Branch: CIVIL ENGINEERING _MOCK-B SOLUTIONS

01. Ans: (B)

02. Ans: (A)

Sol: $$\sigma_z = \frac{Q}{Z^2}\times\frac{3}{2\pi}\left[\frac{1}{1+\left(\frac{r}{z}\right)^2}\right]^{5/2}$$

$$= \frac{500}{3^2}\times\frac{3}{2\pi}\left[\frac{1}{1+\left(\frac{4}{3}\right)^2}\right]^{5/2} = 2.06 \text{ kPa}$$

03. Ans: 14.5 to 14.7

Sol: $$U = \frac{u_i - \bar{u}}{u_i}\times 100$$

$$= \frac{3-0.8}{3} = 0.7333$$

$= 73.33\%$

$$U = \left[\frac{S}{S_f}\right]\times 100$$

$S = 14.66$ mm

04. Ans: (D)

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

$$i = \frac{i_c}{F} = \frac{1}{F}(G-1)/(1+e)$$

$$= \frac{1}{2.5}\frac{(G-1)}{(1+e)}$$

$$= 0.4\frac{(G-1)}{(1+e)}$$

05. Ans: 24

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

$\Rightarrow F^1(x) = f^1(g(x)).\ g^1(x)$ ($\because$ by chain rule)

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

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

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

06. Ans: 119 **(Range: 118 m to 119 m)**

Sol: $$H_C = \frac{f}{\gamma_w(S+1)}$$

$$H_C = \frac{4.23\times10^3}{9.81(2.63+1)}$$

$H_C = 118.78$ m

≈ 119 m

07. Ans: (C)

Sol: $$\theta_A = \theta_B = \theta_{MAX} = \frac{M\left(\frac{L}{2}\right)}{EI} = \frac{ML}{2EI}$$

08. Ans: 114 mm **(Range : 112 to 115)**

Sol: $$\theta = \frac{TL}{GJ}$$

$$3\times\frac{\pi}{180} = \frac{12\times10^6\times6\times10^3}{\frac{\pi}{32}(d)^4(83\times10^3)}$$

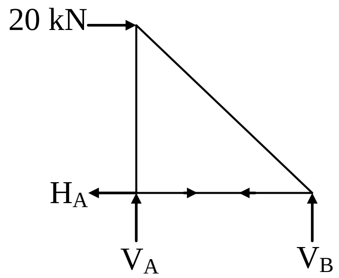
$d = 113.97$mm

$\simeq 114$ mm

09. Ans: (C)

10. Ans: (D)

Sol: By inspection F_{CD} & $F_{DA} = 0$



$\therefore \Sigma F_X = 0 \quad H_A = 20$ kN (Tensile)

11. Ans: (D)

Sol: We know that,

$P(A \cap B) \le \min$ of $\{P(A), P(B)\}$

$\Rightarrow P(A \cap B) \le 0.25$ .... (1)

we have, $P(A \cup B) \le P(S)$

$\Rightarrow \{P(A) + P(B) - P(A \cap B)\} \le 1$

$\Rightarrow \{0.25 + 0.8 - P(A \cap B)\} \le 1$

$\Rightarrow 0.05 \le P(A \cap B)$ .... (2)

From (1) and (2), we have

$0.05 \le P(A \cap B) \le 0.25$

12. Ans: (A)

Sol: Horizontal thrust $= \dfrac{WR}{2} = \dfrac{25 \times 10}{2} = 125\,\text{kN}$

