DETAILED SOLUTIONS

MADE EASY

India's Best Institute for IES, GATE & PSUs

UPPSC-AE : 2021
ASSISTANT ENGINEER

CIVIL ENGINEERING

Test 3

Full Syllabus Test : Civil Engineering Paper-I + Hindi

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (d)

Finer the soil, more plasticity, more compressibility.

2. (b)

$$q = kH\frac{N_f}{N_D}$$

From above, $N_f = 3, N_d = 10$

$$q = (5\times10^{-3}\times10^{-2})\times(5-0)\times\frac{3}{10}$$

$$q = 7.5 \times 10^{-5} \text{ m/day/m}$$

$$q = 75 \times 10^{-6} \text{ m/day/m}$$

3. (b)

$$\gamma_d = \frac{W_{\text{solid}}}{V_{\text{soil}}} = \frac{18}{1} = 18 \text{ kN/m}^3$$

$$\gamma_d = \frac{G\gamma_w}{1+e}$$

$$18 = \frac{2.7\times10}{1+e} \qquad e = 0.5$$

Now, $w_w = 20 - 18 = 2 \text{ kN}$

$W_{\text{solid}} = 18 \text{ kN}$

$\therefore$ $$W = \frac{W_w}{W_{\text{solid}}} = \frac{1}{9}$$

Now $Se = wG$

$$(S)(0.5) = \frac{1}{9}\times2.7$$

$$S = 0.6 \quad \text{i.e. } 60\%$$

4. (d)

Coefficient of uniformity: $$C_u = \frac{D_{60}}{D_{10}} = \frac{1.8}{0.3} = 6$$

Coefficient of curvature: $$C_c = \frac{D_{30}^2}{D_{60}\times D_{10}} = \frac{0.6^2}{1.8\times0.3} = 0.67$$

Now, $$\text{Ratio} = \frac{C_u}{C_c} = \frac{6}{0.67} = 9$$

5. (d)

$$\text{FOS} = \frac{i_c}{i}$$

$$i = \frac{i_c}{FOS} = \frac{G-1}{1+e} \times \frac{1}{FOS}$$

$$i = \frac{2.6-1}{1+0.8} \times \frac{1}{4}$$

$$i = 0.22$$

6. (c)

For square footing, over pure clay

$$q_{nu} = 1.3 \times 5.7 \times C_u$$
$$= 7.41\ C_u$$

7. (c)

$$V_{solid} = \frac{V_{soil}}{1+e} = \frac{6}{1+0.5} = 4\,m^3$$

$$G = \frac{W_{solid}}{V_{solid}\gamma_w}$$

$\therefore$ $$W_{solid} = 2.7 \times 4 \times 10 = 108 \text{ kN}$$

$$W_w = \gamma V - W_{solid} = (20 \times 6) - 108 = 12 \text{ kN}$$

$$V_w = \frac{W_w}{\gamma_w} = \frac{12}{10} = 1.2\,m^3$$

$$V_{air} = 6 - 4 - 1.2 = 0.8 \text{ m}^3$$

8. (c)

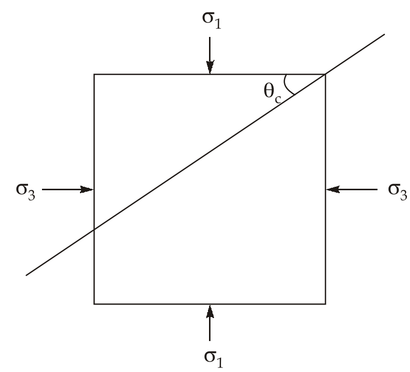
$\because$ Pile group has 4 × 4 pile in group.

$\therefore$ $$B = 3S + D$$
$$= 3(2.5) + 0.8 = 8.3 \text{ m}$$

Based on group action,

$$Q_{sf} = \alpha C_u A_s = \alpha C_u (4BL)$$
$$= (1)(40)(4 \times 8.3 \times 6)$$
$$= 7968 \text{ kN}$$

9. **(c)**



$$\sigma_3 = 100 \text{ kPa}, \sigma_d = 200 \text{ kPa}$$
$$\sigma_1 = \sigma_3 + \sigma_d = 300 \text{ kPa}$$
$$\sigma_1 = \sigma_3 \tan^2\theta_c$$
$$300 = 100 \tan^2\theta_c$$
$$\theta_c = \tan^{-1}\sqrt{3} = 60°$$

i.e. failure plane is 30° from vertical.

