DETAILED SOLUTIONS

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UPPSC-AE : 2021
ASSISTANT ENGINEER

CIVIL ENGINEERING

Test 5

Full Syllabus Test : Civil Engineering Paper-I + Hindi

ANSWER KEY

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

DETAILED EXPLANATIONS

2. (b)

$P = 50\%$, $w_L = 40\%$, $w_p = 20\%$

$\therefore \quad I_p = w_L - w_p = 40 - 20 = 20\%$

$GI = 0.2a + 0.005ac + 0.01bd$

where,

$a = P - 35 = 50 - 35 = 15\% < 40\%$

$b = P - 15 = 50 - 15 = 35\% < 40\%$

$c = w_L - 40 = 40 - 40 = 0 < 20\%$

$d = I_P - 10 = (w_L - w_p) - 10 = 10\% < 20\%$

$GI = 0.2\,(15) + 0.005\,(15 \times 0) + 0.01\,(35 \times 10)$

$GI = 3 + 3.5 = 6.5$

3. (d)

$$\text{Suitability number} = 1.7\sqrt{\frac{3}{D_{50}^2}+\frac{3}{D_{20}^2}+\frac{1}{D_{10}^2}}$$

$$= 1.7\sqrt{\frac{3}{2^2}+\frac{3}{1^2}+\frac{1}{0.5^2}}$$

$$= 1.7\sqrt{\frac{3}{4}+3+4} = 4.73$$

4. (a)

$$\gamma_d = \frac{G\gamma_w}{1+wG}(1-n_a)$$

$$1.8 = \frac{2.7\times 1}{1+(0.15\times 2.7)}(1-n_a)$$

$$n_a = 0.0633$$

$$n_a = 6.33\%$$

5. (c)

$$V_{\text{soils}} = \frac{V_{\text{soil}}}{1+e}$$

$$\left(\frac{V_{\text{soil}}}{1+e}\right)_{\text{fill}} = \left(\frac{V_{\text{soil}}}{1+e}\right)_{\text{pit}}$$

$$\frac{32000}{1+0.6} = \frac{(V_{\text{soil}})_{\text{pit}}}{1+1}$$

$$(V_{\text{soil}})_{\text{pit}} = \frac{32000\times 2}{1.6}$$

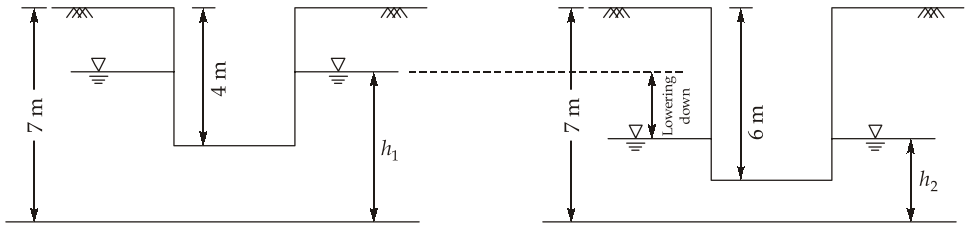
$$(V_{\text{soil}})_{\text{pit}} = 40000\ \text{m}^3$$

6. (a)

The consistency of soil will change from plastic to liquid state leading to it's volumetric increment.

7. (a)

Case-1: Case-2:



First stage,

$$\gamma_{sat}(7-4) = \gamma_w(h_1)$$
$$22 \times 3 = 10 \times h_1$$
$$\therefore \quad h_1 = 6.6 \text{ m}$$

Second case:

$$\gamma_{sat}(7-6) = \gamma_w(h_2)$$
$$\therefore \quad h_2 = 2.2 \text{ m}$$
$$22 \times 1 = 10 \times h_2 \qquad (\therefore h_2 = 2.2 \text{ m})$$