13. Ans: 221 **(Range: 219 to 223)**

Sol: $R = \dfrac{V^2}{125f}$

$= \dfrac{(60)^2}{125 \times 0.13}$

$R = 221.538$ m

14. Ans: (A) **15. Ans: (B)**

16. Ans: 180 **(Range: 178 to 181)**

Sol: $C_s = \dfrac{Q_1C_1 + Q_2C_2}{Q_1 + Q_2}$

$120 = \dfrac{400 \times 10^3 \times 45 + 20 \times Q}{45 + Q}$

$100\,Q = 180 \times 10^5 - 120 \times 45$

$Q = 179946$ *l*/s

$\approx 180\ m^3/s$

17. Ans: (C)

18. Ans: (A)

Sol: $\left(\dfrac{\delta_1}{\delta_2}\right)^2 = \dfrac{x_1}{x_2}$

$\Rightarrow \left(\dfrac{2}{15}\right)^2 = \dfrac{x_1}{x_2}$

$\Rightarrow \dfrac{x_1}{x_2} = \dfrac{4}{225}$

$\dfrac{x_1}{x_1 + 10} = \dfrac{4}{225}$

$225x_1 = 4x_1 + 40 \Rightarrow 221\,x_1 = 40$

$\Rightarrow x_1 = 18.09$ cms

19. Ans: (C)

Sol: $h_1 = 12$ mm $\quad d_1 = 3$ mm

$h_2 = ?$ $\quad d_2 = 5$ mm

$h \propto \dfrac{1}{d}\left(h = \dfrac{4\sigma\cos\theta}{\gamma d}\right)$

$\dfrac{h_1}{h_2} = \dfrac{d_2}{d_1} \Rightarrow \dfrac{12}{h_2} = \dfrac{5}{3}$

$h_2 = 7.2$ mm

20. Ans: (C)

21. Ans: (B)

22. Ans: 1440

Sol:

$$\left.\begin{aligned} &1.5\,DL + 1.5\,LL = 1.5\times 450 + 1.5\times 500 \\ &= 1425 \text{ N/m} \\ &1.5\,DL + 1.5\,WL = 1.5\times 450 + 1.5\times 250 \\ &= 1050 \text{ N/m} \\ &1.2\,DL + 1.2\,LL + 1.2\,WL \\ &= 1.2\times 450 + 1.2\times 500 + 1.2\times 250 \\ &= 1440 \text{ N/m} \end{aligned}\right\} \text{maximum}$$

23. Ans: (D)

24. Ans: 4.64 **(Range: 4.62 to 4.7)**

Sol: $\frac{\vec{F}_1.\vec{F}_2}{F_2} = \frac{F_1F_2\cos\theta}{F_2}$ = $F_1\cos\theta$

= component of F_1 in the direction F_2

$\vec{F}_1.\vec{F}_2 = (2\hat{i}+3\hat{j}+4\hat{k}).(4\hat{i}+3\hat{j}+2\hat{k})$

= 25

$|\vec{F}_2| = \sqrt{29}$

$F_1\cos\theta = \frac{25}{\sqrt{29}} = 4.64\text{N}$

25. Ans: (A)

Sol: Soils that are transported by running water are called Alluvial soils.

26. Ans: (B)

Sol: Q = 2000 kN

$\therefore$ u.d.l or pressure, $q = \frac{Q}{\frac{\pi}{4}d^2} = \frac{2000}{\frac{\pi}{4}(3)^2}$

= 282.94 kPa

$$\sigma_z = q\left[1-\left\{\frac{1}{1+\left(\frac{a}{z}\right)^2}\right\}^{\frac{3}{2}}\right]$$

a = radius of the foundation = $\frac{3}{2}$ = 1.5 m

$$\therefore \sigma_z = 282.94\left[1-\left\{\frac{1}{1+\left(\frac{1.5}{10}\right)^2}\right\}^{\frac{3}{2}}\right]$$

= 9.28 kPa

27. Ans: 7.5

Sol: $q = k.H.\frac{N_f}{N_d}$

H = 8 – 1 = 7m

N_f = 5

N_d = 7

$q = 1.5\times 10^{-6}\times 7\times\frac{5}{7}$

$= 7.5\times 10^{-6}\ \text{m}^3/\text{sec}$

28. Ans: 1.877 **(Range: 1.8 to 1.9)**

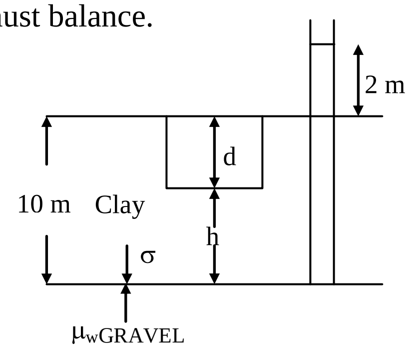
Sol: For the bottom heave not to occur, upward and down ward acting stresses at the top of gravel layer must balance.

