (D)

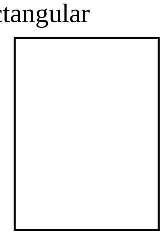
16. Ans: 1.32 **Range: (1.28 to 1.4)**

Sol: I-beam –bending about major axis



$SF_1 = 1.13$

Rectangular



$SF_2 = 1.5$

$\therefore$ Ratio = $\dfrac{1.5}{1.13} = 1.32$

17. Ans: 5 No Range

Sol: Let X = Amount the player wins in rupees

The probability distribution for X is given below.

Number of heads	0	1	2
X	x	1	3
P(X)	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{1}{4}$

For the game to be fair we have to find x, so that E(X) = 0

$\Rightarrow x.\left(\frac{1}{4}\right) + 1.\left(\frac{2}{4}\right) + 3.\left(\frac{1}{4}\right) = 0$

$\Rightarrow x = 5$

$\therefore$ Number of rupees, the player has to lose if no head occur = 5.

18. Ans: (B)

Sol: The shear strain rate is

$$\gamma_{xy} = \frac{1}{2}\left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}\right) = \frac{1}{2}(0+0) = 0$$

19. Ans: (B)

Sol: efficiency of transmission $= \dfrac{H - h_f}{H} \times 100$

$$= \frac{H - H/3}{H} \times 100 = \frac{2}{3} \times 100 = 66.67\%$$

20. Ans: 24 No Range

Sol: Given that F(x) = f(g(x))

$\Rightarrow F^1(x) = f^1(g(x)).\ g^1(x)$

($\because$ by chain rule)

$\Rightarrow F^1(5) = f^1(g(5)).\ g^1(5)$

$\Rightarrow F^1(5) = f^1(-2)\ .6$

$\therefore F^1(5) = (4)\ (6) = 24$

21. Ans: (C) **22. Ans: (B)**

23. Ans: (B)

24. Ans : (B)

Sol: Adhesion of the bitumen to an aggregate in the presence of water can be known by static immersion test

25. Ans: 4 No Range

Sol: The constant term in the characteristic equation of a matrix is equal to the determinant of a matrix

$\therefore$ det(A) = 4

26. Ans: (B)

Sol: line equation of AB is,

Here A = (1 , 1) B = (3 , 2)

$$y - 1 = \frac{1}{2}(x-1) \Rightarrow y = \frac{x+1}{2}$$

$$dy = \frac{dx}{2}$$

$$\therefore \int_C \text{Re}\ z\ dz = \int_1^3 x(dx + i dy)$$

$$= \int_1^3 x\left(dx + i\frac{dx}{2}\right) = \left(1 + \frac{i}{2}\right)\left[\frac{x^2}{2}\right]_1^3$$

$$= 4 + 2i$$

27. Ans: (A)

Sol: The length of weaving section

L = 4w = 4 × 15 = 60 m

Highest proportioning ratio will give minimum capacity which is the capacity of the rotary.

$$\text{Capacity of rotary} = \frac{280w\left(1+\frac{e}{w}\right)\left(1-\frac{p}{3}\right)}{1+\frac{w}{\ell}}$$

$$= \frac{280\times15\left(1+\frac{11}{15}\right)\left(1-\frac{0.78}{3}\right)}{1+\frac{15}{60}}$$

$$= 4309.76\,\text{PCU/hr}$$

28. Ans: (B)

Sol: Modulus of subgrade reaction is calculated for the pressure caused because of the load corresponding to a settlement of 1.25mm = 1430kg

$$\text{Pressure p} = \frac{1430}{\pi 15^2} = 2.023\frac{kg}{cm^2}$$

$$K_1 = \frac{2.023}{0.125} = 16.18\frac{kg}{cm^3}$$

Standard plate diameter = 75 cm

Modulus of subgrade reaction corresponding to standard plate size

$$= \frac{k_1 a_1}{a} = \frac{16.18\times30}{75} = 6.472\,kg/cm^3$$

29. Ans: (C)

Sol:

Case I:

$$\text{Super elevation e} = \frac{V^2}{225R} = \frac{80^2}{225\times300}$$

$$= 0.094 > 0.07$$

Hence ‘e’ is restricted to 0.07.