10. **(b)**

$$T_v = \frac{C_v t}{d^2}$$

For $U = 50\%$, $T_v = 0.196$

Since there is 2-way drainage

$$d = \frac{H}{2} = \frac{10}{2} = 5 \text{ m}$$
$$0.196 = \frac{0.25 \times t}{(10/2)^2}$$
$$t = \frac{0.196 \times 25}{0.25} = 19.6 \text{ years}$$

12. **(a)**

$$Z_0 = \frac{2c}{\gamma\sqrt{k_a}}, \qquad k_a = 1 \text{ for cohesive soil}$$
$$= \frac{2 \times 20}{20 \times 1} = 2 \text{ m}$$

13. **(a)**

$$T_v = \frac{C_v t}{d^2} = \frac{k}{m_v \gamma_w} \times \frac{t}{d^2}$$
$$\frac{T_{v1}}{T_{v2}} = \frac{k_1}{k_2} \times \frac{m_{v2}}{m_{v1}} \times \frac{t_1}{t_2} \times \frac{d_2^2}{d_1^2}$$

For same degree of consolidation,

$$T_{V_1} = T_{V_2}$$

$$1 = \frac{1}{4} \times \frac{2}{1} \times \frac{20}{t_2} \times \frac{(1/4)}{1}$$

$$t_2 = 2.5 \text{ year}$$

14. **(c)**

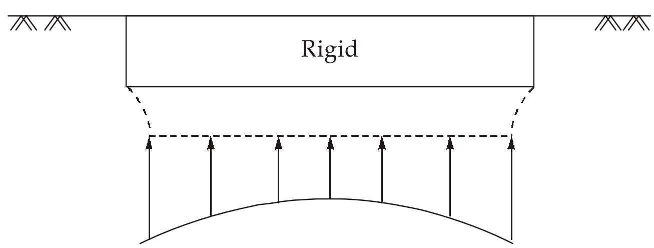
Pheratic line is flow line, separates the saturated and unsaturated soil mass.

15. **(b)**

$$k_{eq} = (k_x k_y k_z)^{1/3}$$
$$= (2 \times 10^{-5} \times 4 \times 10^{-5} \times 8 \times 10^{-5})^{1/3}$$
$$= 4 \times 10^{-5} \text{ m/s} = 0.04 \text{ mm/s}$$

16. **(d)**

- The contact pressure for rigid footing resting on clay minimum at centre.



- The settlement of flexible footing resting on clay is non-uniform.

17. **(d)**

$$q_u = CN_c + \gamma D_f N_q R_q^*$$

First term can get change if shape of footing changes.

19. **(c)**

- Cordite is gelatenized combination of nitroglycerin and nitrocellulose.
- It is smokeless explosive and produces powerful gases.

20. **(c)**

Mc. Neil's is process of seasoning of timber.

22. **(a)**

Brick size with mortar = 20 cm × 10 cm × 10 cm

$$\therefore \text{Number of brick per m}^3 \text{ masonry} = \frac{1}{0.20 \times 0.10 \times 0.10} = 500$$

Volume of brick = $500 \times (0.19)\,(0.09)(0.09) = 0.7695 \text{ m}^3$

$\therefore$ Volume of mortar = $1 - 0.7695 = 0.2305 \text{ m}^3$

29 . (d)

- Rapid hardening cement has higher amount of C_3S and more fineness to accelerate the strength gaining process but more fineness also accelerate setting processes, so to control that higher gypsum is also added.
- RHC doesn't help in resisting sulphate attack.

30. (c)

- Lime, if in excess impart unsoundness due to slacking process as well as due to sulphate attack.
- MgO in excess causes crack in mortar and concrete and also causes unsoundness.