Given

FOS = 1.2

$\frac{\sigma}{u_w} = 1.2$

$\sigma = 1.2\,u_w$



$\gamma_{sat}\times h = 1.2\times\gamma_w\times 12$

$$\frac{(G+es)\gamma_w}{1+e}\times h = 1.2\times\gamma_w\times 12$$

$$\frac{(2.7+1.2)}{1+1.2}\times h = 1.2\times 12$$

$$h = 8.123 \text{ m}$$

∴ Depth of excavation, d = 10 – h

= 10 – 8.123

d = 1.877 m

29. Ans: (B)

Sol: Given $v = y + e^{-x}\cos y$

$\Rightarrow v_x = -e^{-x}\cos(y)$ and $v_y = 1 - e^{-x}\sin(y)$

Consider $du = (u_x)\,dx + (u_y)\,dy = (v_y)\,dx + (-v_x)\,dy$

$\Rightarrow du = (1 - e^{-x}\sin y)\,dx + (e^{-x}\cos y)\,dy$

$\Rightarrow \int du = \int (1 - e^{-x}\sin y)\,dx + \int 0\,dy + k$

$\Rightarrow u = x + e^{-x}\sin y + k$

Now the required analytic function f(z) is given by f(z) = u + iv

$\Rightarrow f(z) = (x + e^{-x}\sin y + k) + i\,(y + e^{-x}\cos y)$

$\therefore f(z) = z + ie^{-z} + k$

30. Ans: (D)

Sol: $F.O.S = \dfrac{C}{\gamma_{sat}\times H\times S_n}$

Since water level goes down suddenly, γ_{sat} is to be used $\gamma_{sat} = \dfrac{(G+es)\gamma_w}{1+e}$

$$\therefore \gamma_{sat} = \frac{(2.7+0.81\times 1)\times 1}{1+0.81}$$

$\gamma_{sat} = 1.94$ g/cc

$\gamma_{sat} = 1.94$ t/m^3

For sudden drawdown condition, $\phi' = \dfrac{\gamma'}{\gamma}\times\phi$

$$= \frac{(1.94-1)}{1.94}\times 14$$

$$\phi' = 6.78°$$

Stability number for $\phi' = 6.78°$ is

$$S_N = 0.116 + \frac{(0.122-0.116)}{(7-6)}\times(7-6.78)$$

$S_N = 0.11732$

$$\therefore FOS = \frac{C}{\gamma_{sat}HS_N} = \frac{2.5}{1.94\times 10\times 0.11732}$$

FOS = 1.098

31. Ans: (B)

Sol: We know, Darcy's equation as :

$$Q = k.i.A$$

$$i = \frac{h}{L}$$

Given head loss is 380mm in a length of 250mm.

Also $A = \dfrac{\pi}{4}\times(82.5)^2$ ---mm^2

$$\therefore\ Q = \frac{191\times 10^3}{60}\ \text{mm}^3/\text{sec}$$

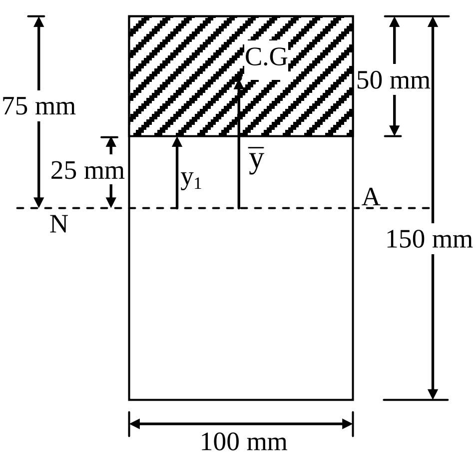
(1 ml = 1cm^3 or 10^3 mm^3)

$$\therefore\ \frac{191\times 10^3}{60} = k\times\frac{380}{250}\times\frac{\pi}{4}\times(82.5)^2$$

$\Rightarrow k = 0.3917$ mm/sec

32. Ans: 0.4 **(No Range)**

Sol:



Given:

Width, b = 100 mm

Depth, d = 150 mm

Shear force, F = 4500 N

Let τ = Shear stress at a distance of 25 mm above the neutral axis

$$\tau = F.\frac{A\bar{y}}{I.b}$$

where A = Area of the beam above y_1

$= 100 \times 50 = 5000\ mm^2$

$\bar{y}$ = Distance of the C.G of the area A from neutral axis

$$= 25 + \frac{50}{2} = 50\ mm$$

I = M.O. I of the total section

$$= \frac{bd^3}{12}$$

$$= \frac{100 \times 150^3}{12} = 28125000\ mm^4$$

B = Actual width of section at a distance y_1 from N.A = 100 m

$$\tau = \frac{4500 \times 5000 \times 50}{28125000 \times 100} = 0.4\ N/mm^2$$

33. Ans: (C)

Sol: Total error in latitude = + 150 + 0 – 90 – 50

= + 10 m

Correction to latitude

$$AB = -10 \times \frac{200}{(200+300+400+100)} = -2\ m$$

Corrected latitude of AB = 150 – 2 = 148 m

34. Ans: (C)

Sol: Multiplication constant (k) $= \frac{f}{i} = \frac{25}{2.5 \times 10^{-1}}$

k = 100

Additive constant (C) = f + d = 25 + 15

$= (40) \times 10^{-2} = 0.4m$

35. Ans: 0.2

Sol: Given that $\frac{dy}{dx} = x^3 - 2y$ $\quad (\because \frac{dy}{dx} = f(x, y))$

with y(0) = 0.25 $\quad (\because y(x_0) = y_0)$

Let $x_0 = 0$, $y_0 = 0.25$ & h = 0.1

Then $x_1 = x_0 + h = 0.1$

The formula for Euler's forward method is

$y(x_1) \simeq y_1 = y_0 + h\, f(x_0, y_0)$

$\Rightarrow y(0.1) \simeq y_1 = 0.25 + (0.1)\left(x_0^3 - 2y_0\right)$

$\Rightarrow y(0.1) \simeq y_1 = 0.25 + (0.1)\,[0 - 2(0.25)]$

$\therefore y(0.1) \simeq y_1 = 0.25 - (0.1)(0.5)$

$= 0.25 - 0.05 = 0.2$

36. Ans: (C)

Sol: Modified equation for simply supported end

$$M_{BC} = \overline{M}_{BC} - \frac{\overline{M}_{CB}}{2} + \frac{3EI}{L}\left(\theta_B - \frac{\delta}{\ell}\right)$$

$$\overline{M}_{BC} = \frac{-W\ell}{8} = \frac{-32 \times 4}{8} = -16$$

$$\overline{M}_{CB} = \frac{W\ell}{8} = \frac{32 \times 4}{8} = 16$$

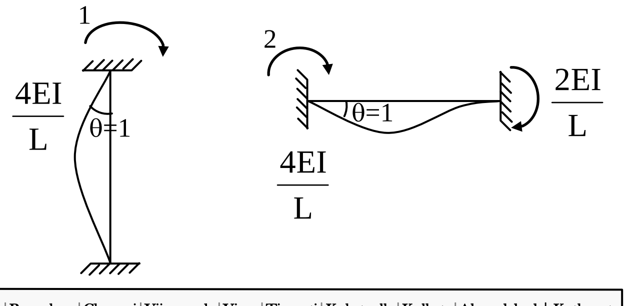
$$M_{BC} = -16 - \frac{16}{2} + \frac{3EI}{4}(\theta_B - 0)$$

$$M_{BC} = -24 + \frac{3}{4}EI\theta_B$$

37. Ans: (D)

Sol: To generate stiffness matrix first fix all co ordinates

For Ist column



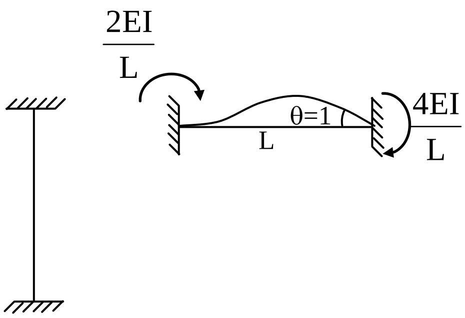
$$\therefore K_{11} = \frac{4EI}{L} + \frac{4EI}{L}$$

$$= \frac{4E(2I)}{5} + \frac{4E(2I)}{4}$$

$K_{11} = 3.6EI$

$$K_{21} = \frac{2E(2I)}{4} = EI$$

For 2[nd] column:



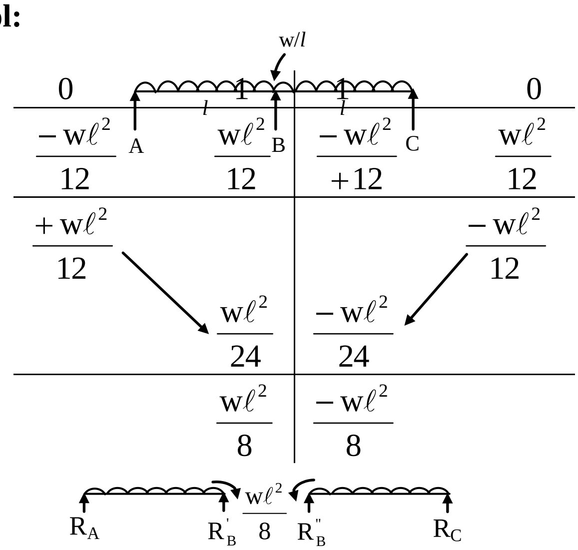
$$\therefore K_{12} = \frac{2E(2I)}{4} = EI$$

$$K_{22} = \frac{4E(2I)}{4} = 2EI$$

$$\therefore [K] = \begin{bmatrix} 3.6EI & EI \\ EI & 2EI \end{bmatrix}$$

38. Ans: (B)

Sol:



$$R_B \times \ell = \frac{w\ell^2}{2} + \frac{w\ell^2}{8}$$

$$R_B \times \ell = \frac{5w\ell^2}{8} = \frac{5}{8} w\ell$$

$$R'_B = \frac{5}{8} w\ell$$

Due to summetry $R''_B = R'_B$

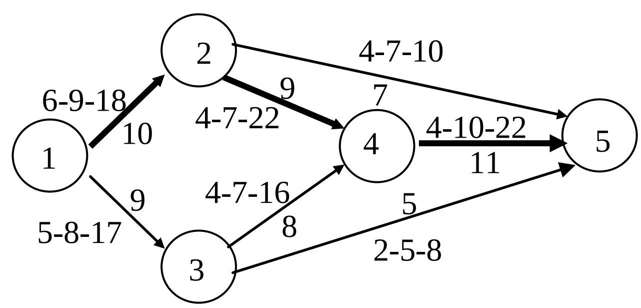
$$R_B = R'_B + R''_B$$

$$R_B = \frac{10}{8} w\ell = 1.25\, w\ell$$

39. Ans: (B)

Sol: $t_E = \dfrac{t_o + 4t_L + t_P}{6}$

$$\sigma^2 = \left(\frac{t_p - t_o}{6}\right)^2$$



Variance calculation is given in the table below:

Activity	$t_o - t_L - t_P$	t_E	σ^2
1-2	6-9-18	10	4
1-3	5-8-17	9	4
2-4	4-7-22	9	9
3-4	4-7-16	8	4
2-5	4-7-10	7	1
4-5	4-10-22	11	9
3-5	2-5-8	5	1

Critical path:

1 – 2 – 5 = 10 + 7 = 17
1 – 2 – 4 – 5 = 10 + 9 + 11 = 30
1 – 3 – 4 – 5 = 9 + 8 + 11 = 28
1 – 3 – 5 = 9 + 5 = 14

Critical path = 1 – 2 – 4 – 5

40. Ans: (C)

Sol: Total Float (F_T) = LST - EST = LFT - EFT

Free Float (F_F) = Total float - head event slack

= F_T - Sj

Independent float (F_{1D}) = free float -slack at tail event

= F_T - F_F

Interference float: It is the difference between total float and free float

$F_{1T} = F_T - F_F$

= Slack at head event

If the Project duration for backward pass is taken less than the project duration after forward pass then the interference float can be negative also.

Independent float and interference float equations may never be equal but they can be equal in their numerical value.