$$e+f = \frac{V^2}{127R} = \frac{80^2}{127\times300} = 0.168$$

f = 0.168-0.07 = 0.098 < 0.15 . Hence OK

Case II:

Using e = 0.07 and f= 0.15

$$0.07+0.15 = \frac{V^2}{127R}$$

$$0.22 = \frac{100^2}{127\times R}$$

R = 357.91m

Percentage change in radius

= (357.91-300)/300 × 100 = 19.3%

30. Ans: 2242.6 (Range: 2240 to 2245)

Sol: As per ICAO recommendations the basic runway length increased at a rate of 7% for 300 m rise in elevation above MSL

For 300 m → 7%

Then 520 m → ?

$$? = \frac{520\times7}{300} = 12.13\%$$

Corrected length of runway

$$= 2000 + 2000 \times \frac{12.13}{100}$$

= 2242.6 m

31. Ans: (B)

Sol: For eigen vector, Ax = λx

$$\begin{bmatrix}1 & 1 & 3\\1 & 5 & 1\\3 & 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} = (-2)\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}$$

$\Rightarrow x_1 + x_2 + 3x_3 = -2x_1 \rightarrow (1)$

$\Rightarrow x_1 + 5x_2 + x_3 = -2x_2 \rightarrow (2)$

$\Rightarrow 3x_1 + x_2 + x_3 = -2x_3 \rightarrow (3)$

$(1) \Rightarrow 3(x_1 + x_3) = -x_2 \rightarrow (4)$

$(2) \Rightarrow x_1 + x_3 = -7x_2 \rightarrow (5)$

$(3) \Rightarrow 3(x_1 + x_3) = -x_2 \rightarrow (6)$

From (5) → $x_1 + x_3 - 7(3(x_1 + x_3)) = 0$

$$\Rightarrow x_1 + x_3 = 0$$

Suppose $x_1 = k \Rightarrow x_3 = -k$

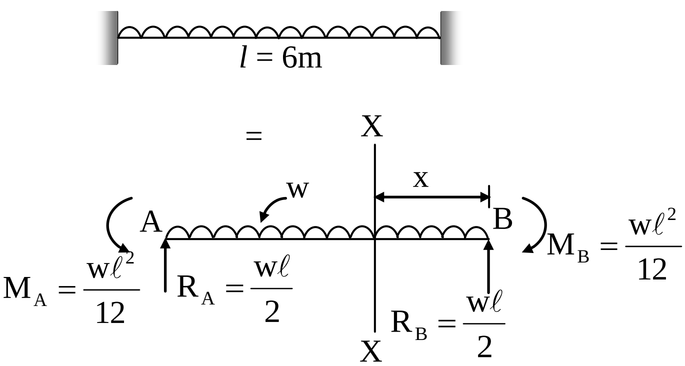
$$\therefore x_2 = -3(x_1 + x_3)$$
$$= 0$$

$$\therefore \text{Eigen vector} \begin{bmatrix} k \\ 0 \\ -k \end{bmatrix}$$

$$\text{For } k = 1 \Rightarrow \text{eigen vector} = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$$

32. Ans: (D)

Sol:



$M_x = 0$

$$R_B(x) - \frac{wx^2}{2} - \frac{w\ell^2}{12} = 0$$

$$\frac{w\ell}{2}(x) - \frac{wx^2}{2} - \frac{w\ell^2}{12} = 0$$

$$\ell x - x^2 - \frac{\ell^2}{6} = 0$$

$$6x^2 - 6\ell x + \ell^2 = 0$$

x = 4.732 from any support

∴ Distance of POC from midspan = 4.732 – 3 = 1.732 m

33. Ans: 3365.73 **Range : 3364 to 3367**

Sol: To find w on the cable

We know that in a two-hinged stiffening girder the live load is transmitted to the cable as equivalent u.d.*l* over the entire span. Therefore total load one the cable per meter length.

$$w = \frac{\text{Total}(D.L + L.L)}{\text{Span}}$$

$$= \frac{20 \times 100 + 500}{100} = 2.5 \text{ kN/m}$$

Step 2: To find H, the horizontal pull

$$H = \frac{W\ell^2}{8y_c} = \frac{25 \times 100 \times 100}{8 \times 10} = 3125 \text{ kN}$$