31. (b)

Type of cement	$SSA(cm^2/gm)$
OPC	2250
PPC	3000
SSC	4000

32. (d)

$$M = t \times 24 \times [T - (-11)]$$
$$= 16 \times 24 \times [15 + 11] = 9984°\text{C-hour}$$

We know

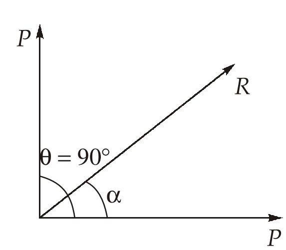
Maturity of fully matured concrete considered as 19800°C hour

$$\therefore \quad \text{Ratio} = \frac{9984}{19800} = 0.5042$$

35. (c)

$$kE = \frac{P^2}{2m} = \text{Constant}$$
$$\frac{P_1^2}{m_1} = \frac{P_2^2}{m_2}$$
$$\frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}} \quad \text{i.e. } P \propto \sqrt{m}$$

36. (c)



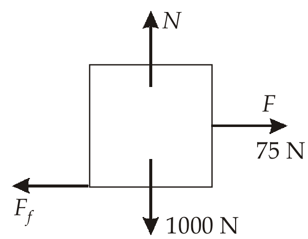
$$\tan\alpha = \frac{Q\sin\theta}{P+Q\cos\theta}$$

$$\tan\alpha = \frac{P\sin\theta}{P+P\cos\theta} = \frac{\sin 90°}{1+\cos 90°} = 1$$

$\therefore$ $$\alpha = 45°$$

$$R = \sqrt{P^2+P^2+2(P)(P)\cos(2\times 45°)} = P\sqrt{2}$$

37. (c)



$\because$ $$F_f = \mu N = 0.5 \times 1000 = 500 \text{ N}$$

$\therefore$ $$F_f > F \quad \rightarrow \text{Body is in rest}$$

$\therefore$ $$F = F_f = 75 \text{ N}$$

38. (d)

$$F = \frac{\Delta P}{\Delta t} = \frac{mv-mu}{\Delta t} = \frac{0.4\times v}{(10\times 10^{-3})}$$

$$100 = \frac{0.4\times v}{10\times 10^{-3}}$$

$$v = 2.5 \text{ m/s}$$

39. (a)

- For true stress, the actual area at any time is used. The actual area is less than original area, due to elongation in specimen therefore true stress is more than nominal stress.
- Grip of universal testing machine introduces stress concentration.

40. (d)

$$k = 1.4 \times 10^6 \text{ kg/cm}^2$$

$$\sigma_v = 1400 \text{ kg/cm}^2$$

$$\frac{dv}{v} = \frac{\sigma_v}{k} = \frac{1400}{1.4\times 10^6}$$

$$\frac{dv}{v} = 0.001$$

$$dv = 0.001 \times 6000 \text{ cm}^3 = 6 \text{ cm}^3$$

41. (d)

$$\text{Deformation in the bar, } \delta = \frac{WL}{AE}$$

$$\text{Strain energy} = \frac{1}{2}W\delta = \frac{1}{2} \times W \times \frac{WL}{AE}$$

$$\text{Strain energy} = \frac{W^2L}{2AE}$$

42. (b)

$$E = 2G(1 + \mu)$$

$$220 = 2 \times 120\,(1 + \mu)$$

$$\frac{220}{240} = 1 + \mu$$

$$\mu = 1 - \frac{220}{240}$$

$$\mu = \frac{20}{240} = \frac{1}{12}$$

43. (c)

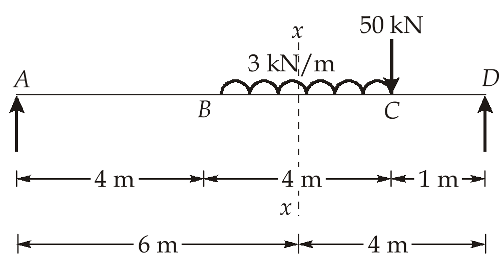
$$\Sigma M_A \circlearrowright = 0$$

$$20 \times 2 + 200 = R_D \times 10$$

$$240 = R_D \times 10$$

$$R_D = 24 \text{ kN}$$

44. (a)



SF at the section just right of middle of UDL:

$$\Sigma M_A \circlearrowright = 0$$

$$R_D \times 10 = 50 \times 8 + 3 \times 4 \times 6$$

$$R_D = \frac{472}{10} = 47.2 \text{ kN}$$

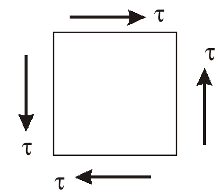
$$SF = 47.2 - 50 - 3 \times 2 = -8.8 \text{ kN}$$

45. (d)

At the plane of max shear stress, normal stress = $\frac{\sigma_1 + \sigma_2}{2} = \frac{120 + (-70)}{2} = 25 \text{MPa}$