Depth of lowering of GWT = 6.6 – 2.2 = 4.4 m

8. (c)

$$h_c = \frac{C}{eD_{10}}$$

$$\frac{(h_c)_A}{(h_c)_B} = \frac{e_B}{e_A} \times \frac{(D_{10})_B}{(D_{10})_A}$$

$$\frac{(h_c)_A}{(h_c)_B} = \frac{e_B}{3e_B} \times \frac{(D_{10})_B}{\frac{1}{2}(D_{10})_B}$$

i.e. $$\frac{(h_c)_A}{(h_c)_B} = \frac{2}{3}$$

9. (a)

$$k_H = \frac{k_1z_1 + k_2z_2 + k_3z_3}{z_1 + z_2 + z_3}$$

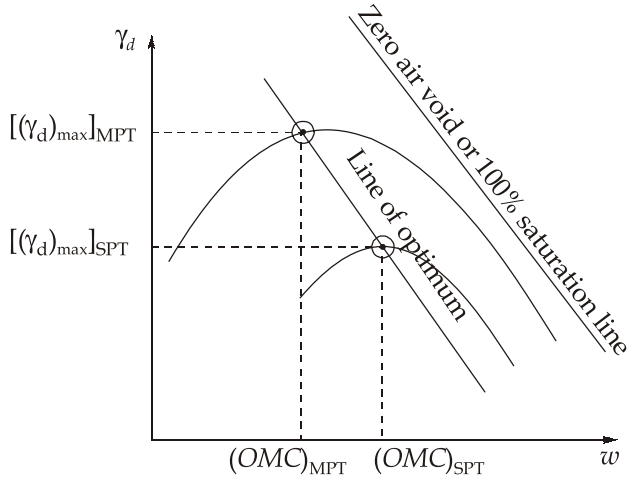
$$k_H = \frac{kz + k(2z) + k(3z)}{z + 2z + 3z} = k$$

$$k_V = \frac{z_1 + z_2 + z_3}{\frac{z_1}{k_1} + \frac{z_2}{k_2} + \frac{z_3}{k_3}}$$

$$k_V = \frac{z+2z+3z}{\frac{z}{k}+\frac{2z}{k}+\frac{3z}{k}} = \frac{6z}{\frac{1}{k}(6z)} = k$$

$$\frac{k_V}{k_H} = 1$$

10. (c)



11. (d)

$$\frac{\Delta H}{H_0} = \frac{\Delta e}{1+e_0}$$

$$\Rightarrow \quad \frac{0.5}{5} = \frac{\Delta e}{1+0.8}$$

$$\therefore \quad \Delta e = 1.8 \times 0.1 = 0.18$$

$$\therefore \quad e_f = 0.8 - 0.18 = 0.62$$

12. (d)

- Primary consolidation occurs more quickly in coarse grained soil.
- Coefficient of consolidation normally increases with decreasing liquid limit of clay.

13. (b)

For a cohesionless soil:

$$\sigma_1' = \sigma_3' \tan^2\left(45+\frac{\phi}{2}\right)$$

$$(100 - 20) = (40-20)\tan^2\left(45+\frac{\phi'}{2}\right)$$

$$4 = \tan^2\left(45+\frac{\phi'}{2}\right)$$

$$\tan(\theta_c) = 2$$

$$(\theta_c) = \tan^{-1}(2)$$

14. (c)

- A sand with it's void ratio more than it's critical void ratio decreases in volume when sheared.
- Liquefaction is phenomenon of development of positive pore pressure in loose saturated sand or silt.

16. (a)

$$\frac{S_F}{S_P} = \left(\frac{B_F}{B_P}\times\frac{B_P+0.3}{B_F+0.3}\right)^2$$

$$S_F = 20\times\left[\frac{2.5}{0.25}\times\frac{0.25+0.3}{2.5+0.3}\right]^2$$

$$S_F = 20\times\left[\frac{2.5}{0.25}\times\frac{0.55}{2.8}\right]^2$$

$$= 77.157 \text{ mm} \simeq 77 \text{ mm}$$

17. (b)

$$N_c = 15+\frac{1}{2}(N_R-15)$$

$$= 15+\frac{1}{2}(45-15)=30$$

18. (b)

$$q_{nu} = \left(1+0.3\frac{B}{L}\right)CN_c$$

$$= \left(1+0.3\frac{6}{9}\right)\times 70\times 5.7$$

$$= 478.8 \text{ kN/m}^2 \simeq 480 \text{ kN/m}^2$$

22. (a)

Dry rot timber is caused by lack of ventilation.

24. (d)

Manganese steel is used in manufacturing of rails.