Vertical reaction at supports

$$V_A = V_B = \frac{25 \times 100}{2} = 1250 \text{ kN}$$

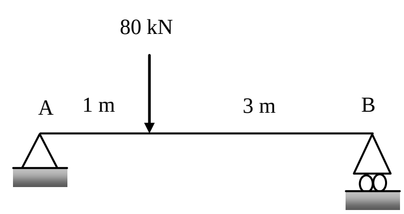
Maximum tension in the table

$$T_{max} = \sqrt{H^2 + V^2} = \sqrt{3125^2 + 1250^2}$$
$$= 3365.73 \text{ kN}$$

34. Ans: (B)

Sol:

$$M_{AB} = M_{F_{AB}} + \frac{2EI}{L}\left(2\theta_A + \theta_B - \frac{3\delta}{L}\right)$$



$$M_{F_{AB}} = \frac{-80 \times 1 \times 3^2}{4^2} - 45 \text{ kN-m}$$

$$M_{F_{BA}} = \frac{80 \times 3 \times 1^2}{4^2} = 15 \text{ kN-m}$$

$$M_{AB} = -45 + \frac{2EI}{4}\left[2\theta_A - \frac{\theta_A}{2}\right] \quad \left(\theta_B = \frac{-\theta_A}{2}\right)$$

$$= -45 + \frac{EI}{2}\left(\frac{3}{2}\theta_A\right)$$

$$= -45 + \frac{EI}{2}\left(\frac{3}{2} \times \frac{EI}{1000}\right)$$

$$= -45 + \frac{3}{4}\left(\frac{EI}{1000}\right)EI$$

$$= -45 + \frac{3}{4}\frac{(5\times10^4)^2}{1000} = -43.125 \simeq 45$$

$$M_{BA} = 15 + \frac{2EI}{4}(2\theta_B + \theta_A)$$

$$= 15 + \frac{2EI}{4}\left(-\frac{2\theta_A}{2} + \theta_A\right) = 15\,\text{kN-m}$$

35. Ans: (D)

Sol: True bearing = Magnetic bearing ± Magnetic declination

True bearing of sun at noon is 180°

Declination = True bearing – Magnetic declination

= 180° – 178°

= 2° E

∴ True bearing of line

AB = M.B + Declination

= 72°40′ + 2°

= 74°40′

36. Ans: (A)

Sol: $S = \frac{f}{H} = \frac{0.2}{1600} = \frac{1}{8000}$

b = 102.5 mm; Actual base length

$$B = \frac{bH}{f}$$

$$= 102.5 \times \frac{1600}{200} = 820 \text{ m}$$

$$P_a = \frac{Bf}{(H - ha)} = \frac{820 \times 200}{(1600 - 0)} = 102.5 \text{ mm}$$

$$P_b = \frac{820 \times 200}{(1600 - 30)} = 104.45 \text{ mm}$$

Parallax difference = $P_b - P_a$ = 104.45- 102.5

= 1.95 mm

37. Ans: (A)

Sol: $$\frac{\partial\omega}{\partial y} = \frac{1}{1 + \left(\frac{y}{x}\right)^2}\frac{\partial}{\partial y}\left(\frac{y}{x}\right) = \frac{x^2}{x^2 + y^2}\frac{1}{x}$$

$$= \frac{x}{x^2 + y^2}$$

$$\frac{\partial\omega}{\partial x} = \frac{1}{1 + \left(\frac{y}{x}\right)^2}\frac{\partial}{\partial x}\left(\frac{y}{x}\right) = \frac{x^2}{x^2 + y^2}\left(\frac{-y}{x^2}\right)$$

$$= \frac{-y}{x^2 + y^2}$$

38. Ans: 168

Sol:

S-curve method

4-hr UH —— DERIVE ——→ 2-hr UH

D = 4 T = 2

Time (hr)	4-hrUH Q, m^3/s	Lag 4-hr S-curve add	S_A S-curve	Lag 2hr S_B - Curve	$S_A - S_B$	Ord. of 2-hr UH $= \frac{S_A - S_B}{(T/D)} \times 1$
0	0	-	0	-	0	0
2	20	-	20	0	20	40
4	80	0	80	20	60	120
6	128	20	148	80	68	136
8	152	80	232	148	84	**168**
10	135	148	283	232	51	102
12	88	232	320	283	37	74
14	55	283	338	320	18	36
16	22	320	342	338	4	8
18	6	338	344	342	2	4
20	2	342	344	344	0	0
22	0	344	344	344	0	

39. Ans : (C)

Sol:

$\sum T = 500$ kN, $\sum N = 900$ kN, $\sum U = 200$ kN,

$L_c = 27$ m, $C' = 20$ kPa, $\varphi' = 20^0$

$$F = \frac{C'L_c + \sum(N-U)\tan\phi}{\sum T}$$

$$= \frac{20 \times 27 + (900-200)\tan 20}{500} = 1.59$$

40. Ans: (A)

Sol: $\gamma_d = \frac{\gamma_w G}{1+e} = \frac{9.81 \times 2.65}{1+0.65} = 15.76 \text{ kN/m}^3$

w.c at full saturation is ω_2

$e = \frac{\omega_2 G}{S_r} \Rightarrow \qquad 0.65 = \frac{\omega_2 \times 2.65}{1}$

$\therefore \omega_2 = 0.245$

Wt. of water to be added = $\gamma_d V [\omega_2 - \omega_1]$

= 15.76 × 1 [0.245 – 0.10] = 2.29 kN

41. Ans: (C)

Sol: $\phi_w = \phi_m = \frac{\gamma^1}{\gamma_{sat}} \times \phi = \frac{19-9.81}{19} \times 10^o$

$= 4.8^o$ say 5^o

$\therefore S_n = 0.13$

$S_n = \frac{C}{F_c \times \gamma_{sat} \times H}$ for sudden draw down

$0.13 = \frac{40}{F_c \times 19 \times 25} \Rightarrow F_c = 0.65$

42. Ans: (B)

Sol: $q = kH\frac{N_f}{N_d}$

$= \sqrt{k_x k_y} \times H . \frac{N_f}{N_d}$

$= \sqrt{1.39 \times 6 \times 1.39} \times (9.6 - 0.6) \times \frac{5}{(8-1)}$

$q = 21.89\ m^3/d/m$

$Q = q \times L$

$= 21.89 \times 50 = 1094.5\ m^3/day$

43. Ans: 0.126 to 0.128

Sol: $G = 2.67$

$w = 0.2$

$S_r = 100\%$ or 1

$H = 2cm$, $\Delta H = 0.05$ cm

$e_o \times S = W \times G$

$e_o = 0.2 \times 2.67$

$= 0.534$

$$\frac{\Delta H}{H_o} = \frac{\Delta e}{1+e_o}$$

$$\Delta e = \frac{0.05}{2}(1+0.534)$$

$= 0.03835$

$$C_c = \frac{\Delta e}{\log_{10}\left(\frac{\sigma'_f}{\sigma_o}\right)} ss$$

$$= \frac{0.03835}{\log_{10}\left(\frac{90}{45}\right)}$$

$= 0.127$

44. Ans: 35.50 **(Range 35 to 36)**

Sol: We know

$$\frac{S_f}{S_p} = \left[\frac{B_f}{B_p}\left(\frac{B_p+0.3}{B_f+0.3}\right)\right]^2$$