46. (d)

For the state of pure shear:

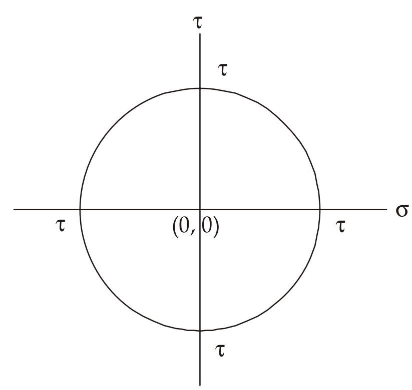


$$\text{centre} = \left(\frac{\sigma_x + \sigma_y}{2}, 0\right) = \left(\frac{0+0}{2}, 0\right) = (0, 0)$$

$$\sigma_{1,\,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2}$$

$$\sigma_{1,\,2} = \pm\,\tau$$

Principal stresses = tensile and compressive



47. (b)

$$\tau_{\max} = \frac{3}{2} \times \tau_{avg}$$

$$6 = \frac{3}{2} \times \frac{80 \times 10^3}{100 \times d}$$

$$d = 200 \text{ mm}$$

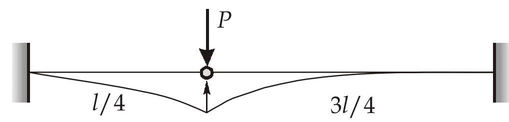
48. (d)

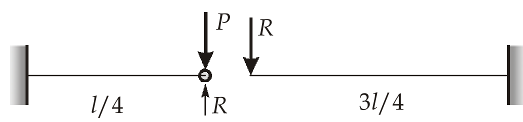
Hoop stress varies with radius R

$$\sigma_h = \frac{B}{R^2} + A$$

So variation will be hyperbolic.

49. (b)





$$\frac{(P-R)\left(\frac{l}{4}\right)^3}{3EI} = \frac{R\left(\frac{3l}{4}\right)^3}{3EI}$$

$$\frac{(P-R)l^3}{4^3} = \frac{R\times 27l^3}{4^3}$$

$$(P - R) = 27R$$

$$P = 28R$$

$$\delta_{hinge} = \frac{P}{28}\times\frac{\left(\frac{3l}{4}\right)^3}{3EI} = \frac{P}{28}\times\frac{27l^3}{64\times 3EI} = \frac{9Pl^3}{1792EI}$$

50. (a)

$$\tau_{max} = \frac{16T}{\pi d^3}$$

$$\sigma_{max} = \frac{32M}{\pi d^3}$$

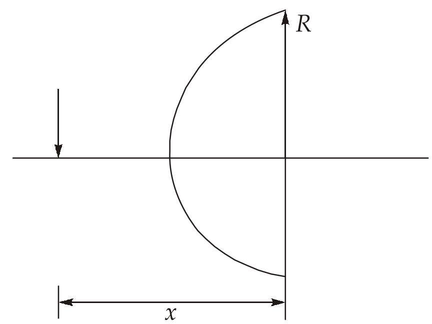
$$\frac{\tau_{max}}{\sigma_{max}} = \frac{16T}{32M} = \frac{T}{2M}$$

$$= \frac{10}{2\times 10} = 0.5$$

51. (b)

$$e = \frac{D^2+d^2}{8D} = \frac{100^2+80^2}{8\times 100} = 20.5 \text{ mm}$$

52. (c)



$$x = \frac{4R}{\pi}$$

$$x = \frac{4(D/2)}{\pi} = \frac{2D}{\pi}$$

53. (c)

ISO 800 : 2007, Clause 1.3.13

54. (a)

ISO 800 : 2007, Clause 1.3.43

55. (c)

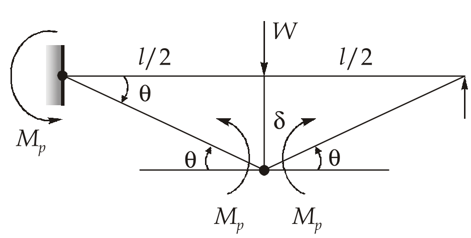
ISO 800 : 2007, Table 3

56. (c)

S_{max} depends on thickness of thinner member

$$S_{max} = t - 1.5 \text{ mm} \quad \text{(for square edges)}$$

57. (b)



$$W \times \delta = 3M_p\theta$$

$$W \times \delta = 3M_p \frac{\delta}{l/2}$$

$$W = \frac{6M_p}{l}$$

58. (c)

$$Mp = f_y Z_p$$

$$150 \times 10^6 = f_y \times 5 \times 10^{-4} \times 10^9$$

$$\frac{150\times10^6}{5\times10^5} = f_y$$

$$f_y = 300 \text{ MPa}$$

59. (b)

Intermediate stiffeners are also called stability stiffeners and are provided to check the diagonal buckling of the web. Such stiffeners increase the buckling resistance of the web caused by shear.