25. (c)

$$\text{Gel space ratio} = \frac{0.657C}{0.319C+w}$$

$$= \frac{0.657\times 1000}{0.319\times 1000+(0.5\times 1000)}$$

$$= \frac{0.657\times 1000}{0.319\times 1000+(0.5\times 1000)}$$

$$= \frac{0.657\times 1000}{0.319\times 1000+500} = 0.802$$

26. (b)

$$\text{Volume of cement} = \frac{1}{1+2+4} \text{ volume of concrete.}$$

$$\therefore \quad \text{Volume of concrete} = 7 \text{ (Volume of cement)}$$

$$\text{Volume of concrete} = 7(35 \times 10^{-3})$$

$$\text{Volume of wet concrete} = \frac{2}{3}(7 \times 35 \times 10^{-3}) = 0.163\,\text{m}^3$$

27. (d)

Cyclopean concrete has size of aggregate is more than 150 mm so can't produce high slump.

30. (d)

Chemically combined water, contribute in building the strength of cement.

31. (c)

In low heat cement C_3A and C_3S used to reduce heat of hydration and C_2S is responsible for strength of cement.

32. (c)

Quick setting cement has an initial setting time of about 15 minute.

36. (a)

$$x = t^3 - 4t^2 + 4$$

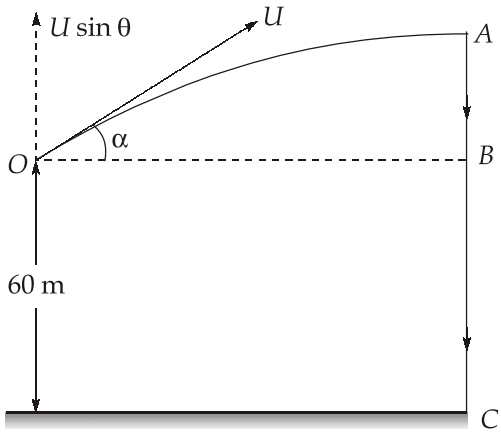
$$v = \frac{dx}{dt} = 3t^2 - 8t$$

$$a = \frac{dV}{dt} = 6t - 8$$

at $t = 2$ sec

$$a = 4\ \text{m/s}^2$$

37. (b)



From top of tower to attain time for maximum height OA is

$$t_1 = \frac{U\sin\alpha}{g} = \frac{20\times\sin 30}{10} = 1\,\text{sec}$$

From top of tower to attain maximum height i.e. AB,

$$h = \frac{U^2\sin^2\alpha}{2g} = \frac{(20)^2\times\sin^2 30}{2\times 10}$$

$$= \frac{400\times 1/4}{20} = 5\text{ m}$$

Now A to C, total height = 65 m.
Now time for fall down from A to C,

$$S = Ut + \frac{1}{2}gt^2$$

$$t^2 = \frac{65\times 2}{10}$$

$$t = \sqrt{13}\,\text{sec}$$

$\therefore$ Total time taken is $1+\sqrt{13}\,\text{sec}$

38. (b)

$$W = 10\text{ N}$$

$$mg = 10$$

$\therefore$ $$m = 1\text{ kg}$$

$$kE = \frac{1}{2}mV^2 = \frac{1}{2}\times 1\times(4)^2 = 8J$$

39. (a)

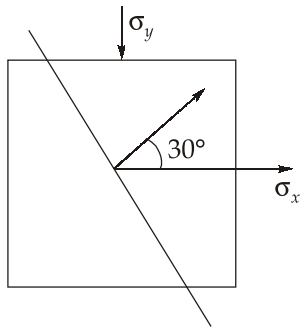
Given: $H = 2.5$ m, $h_1 = 0.5$ m

$$h_1 = e^2h$$

$$\frac{0.5}{2.5} = e^2$$

$$e = \sqrt{\frac{1}{5}}$$

41. (b)



$$\sigma_x = 90\text{ MPa}$$

$$\sigma_y = -60\text{ MPa}$$

$$\tau = \frac{\sigma_x-\sigma_y}{2}\sin 2\theta$$

$$\tau = \frac{90-(-60)}{2}\sin 60$$

$$\tau = 75\times\frac{\sqrt{3}}{2} = 64.95\text{ MPa}$$

42. (c)

$$\tan(2\theta_p)\ \tan(2\theta_s) = -1$$

$$\Rightarrow \quad 2\theta_p - 2\theta_s = 90°$$

$$\theta_p - \theta_s = 45°$$

43. (a)