B_f = width of foundation, in metres

B_p = width of plate, in metres

S_f = settlement of foundation

S_p = settlement of plate

∴ Given $S_p = 1.5$ cm = 15 mm

$B_f = 1$ m

$B_p = 0.3$ m

$$\therefore\ S_f = 15\left(\frac{1\times(0.3+0.3)}{0.3(1+0.3)}\right)^2$$

$S_f = 35.50$ mm

45. Ans: 52.5 **(Range: 51 to 54)**

Sol: $\Sigma M_B = 0$

$\Rightarrow V_A \times 12 - (50 + 10) \times 11 - 100 \times 6 = 0$

$$V_A = \frac{1260}{12} = 105 kN$$

This reaction is shared by 2-wheels

So each static wheel load

$$= \frac{V_A}{2} = \frac{105}{2} = 52.5 kN$$

46. Ans: 20

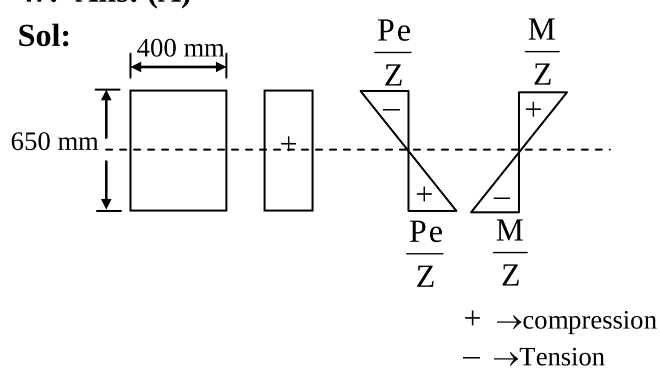
Sol: As per IS:456-2000 clause 23.2.1

$$\frac{\text{Span}}{\text{effective depth}} \le \text{Permissible value}$$

Beam	Permissible value
1. Cantilever	7
2. Simply supported	20
3. Continuous	26

47. Ans: (A)

Sol:



$$Z = \frac{bd^2}{6} = \frac{400\times 650^2}{6} = 28.17 \times 10^6\ mm^3$$

$P = 1440$ kN

$e = 180$ mm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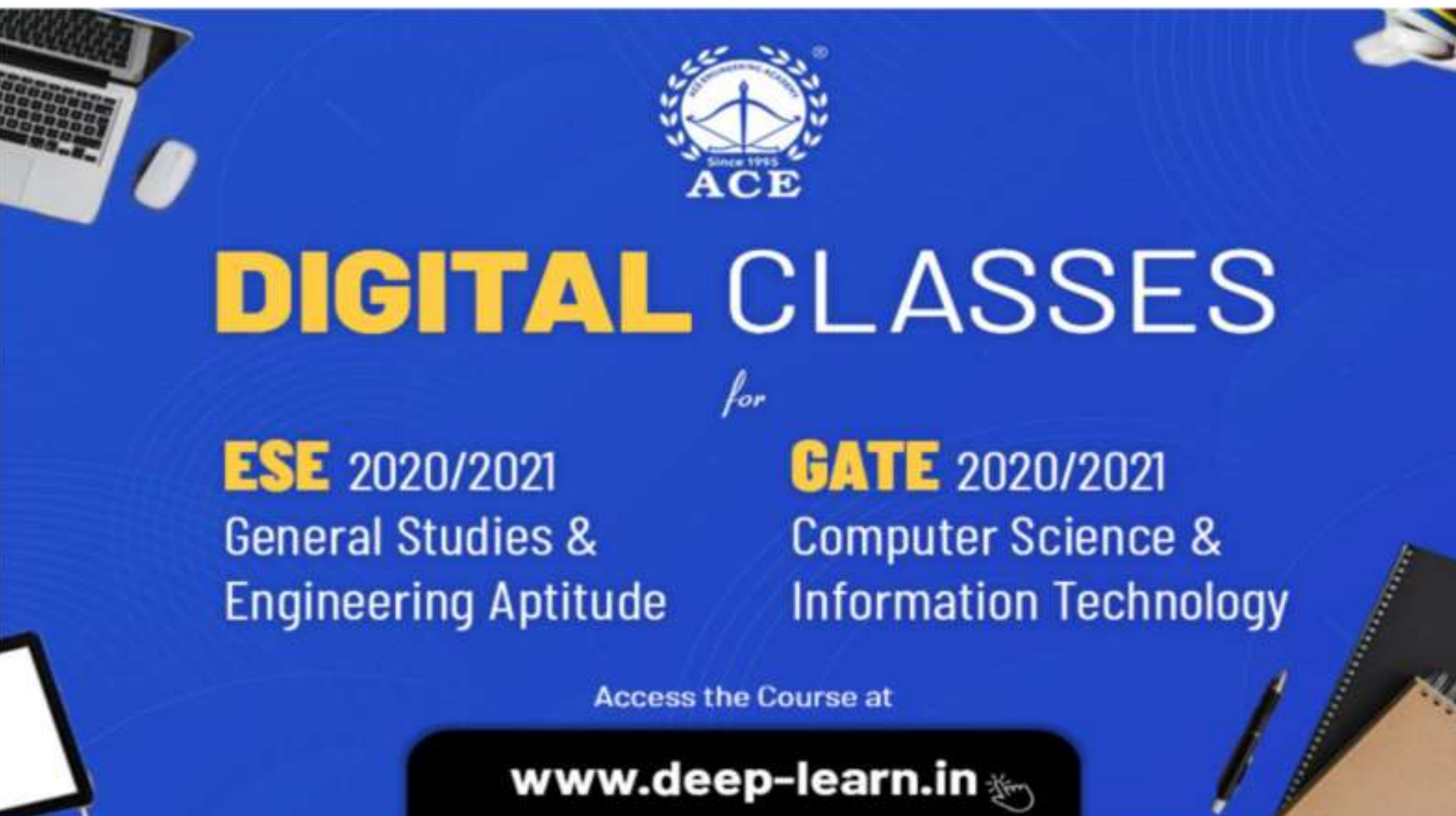
AIR 8 KULDEEP KUMAR E&T
AIR 8 HEMANT KUMAR ME
AIR 8 YOGESH KUMAR CE
AIR 9 DEEPITA ROY EE
AIR 9 E&T
AIR 9 ME
AIR 9 ANKIT KUMAR CE
AIR 10 ANKITA SHARMA EE
AIR 10 E&T
AIR 10 SUMIT ME
TOTAL SELECTIONS in Top 10: 33
(EE: 9, E&T: 8, ME: 9, CE: 7) and many more...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$$M = \frac{WL}{4} = \frac{150\times10^3\times6500}{4}$$