60. (c)

As per IS code 875 clause 5.3

k_1 = Probability factor or Risk coefficient

k_2 = Terrain, height structure size

k_3 = Topography factor

61. (c)

$$M = \frac{Wl^2}{8} = \frac{10\times6.6^2}{8}$$

$$M = 54.54 \text{ kNm}$$

$$M \le \sigma_t z$$

$$z \ge \frac{M}{\sigma_t}$$

Required section modulus, $z_{req} = \frac{M}{\sigma_t} = \frac{54.45\times10^6}{0.66\times250}$ = 330000 mm^3 = 330 cm^3

Beam section	$z(cm^3)$
ISMB 300	573.6
ISMB 400	1022.9
ISMB 500	1808.7
ISMB 600	3060.4

62. (a)

Lacing system in a column is designed to resist a transverse shear of 2.5% of axial load.

$$= \frac{2.5}{100}\times1500 = 37.5 \text{ kN}$$

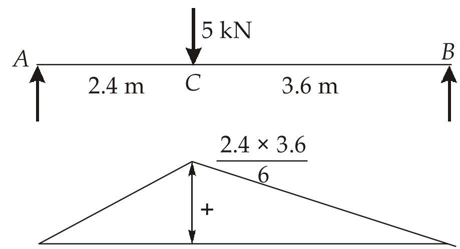
63. (c)

Refer IS 800 : 2007, Clause 8.2.2

64. (d)

Refer IS 800 : 2007 Table 5.

65. **(c)**



ILD for bending moment at *C*.

Maximum bending moment, $M = \frac{5 \times 2.4 \times 3.6}{6} = 7.2 \text{ kNm}$

66. **(c)**

For rigid-jointed plane frame, $D_{s1} = 3m + r - 3j$

For pin-jointed plane frame, $D_{s2} = m + r - 2j$

Difference, $\Delta D_s = D_{s1} - D_{s2}$

$= 3m + r - 3j - (m + r - 2j)$

$= 2m - j$

67. **(b)**

$$H = \frac{\int \frac{H_{xy} d_x}{EI_c} + \alpha t l}{\int \frac{y^2 d_x}{EI_c} + \frac{l}{AE} + k}$$

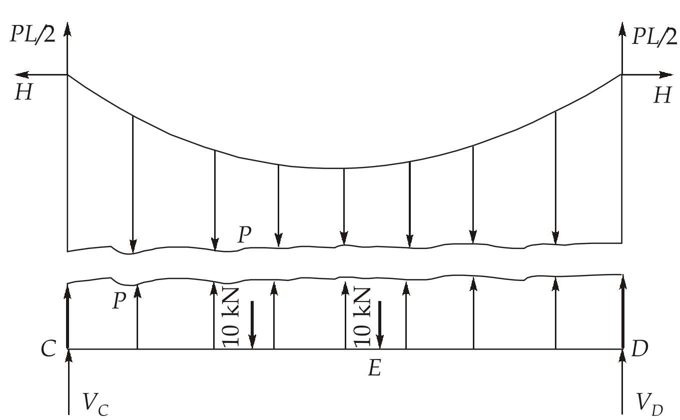
68. **(b)**

$$\frac{dH}{H} = -\frac{dh}{h}$$

$$\frac{dH}{20} = -\frac{(0.08)}{4}$$

$$dH = -0.4 \text{ kN}$$

70. **(c)**



$$V_C + V_D = 100P + 20 \quad \text{...(i)}$$

$$\Sigma M_C = 0$$

$$\Rightarrow \quad 10 \times 20 + 10 \times 40 - P \times 100 \times 50 = V_D \times 100$$

$$V_D = 6 - 50P \quad \text{...(ii)}$$

$$\Sigma M_E = 0 \quad \text{(right side)}$$

$$V_D \times 50 = -P \times 50 \times 25$$

$$V_D = -25P \quad \text{...(iii)}$$

$$6 - 50P = 25P$$

$$25P = 6$$

$$P = \frac{6}{25}\ \text{kN/m}$$

On cable,
$$H = \frac{Pl^2}{8h} = \frac{\frac{6}{25} \times 100^2}{8 \times 10} = 30\,\text{kN}$$