41. Ans: (A)

Sol; Given $(2xy - 9x^2)dx + (2y + x^2+1)dy = 0$

Here, $M = 2xy - 9x^2$ and $N = 2y + x^2 + 1$

Now, $\frac{\partial M}{\partial y} = 2x = \frac{\partial N}{\partial x}$

∴ The given D.E is exact

Now the general solution of the given D.E is

$\int(2xy - 9x^2)\,dx + \int(2y + 0 + 1)\,dy = C$

$\Rightarrow x^2y - 9\frac{x^3}{3} + y^2 + y = C$ .... (1)

but y = – 3 at x = 0

Now (1) becomes

0 – 0 + 9 – 3 = C

⇒ C = 6

∴ The solution of a given D.E is

$x^2y - 3x^3 + y^2 + y = 6$

42. Ans: 19.59 (Range: 18-21)

Sol:

Time t (sec)	No of vehicle s (q)	V(m/sec) $= \frac{\text{Distance}}{\text{time}}$	qV	q/V
2.6	11	11.53	126.83	0.954
2.8	27	10.71	289.17	2.521
3.0	62	10	620	6.2
3.4	52	8.823	458.8	5.893
Total	152		1494.8	15.57

$$\text{TMS} = \frac{\sum q_i v_i}{\sum q_i} = \frac{1494.8}{152} = 9.83 \text{ m/s}$$

$$\text{SMS} = \frac{\sum q_i}{\sum \frac{q_i}{v_i}} = \frac{152}{15.57} = 9.76 \text{ m/s}$$

TMS + SMS = 19.59 m/s

43. Ans: (C)

So: Let us take Ratio 1:2:3

$$P \rightarrow \frac{[(19\times1)+(7\times2)+(3\times3)]}{15} = 2.8$$

$$Q \rightarrow \frac{[(2\times1)+(8\times2)+(4\times3)]}{22} = 1.36$$

$$R \rightarrow \frac{[(14\times1)+(5\times2)+(1\times3)]}{12} = 2.25$$

$$S \rightarrow \frac{[(9\times1)+(15\times2)+(6\times3)]}{16} = 3.56$$

44.Ans:872.36 **(Range 871 to 873)**

Sol: h = 25 cm

k = 6.9 kg /cm^3

μ = 0.15

E = 3 × 10^5 kg/cm^2

Radius of relative stiffness

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

$$= \left(\frac{3\times10^5\times(25)^3}{12\times6.9(1-(0.15)^2)}\right)^{\frac{1}{4}}$$

= 87.23 cm = 872.3 mm

45. Ans: 0.4 **(Range: 0.4 to 0.4)**

Sol: Volume of Runoff in 2 hours = 2000 m^3

Amount of Rainfall in 2 hours

= i (cm/hr) × time

Intensity of 4hr UH $= \left(\frac{1}{T_r}\right) = \frac{1}{4} = 0.25$

$\therefore$ Amount of Rainfall in 2 hrs = 0.25 × 2

= 0.5 cm

$\therefore$ Area × Rainfall = Volume of Runoff

A × (0.5 × 10^{-2}) = 2000 m^3

$\Rightarrow$ A = 400 × 10^3 m^2

A = 0.4 km^2

46. Ans: (B)

Sol: For the same turbine wheel

Unit power $\left(P_u = P/H^{3/2}\right)$can be used

$$\frac{P_2}{H_2^{3/2}} = \frac{P_1}{H_1^{3/2}}$$

$$P_2 = P_1\left(\frac{H_2}{H_1}\right)^{3/2}$$

$$P_2 = 1(MW)\times\left(\frac{144}{225}\right)^{1.5}$$

$$P_2 = 1(MW)\times0.512 = 0.512\ \ MW$$

% of power decreased = $\frac{P_1 - P_2}{P_1}$

$$= \frac{1-0.512}{1} = 0.488 = 48.8\%$$

47. Ans: (D)

Sol: Given curve 'C' is a closed curve.

So, we have to evaluate the integral by using Green's theorem.

By Green's theorem, we have

$$\oint_C (M\,dx + N\,dy) = \iint_R \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dx\ dy$$

Now, $\oint_C [(x-y)dx + (x+3y)\,dy]$

$$= \iint_R \left[\frac{\partial}{\partial x}[x+3y] - \frac{\partial}{\partial y}(x-y)\right] dx\ dy$$

$$= \iint_R [1-(-1)]\,dx\,dy$$

$= 2\iint_R 1dx\,dy$ = 2(Area of the circle 'C')