$= 243.75 \times 10^6$ Nmm

Total stress at top fibre = $\frac{P}{A} - \frac{Pe}{z} + \frac{M}{Z}$

$$\frac{P}{A} = \frac{1440\times10^3}{400\times650} = 5.54\,N/mm^2$$

$$\frac{Pe}{Z} = \frac{1440\times10^3\times180}{28.17\times10^6} = 9.20\ N/mm^2$$

$$\frac{M}{Z} = \frac{243.75\times10^6}{28.17\times10^6} = 8.65\ N/mm^2$$

$\therefore$ Total stress at top = 5.54 – 9.20 + 8.66

= 4.99 N/mm^2

$\simeq$ 5 N/mm^2 (compressive)

48. Ans: (B)

Sol: Note: Quick to answer the given question. Input power always greater than output. Hence option (B) is correct

Power (I/P hydro) = ρgQH/Jet

$$= \rho.g.\frac{\pi}{4}d^2.V_{Jet}.H$$

$$= \rho.g.\frac{\pi}{4}.d^2.\sqrt{2gH}.H$$

$$= 1000\times10\times\frac{\pi}{4}(0.2)^2\times\sqrt{2\times10\times400}\times400$$

= 11239.7 kW

Total power for 2 Jets = 2 × 11239.7

= 22479 kw

$$= \frac{22479}{0.75}\text{MHP}$$

$\backsimeq$ 29,100 MHP

49. Ans: (C)

Sol: Average height of surface protrusions ,

$k = 0.1\times10^{-3}$m

Shear velocity, $V^* = \sqrt{\frac{\tau_0}{\rho}} = \sqrt{\frac{8.1}{10^3}}$

$= 9\times10^{-2}$m/s

Roughness Reynolds number

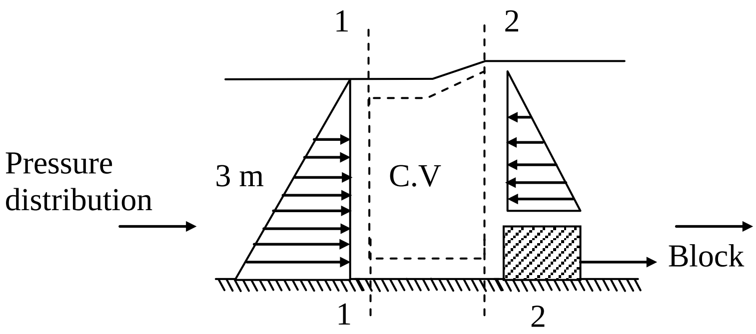
$$\frac{V^*k}{\nu} = \frac{9\times10^{-2}\times0.1\times10^{-3}}{0.009\times10^{-4}}$$

$$= \frac{9\times10^{-6}}{9\times10^{-7}} = 10$$

Since $\frac{V^*k}{\nu}$ lies between 3 and 70, the surface is in transition.