71. (b)

Joint	Member	Stiffness	Total	D.F
B	BA	$\frac{4E(2I)}{5} = \frac{8EI}{5}$		$\frac{192}{397}$
	BC	$\frac{3E(0.5I)}{4} = \frac{3EI}{8}$	$\frac{397EI}{120}$	$\frac{45}{397}$
	BD	$\frac{4EI}{3}$		$\frac{160}{397}$

73. (a)

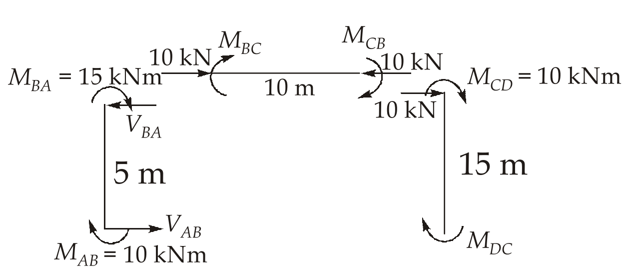
$$M_{F_{BC}} = -\frac{wl^2}{20} = -\frac{2 \times 5^2}{20} = -2.5\,\text{kNm}$$

Now, slope deflection equation for span BC at B

$$M_{BC} = M_{F_{BC}} + \frac{2EI}{L}\left(2\theta_B + \theta_C - \frac{3\Delta}{L}\right)$$

$$M_{BC} = -2.5 + \frac{2EI}{5}(2\theta_B + 0.003) \qquad (\Delta \text{ is } -\text{ve}, \theta_c = 0)$$

74. (d)



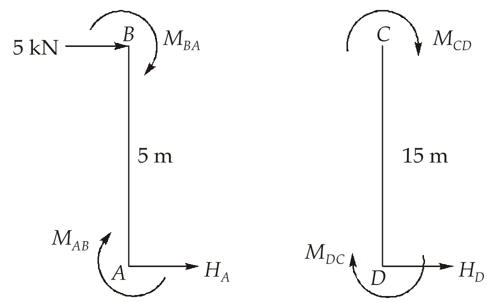
For member AB, $M_{AB} + M_{BA} - V_{BA} \times 5 = 0$

$$V_{BA} = \frac{25}{5} = 5\,\text{kN}$$

For member CD,

$$M_{CD} + M_{DC} + 10 \times 15 = 0$$
$$M_{DC} = -160 \text{ kNm}$$

Alternative:



$$\Sigma_H = 0$$
$$H_A + H_D + 5 = 0$$
$$\Rightarrow \quad \frac{M_{AB} + M_{BA}}{5} + \frac{M_{CD} + M_{DC}}{15} + 5 = 0$$
$$\Rightarrow \quad \frac{10+15}{5} + \frac{10 + M_{DC}}{15} + 5 = 0$$
$$M_{DC} = -160 \text{ kNm}$$

75. (b)

Degree of static indeterminacy, $D_s = 3c - r'$

$$D_s = 3(5) - 3$$
$$D_s = 12$$

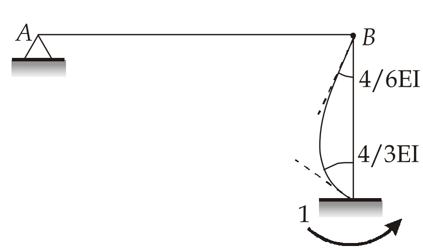
External static indeterminacy, $D_{se} = r - 3$

$$= 6 - 3 = 3$$

Internal static indetrminacy, $D_{si} = D_s - D_{se}$

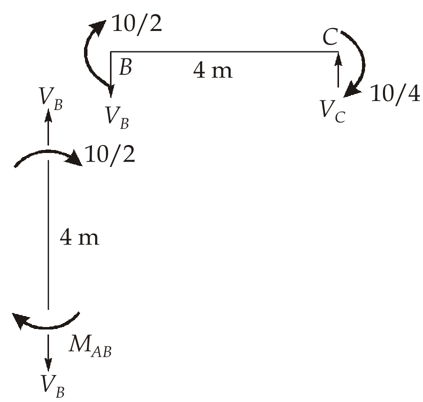
$$= 12 - 3 = 9$$

76. (a)



$$F_{21} = \frac{4}{6EI}$$

77. (b)