= 2(πr^2)$_{r=4}$ = 32 π

48. Ans: 25.6 **(Range : 25.3 to 25.9)**

Sol: $F_x = \rho A\ (V-u)^2$

$$= 10^3\times\frac{\pi}{4}\times(0.065)^2\times(15-3)^2$$

$\therefore$ F_x = 477.84 N

Work done per second by the jet on the plate

= F_x × u

= 477.84 × 3 = 1433.51 watt

Efficiency = $\eta = \frac{output}{input} = \frac{1433.51}{\frac{1}{2}\dot{m}\gamma^2} = \frac{1433.51}{\frac{1}{2}\rho QV^2}$

$$\eta = \frac{1433.51}{\frac{1}{2}\rho A V^3} = \frac{1433.51}{\frac{1}{2}\times 10^3 \times \frac{\pi}{4}\times 0.065^2 \times 15^3}$$

$\therefore \eta = 25.6\%$

49. Ans: (D)

Sol: $q = \frac{Q}{B} = \frac{1.5}{5} = 0.3\,m^3/s/m$

$$y_c = \left(\frac{q^2}{g}\right)^{1/3} = \left(\frac{(0.3)^2}{9.81}\right)^{1/3} = 0.2093\,m$$

Given $y_o = 0.45$ m

$y = 0.34$ m

$y_o > y > y_c$

$\Rightarrow$ M_2 profile

50. Ans: 125 **(No Range)**

Sol: $Ca^{2+} = 5$ m.eq/l; $Mg^{2+} = 2$ m.eq/l

$HCO_3^- = 4.5$ m.eq/l

Total hardness, TH = $Ca^{2+} \times 50 + Mg^{2+} \times 50$

= 5 × 50 + 2 × 50

= 350 mg/l as $CaCO_3$

Total alkalinity, $T_A = CO_3 \times 50 + HCO_3 \times 50$

= 0 + 4.5 × 50

= 225 mg/l as $CaCO_3$

TH > TA

CH = TA = 225 mg/l as $CaCO_3$

NCH = TH – CH

= 350 – 225

= 125 mg/l as $CaCO_3$

51. Ans: (A)

Sol: Suspended matter in sewage = 400 ppm

= 400 mg/l

For 1 million litres of sewage, the suspended matter concentration is 400kg.

Now, 65% of this matter is settled as sludge, and therefore quantity of sludge solids

= 0.65 × 400 = 260 kg

The sludge is having 95% m.c., which means 5 kg of dry solids will make 100 kg of wet sludge.

5 kg of dry solids make = 100 kg of sludge

260 kg of dry solids make = (100/5) × 260

= 5200 kg of sludge

$$\text{Volume of Sludge} = \frac{\text{Mass of sludge}}{\text{Density of sludge}}$$

$$\text{Volume of Sludge} = \frac{5200}{1025}$$

$= 5.073\ m^3$

52. Ans: 0.68 **Range: 0.67-0.69**

Sol: $V_S = \frac{g}{18}(S-1)\frac{d^2}{\nu}$

$$= \frac{9.81}{18}(2.65-1)\frac{(0.04\times 10^{-3})^2}{1.002\times 10^{-6}}$$

$= 1.436\times 10^{-3}$ m/sec

= 1.436 mm/sec

Detention time

$$= \frac{H}{V_S} = \frac{3.5}{1.436\times 10^{-3}} = 2437\,\text{sec} = 0.68\,\text{hours}$$

53. Ans: (C)

Sol: Total O_2 requirement (g/d)

$$= \frac{Q(S_o - S)}{f} - 1.42\,Q_w X_R$$

Given:

$Q = 8 \times 10^6$ L/day

$V = 1000 m^3$

S_0 = Influent BOD = 240 mg/L = .24 g/L

S = Effluent BOD = 40 mg/L = 0.04g/L

f = ratio of 5-day BOD to ultimate BOD

= 0.68

θc = Mean Cell Residence Time = 10 days

Xi = MLVSS in aeration tank = 3500 mg/L

= 3.5g/L

$Q_W \cdot X_R$ = Mass of solids waste per day

$= V \cdot Xi / \theta c$

$= 1000 \times 10^3 \times 3.5 / 10$

$= 35 \times 10^4$ g/day

TOTAL Oxygen requirement

$$= 8 \times 10^6 \frac{(0.25 - 0.04)}{0.68} - 1.42 \times 35 \times 10^4$$

= 18,55,941.18 g/day

= 1855.941 kg/day

= 1856 kg/day

54. Ans: (A)

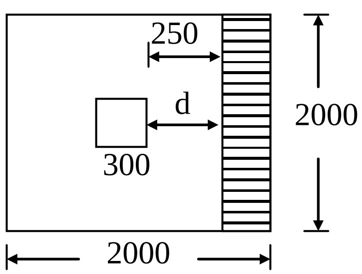
Sol: One way shear stress $\tau_v = \frac{V_u}{Bd}$