50. Ans: 1250 Range: (1000 to 1400)

Sol: As it is an open system let's take control volume as shown below

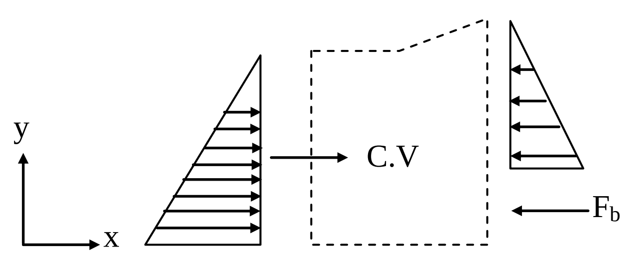


Velocity at (1) – (1)

$$(V_1) = \frac{\text{disch arge}}{\text{Area}} = \frac{30}{3\times3}$$

Similarly

$$(V)_2 = \frac{30}{3\times1.5}$$



F_b = Force on block

Force on C.V, using momentum equation

$$[\rho.\,Q.\,V_2 - \rho\,.\,Q.\,V_1] = \frac{\gamma y_1^2}{2}\times b - \frac{\gamma y_2^2}{2}\times b - F_b$$

$$\Rightarrow F_b = \left[\frac{10^4\times 3^2}{2}\times 3 - \frac{10^4\times 1.5^2}{2}\times 3\right] - \left[10^3\times 30\times\frac{30}{3\times 1.5} - 10^3\times 30\times\frac{30}{3\times 3}\right]$$

= [135000 – 33750] – 100000

= 135000 – 33750 – 10000

F_b = 1250 N

51. Ans: (B)

Sol: $\text{Surface Area} = \frac{Q}{\text{Rate of flow}}$

$$\frac{\pi}{4}d^2 = \frac{1\times 10^6}{10^3\times 24\times 60\times 0.5}$$

d = 1.33 m

Volume of ion exchanger,

$$\frac{\pi}{4}d^2\times H = \frac{Q\times T.H}{\text{Capacity of ion exchanger}}$$

($\therefore$ MLD × mg/*l* = kg/day)

$$\frac{\pi}{4}(1.33)^2\times H = \frac{1\times 10^6\times 130}{80\times 10^6}$$

H = 1.169 m

$\simeq$ 1.17 m

52. Ans: (D)

Sol: The average Noise sound pressure level

$$\overline{L}_p = 20\log_{10}\frac{1}{N}\Sigma(10)^{LN/20}$$

$$= 20\log_{10}\frac{1}{3}\left[10^{\frac{30}{20}} + 10^{\frac{40}{20}} + 10^{\frac{50}{20}}\right]$$

= 43.48

$\simeq$ 43.5 dB

53. Ans: (A)

Sol:

BOD at any time "t" at temp T^oC

$\left(y_t^{T^oC} = L_o[1-e^{-K_T t}]\right)$

Here, K = K_1 = 0.23/day (given)

Using t = 5 days

$\left(y_5^{20^oC}\right)$ = BOD of 5 days = 800 mg/*l*

800 = $L_o[1 - e^{-0.23\times 5}]$

L_o = 1170.68 mg/*l*

Remaining BOD $L_t = L_o\,e^{-Kt}$

$= L_o\,.e^{-Kt}$

$= 1170.68\times e^{-0.23\times 25}$

= 3.726 mg/*l*

$$\%\text{ BOD remained} = \frac{L_t}{L_o}$$

$$= \frac{3.726}{1170.68}$$

= 0.3182%

$\simeq$ 0.32%

54. Ans: 6045 **Range: 6040 to 6050**

Sol:

$$A\ell_2(SO_4)_3 18H_2O + 3Ca(HCO_3)_2 \rightarrow 2A\ell(OH)_3 + 3CaSO_4 + 18H_2O + 6CO_2\uparrow$$