For member *BC*,

$$\frac{10}{2}+\frac{10}{4} = V_B \times 4$$

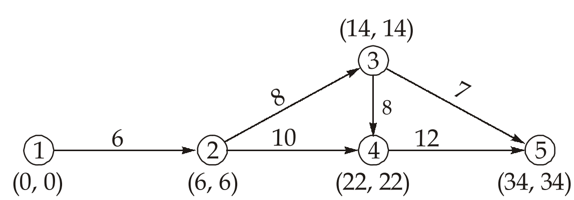
$$\frac{30}{4\times4} = V_B$$

$$V_B = 1.875 \text{ kN}$$

79. (d)

- Independent float doesn't affects the preceding as well as the succeeding activities.
- Interfering float is similar to head event slack.

80. (b)



Critical path ⇒ 1 – 2 – 3 – 4 – 5

81. (b)

Activity (*i*-*j*)	ΔC (Rs.)	ΔL(days)	Cost slope $\left(\frac{\Delta C}{\Delta L}\right)$
1 – 2	1500	3	500
2 – 3	500	2	250

∴ Activity 2 – 3 has least cost slope i.e. Activity 2 - 3 will crash first.

82. (d)

Area to be increased for semi corrugated AC sheet = 10% and if applied on both sides than area% increase 20%.

84. (a)

$$\frac{l_{c1}}{12} = 266.67 \text{ mm}$$

$$w = 300 \text{ mm}$$

Since, $$w > \frac{l_{c1}}{12}$$

For outer span:

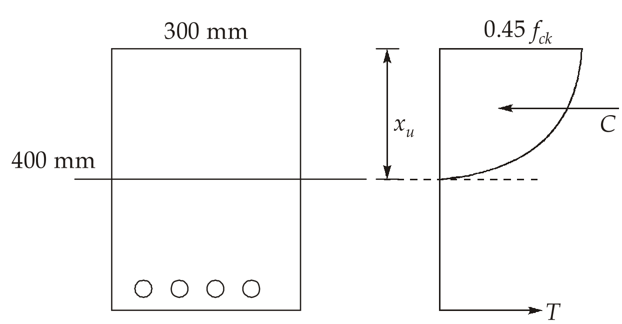
$$\text{Effective span of } 'C' = \min.\begin{cases} L_{c1} + d/2 \\ L_{c1} + w/2 \end{cases}$$

$$(L_{\text{eff}})_C = \begin{cases} 3200 + \dfrac{500}{2} \\ 3200 + \dfrac{300}{2} \end{cases} = 3350 \text{ mm}$$

For inner and middle span.

$$(L_{\text{eff}})_A = (L_{\text{eff}})_B = (L_{ci}) = 3200 \text{ mm}$$

85. (a)



$$\text{Compressive force, } C = \frac{2}{3}(B \times X_u)(0.45 f_{ck}) = 0.3\, f_{ck}\, bX_u$$

Now, $$C = T$$

$\Rightarrow$ $$0.3 f_{ck}\, bX_u = 0.87 f_y A_{st}$$

$$X_u = \frac{0.87 \times 500 \times \frac{\pi}{4} \times 16^2 \times 4}{0.3 \times 30 \times 300}$$

$$X_u = 129.57 \text{ mm} \simeq 130 \text{ mm}$$

88. (d)

Since depth of beam and maximum BM will increase in same direction.