$$E = 3k(1 - 2\mu)$$

$$E = 127 \times 10^3$$

$$\mu = 0.35$$

$$k = \frac{E}{3(1-2\mu)}$$

$$k = \frac{127\times10^3}{3(1-2\times0.35)} = 141.1\times10^3 \text{ MPa}$$

$$= 141.1 \text{ GPa} \simeq 141 \text{ GPa}$$

44. (c)

$$\frac{\sigma}{y} = \frac{E}{R}$$

$$y = \frac{0.5}{2} = 0.25\,\text{mm}$$

$$R = \frac{50}{2}\text{cm} = \frac{500}{2}\text{mm} = 250 \text{ mm}$$

$$\sigma_{max} = 0.25\times\frac{220\times10^3}{250} = 220 \text{ MPa}$$

45. (d)

$$\delta_A = \frac{wl^4}{8EI}$$

$$\delta_B = \frac{wl^4}{30(2EI)}$$

$$\frac{\delta_A}{\delta_B} = \frac{60}{8} = 7.5$$

46. (c)

For triangular section shear stress at any depth.

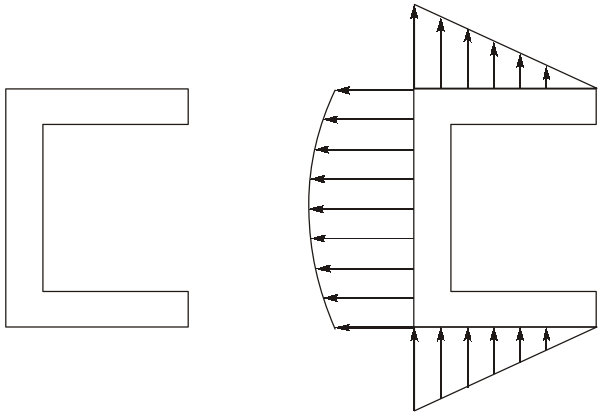
$$\tau = \frac{12V}{bh^3}\left(hy - hy^2\right)$$

For τ to be maximum.

$$\frac{d\tau}{dy} = h - 2y = 0$$

$$\Rightarrow \quad y = \frac{h}{2}$$

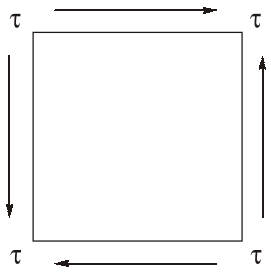
47. (b)



For flanges → Linear
For web → Parabolic

48. (c)

Element on the surface, $\tau = \dfrac{16T}{\pi d^3}$



$$\sigma_1 = \frac{\sigma_x + \sigma_y}{2} + \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2}$$

$$\sigma_x = \sigma_y = 0$$

$$\sigma_1 = \tau = \frac{16T}{\pi d^3}$$

49. (a)

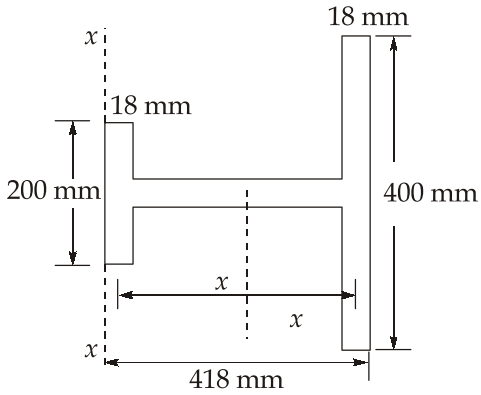
$d = 1.5$ m, $t = 15$ mm
$\sigma_\theta = 65$ MPa
$\eta_\theta = 0.8$

$$\sigma_\theta = \frac{Pd}{2t\eta_\theta}$$

$$P = \frac{65 \times 2 \times 15 \times 0.8}{1.5 \times 10^3}$$

$P = 1.04$ MPa

50. (a)



$$I_1 a = I_2 b$$

$$\frac{18\times 200^3}{12}\times x = \frac{18\times 400^3}{12}\times(400-x)$$

$$x = 8 \times 400$$

$$x = \frac{3200}{9} = 355.55 \simeq 356\,\text{mm}$$

From x-x section = 356 + 9 = 365 mm

52. (d)