3 × 100 parts of alkalinity (as $CaCO_3$) is required by 666 parts of alum

= 15 mg/*l* of alum $= \frac{3\times 100}{666}\times 15$

= 6.757 mg/*l*

Alkalinity in raw water = 1 mg/*l*

Required = 6.757 – 1 = 5.757 mg/*l* as $CaCO_3$

$[CaO + CO_2 \rightarrow CaCO_3]$

56 parts of CaO produces 100 parts of $CaCO_3$

Pure CaO required $= \frac{5.757 \times 56}{100} = 3.224$ mg/l

Quick lime required $= \frac{3.224}{0.8} = 4.03$ mg/l

$\therefore$ Monthly $= 4.03 \times \frac{50 \times 10^6}{10^6} \times 30 = 6045$ kg

55. Ans: (C)

Sol: Lumpsum contract does not requires periodical measurement of contractor's output for payment because in lumpsum contract the amount to be paid by the owner to the contractor is fixed.

56. Ans: (A)

Sol: The right choice is 'on'. 'Tell on' means 'to affect'. 'Tell against' means 'to go against'. 'Tell of' means 'to tell about something'

57. Ans: (C)

Sol: 'is' tired verb must agree with the first subject when 'as well as' is used.

58. Ans: (A)

59. Ans: (D)

Sol: $L = \frac{5}{2}B$

Area = L × B = 1000

$L \times \frac{2L}{5} = 1000$

$L^2 = 2500 \Leftrightarrow L = 50$ m

60. Ans: (B)

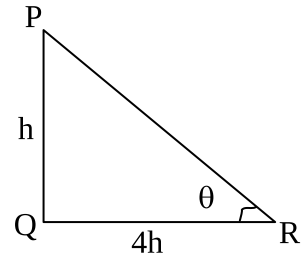
Sol: Supplement of $80^0 = 180^0 - 80^0 = 100^0$.

61. Ans: (D)

Sol: Let the height of tower be 'PQ', 'QR' be the length of shadow to tower in ΔPQR.

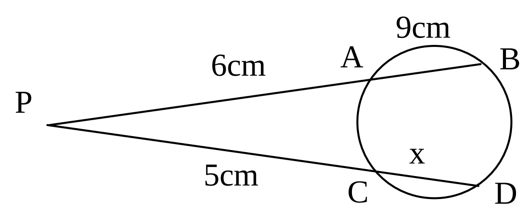
$\tan\theta = \frac{PQ}{QR} = \frac{h}{4h}$

$\therefore \theta = \tan^{-1}\left(\frac{1}{4}\right)$



62. Ans: (A)

Sol: If two chords of a circle, intersect inside a circle (outside a circle) at any point. Then,



PA × PB = PC × PD

⇒ 6 × 15 = 5 × (x + 5)

⇒ x + 5 = 18 ⇒ x = 13 cm

63. Ans: (A)

Sol: Total time between 10 pm to 6 am = 8 hours

% time spent in Light sleep or in Extreme sleep = 30 + 25 = 55%

⇒ Time spent in Light sleep or in Extreme sleep = $\frac{55}{100} \times 8$

$$\Rightarrow \frac{22}{5} = 4.4\,hours$$

64. Ans: (B)

Sol: Total cost of mobiles = 99 × 15000 = Rs. 14,85,000

Total cost of cameras = 53 × 13000 = Rs. 6,89,000

Total cost of TVs = 29 × 59000 = Rs. 17,11,000

Total cost of Refrigerator = 21 × 56000 = Rs. 11,76,000

Total cost of AC = 97 × 25000 = Rs. 24,25,000

Total cost = 14,85,000 + 6,89,000 + 17,11,000 + 11,76,000 + 24,25,000 = Rs. 74,86,000

Total cost in lakhs = Rs. 74.86 lakhs

65. Ans: (A)

Sol: An assumption is an unstated premise. So, we are looking for something that is implied in the argument, and if wrong, will undermine the argument. All that the speaker implies is that Josh is efficient because he has twenty years of practice, and so answer (A) is correct.