So, $$\tau_v = \frac{V_u - \frac{Mu}{d}\tan\beta}{Bd} = \frac{\left(60 - \frac{250}{0.25} \times 0.02\right) \times 10^3}{300 \times 250} \text{N/mm}^2$$

$$= 0.53 \text{ N/mm}^2$$

90. (c)

As per marcus method, coefficient for reduced moments:

For +ve moment, $c_1 = \left(1 - \frac{5}{6}\frac{r^2}{1+r^4}\right)$

For –ve moment, $(1 - c_1) = \frac{5}{6}\frac{r^2}{1+r^4}$

91. (c)

For a continuous two way slab, (HYSD bars)

$\Rightarrow \quad \frac{\text{Span}}{\text{Overall depth}} \le 32$

$\Rightarrow \quad \text{Overall depth} \ge \frac{\text{Span}}{32}$

$\Rightarrow \quad \text{Overall depth} = \frac{3500}{32}$

$= 109.375 \simeq 110 \text{ mm}$

93. (a)

$D = 600$ mm, clear cover = 40 mm, $\phi_n = 10$ mm

Dia. of helix, $D_c = D - 2 \times \text{clear cover} - \phi_n$

$= 600 - 2 \times 40 - 10$

$= 510$ mm

V_u = Volume of helical reinforcement/m.

$$V_u = \frac{1000}{P}(\pi D_c)\left(\frac{\pi}{4}\phi_n^2\right)$$

$$P = \frac{51 \times 10^6 \times \pi^2}{4 \times 2.125 \times 10^6} = 60 \text{ mm}$$

94. (a)

No tension is allowed only in class-I section.

96. (b)

Maximum compressive stress in concrete.

$$\frac{P}{A} + \frac{P_c}{z} = \sigma_c \quad \text{....(i)}$$

For no tension condition.

$$\frac{P}{A} + \frac{P_c}{z} - \frac{M}{z} = 0 \quad \text{...(ii)}$$

From (i) and (ii) eq.

$$\Rightarrow \quad \sigma_c - \frac{M}{z} = 0$$

$$\Rightarrow \quad M = \sigma_c z$$

$$\Rightarrow \quad M = \frac{50 \times 300 \times 500^2}{6}$$

$$\Rightarrow \quad M = 625 \text{ kNm}$$

97. (b)

For building having shear walls, (or brick inflill)

$$T = \frac{0.09h}{\sqrt{H}} = \frac{0.09 \times 24}{\sqrt{25}} = 0.432 \text{ s}$$

101. (d)

जब संधि करते समय ए, ऐ, ओ, औ के साथ कोई भिन्न स्वर हो तो (ए का अय), (ऐ का आय), (ओ का अव), (औ का आव) बन जाता है। यही अयादि संधि कहलाती है।

उदाहरण : नयन, नाविक, भवन, पवित्र, चयन, पवन, गायक, नायक, इत्यादि।

102. (b)

निर् : निर्दोष, निर्माण, निर्जीव, निर्दय, निर्यात, निर्वाह, इत्यादि।

103. (a)

मय : शान्तिमय, आनन्दमय, प्रेममय, जलमय, ज्योतिर्मय, इत्यादि।

105. (c)

इकहरा उद्धरण – ‘ ’

उपविराम – :

विवरण : :–

विस्मयादि बोधक – !

106. (c)

इन्द्र : पुरन्दर, सुरपति, सुरेश, सुरेन्द्र, देवेश, देवेन्द्र, देवराज।

‘हुताशन’ अग्नि का पर्यायवाची शब्द है।

107. (d)

जिस शब्द से किसी विशेष व्यक्ति, वस्तु या स्थान के नाम का बोध हो, उसे व्यक्तिवाचक संज्ञा कहते हैं।

108. (d)

ऋ, ट वर्ग, र्, ष इत्यादि वर्ण का उच्चारण स्थान ‘मूर्द्धा’ है।

109. (a)

वह समास जिसमें एक पद विशेषण तथा दूसरा पद विशेष्य होता है, कर्मधारय समास कहलाता है।

जैसे – नीलकमल : नीला है जो कमल

110. (b)

कामदेव : मदन, मनोज, अनंग, काम, रतिपति, पुष्पधन्वा, मन्मथ।

112. (a)

शुद्ध वाक्य

– सप्रमाण उत्तर दीजिए।

– राष्ट्रपति ने पुरस्कार प्रदान किए।

– कुख्यात आतंकवादी मारा गया।

115. (b)

अपूर्ण भूत के उदाहरण निम्नलिखत हैं–

गीता किताब पढ़ रही थी।

प्रियंका नाच रही थी।

118. (c)

कौआ– काक, काग, काण, वायस, पिशुन, करठ आदि।

125. (b)

विदेशज शब्दों में 'लगाम' फारसी भाषा का शब्द है। उसी प्रकार इस्पात पुर्तगाली तथा बम डच भाषा से लिए गए हैं।

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