Compatibility condition

$$(\Delta_R)\downarrow = (\Delta_R)\uparrow$$

$$\frac{w(l/2)^4}{8EI} + \frac{w(l/2)^3}{6EI}\times\frac{l}{2} = \frac{Pl^3}{3EI}$$

$$\frac{wl^4}{128EI} + \frac{wl^3}{48EI} + \frac{l}{2} = \frac{Pl^3}{3EI}$$

$$\frac{wl^4}{128EI} + \frac{wl^4}{96EI} = \frac{Rl^3}{3EI}$$

$$\frac{wl^4}{32EI}\left[\frac{1}{4}+\frac{1}{3}\right] = \frac{Rl^3}{3EI}$$

$$\frac{7wl^4}{(12\times 32)} = \frac{Rl^3}{EI}$$

$$R = \frac{7wl}{128}$$

53. (a)

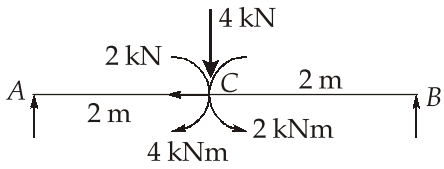
$$P = \frac{\pi^2 EI_{min}}{l_{eff}^2}$$

$$\frac{P_1}{P_2} = \frac{l_2^2}{l_1^2}$$

$$\frac{P_1}{P_2} = \frac{l^2}{(2l)^2}$$

$$\frac{P_1}{P_2} = \frac{1}{4}$$

54. (c)



$$\Sigma M_B = 0$$
$$R_A \times 4 + 4 - 2 - 4 \times 2 = 0$$
$$R_A \times 4 = 6$$
$$R_A = 1.5 \text{ kN}$$
$$SF_C = R_A = 1.5 \text{ kN}$$

55. (c)

$$\text{Plain strain condition stress tensor} = \begin{bmatrix} \sigma_{xx} & \tau_{xy} & 0 \\ \tau_{yx} & \sigma_{yy} & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\text{Strain tensor} = \begin{bmatrix} \varepsilon_x & \frac{\gamma_{xy}}{2} & 0 \\ \frac{\gamma_{yx}}{2} & \varepsilon_{yy} & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

56. (a)

IS 800 : 2007 Table 6.

57. (b)

IS 800 : 2007 Table 7.

58. (c)

For high shear, $V > 0.6V_d$

$0.6V_d = 0.6 \times 180$

$= 108 \text{ kN}$

For the present case, $V = 1.5 \times 100 = 150 \text{ kN}$

Here already $V > 0.6V_d$

i.e. it is the case of high shear therefore no additional shear is required.

59. (b)

Yield stress ratio, $\epsilon = \sqrt{\frac{250}{f_y}} = \sqrt{\frac{250}{250}} = 1$

60. (c)

IS 800 : 2007, Clause 8.7.1.1 (e)

61. (d)

$d_0 = 16 + 2 = 18$ mm

$k_b = \min\left(\frac{e}{3d_0}, \frac{p}{3d_0} - 0.25, \frac{f_{ub}}{f_u}, 1\right)$

$= \min\left(\frac{20}{3\times 18}, \frac{50}{3\times 18} - 0.25, \frac{400}{410}, 1\right)$

$= \min(0.37, 0.676, 0.975, 1)$

$k_b = 0.37$

62. (a)

$f_e = \sqrt{f_a^2 + 3q^2}$

$f_a = 50$ MPa

$q = 40$ MPa

$f_e = \sqrt{(50)^2 + 3\times 40^2}$

$f_e = 85.44 \text{ MPa} \simeq 85 \text{ MPa}$

63. (c)

IS 800 : 2007 Clause 11.2.1 (c).

65. (a)

IS 800 : 2007 clause 1.3.97

66. (d)

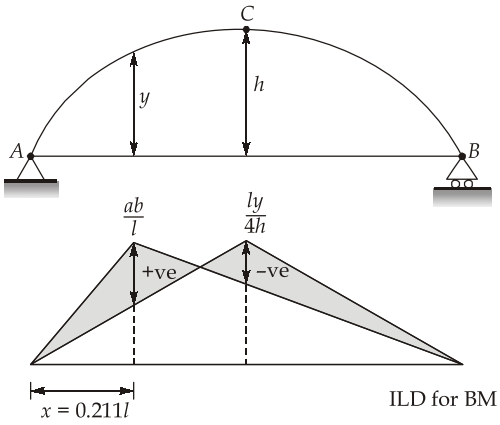
Limit state of serviceability.