V_u = factored vertical shear force at critical section

Net factored pressure on the footing

$$= \frac{400 \times 10^3}{2000 \times 2000} = 0.1 \text{ N/mm}^2$$

As the critical section is at a distance d (250 mm) from face of the column.



$$V_u = 0.1 \times \left(\frac{2000 - 300}{2} - 250\right) \times 2000$$

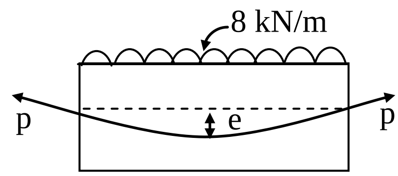
$= 0.1 \times 600 \times 2000$

$= 120 \times 10^3$N

$$\therefore \tau_v = \frac{120 \times 10^3}{2000 \times 250} = 0.24 \text{ N/mm}^2$$

55. Ans: 2000

Sol: Load balancing concept:



$$P.e = \frac{w\ell^2}{8}$$

$$\Rightarrow P = \frac{w\ell^2}{8e} \quad \Rightarrow P = \frac{8 \times 20^2}{8 \times 0.2}$$

P = 2000 kN

56. Ans: (D)

Sol: (PART AND THE WHOLE) A fragment is a piece of broken bone; a shard is a piece of broken pottery. (D)

57. Ans: (A)

58. Ans: (D)

Sol: irretrievably means impossible to recover or get back, so irrevocably is the correct synonym, which means not capable of being changed : impossible to revoke.

59. Ans: (B)

Sol: Indiscriminate (adj.) means not discriminating or choosing randomly; haphazard; without distinction.

60. Ans: (A)

Sol: $a_0 = 1$; $a_n = 2a_{n-1}$ if n is odd

$a_n = a_{n-1}$ if n is even

$a_{100} = a_{100-1} = a_{99} = 2.a_{99-1} = 2.a_{99} = 2.a_{98-1}$

$= 2a_{97}$

$= 2.2a_{97-1} = 2^2.a_{96}$ ……… $2_{50}.a_0 = 2^{50}$

61. Ans: (C)

Sol: A = 1; B = 1

(A) B = B + 1 = 2

(B) & (C) A = A × B = 1 × 2 = 2

Step 2: B = 2 + 1 = 3; A = A × B = 2 × 3 = 6

Step 3: B = 3 + 1 = 4; A = A × B = 6 × 4= 24

Step 4: B = 4 + 1 = 5; A = 24 × 5 = 120

Step 5: B = 5 + 1 = 6; A = 120 × 6 = 720

62. Ans: (A)

Sol: Ratio of efficiency (P & Q) = 2 : 1

Ratio of efficiency (P + Q, R) = 3 : 1

If R does 1 unit work, then P& Q together do 3 units.

Out of 3 units, P does 2 units and Q does 1 unit.

∴ Ratio of efficiency (P, Q & R) = 2 : 1 : 1

Hence, earnings should be divided in the ratio is 2 : 1 : 1.

63. Ans: (C)

Sol: In 1972, A was as old as the number formed by the last two digits of his year of birth.

So, A was born in 1936 (as in 1972, he is 36 yrs older also, last two digits of 1936 are 36).

Hence, B was born in 1936 + 15 = 1951

so, he is 21 yrs old in 1972.

64. Ans: (B)

Sol: Difference (in thousands) between the numbers of customers in the 2 complexes in:

January: 22 – 20 = 2

February: 25 – 24 = 1

March: 20 – 15 = 5

April: 28 – 25 = 3

May: 20 – 14 = 6 [Max]

June: 20 – 15 = 5

65. Ans: (B)

Sol: The issue is more about punishing criminals, and so punishment is more important than crime prevention (correct answer B).