1. Deflection limit.
2. Vibration limit.
3. Durability.
4. Fire resistance.

67. (d)

IS 800 : 2007 Table 11.

68. (d)



69. (c)

$$H = \frac{wl^2}{16h} = \frac{2\times 40^2}{16\times 10} = 20\,\text{kN}$$

$$y = \frac{4h}{l^2}(lx - x^2)$$

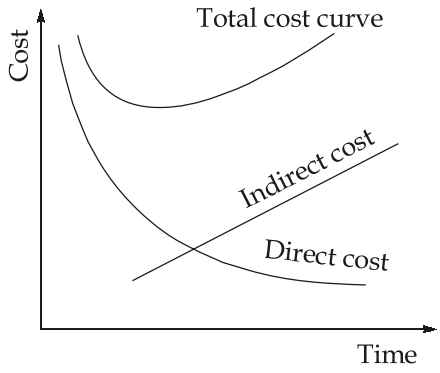
$$\frac{dy}{dx} = \frac{4h}{l^2}(l - 2x)$$

$$\left(\frac{dy}{dx}\right)_{x=0} = \frac{4h}{l} = \frac{4\times 10}{40} = 1$$

$$\tan\theta = 1$$

$$\Rightarrow \quad \theta = \tan^{-1}(1) = 45°$$

70. (c)



72. (b)

Loading is symmetrical but frame is unsymmetrical.
Sway will exist in the direction of weak column.

74. (c)

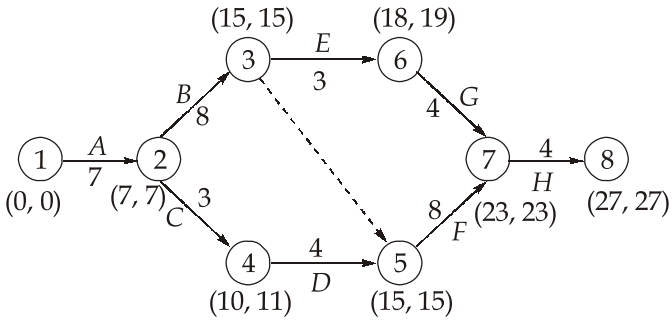
Joint	Members	Stiffness	Total stiffness	D.F.
B	BC	4E(2I)/4	3EI	2/3
	BA	4EI/4		1/3

	A	B		C
	AB	BA	BC	CB
D.F.	–	1/3	2/3	–
Fixed EM	0	0	0	0
Bal.	–	+10	+20	
C.O	+5			+10
	+5	+10	+20	+10

76. (a)

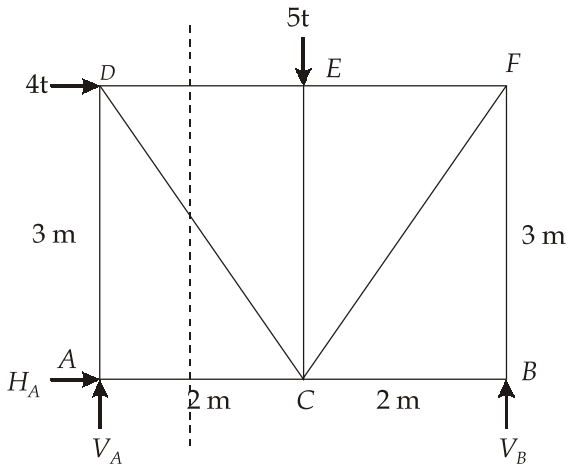
$$K.I. = 3j - r + r' - m$$
$$K.I. = 3 \times 7 - 5 + 4 - 7$$
$$K.I. = 13$$

77. (b)



For activity 7-8, EST = T_E^i = 23 days

78. (b)



$$V_A + V_B = 5t$$

$$\Sigma M_A \circlearrowleft = 0$$

$$5t \times 2 + 4t \times 3 = V_B \times 4$$

$$\frac{10+12}{4} = V_B$$

$$V_B = \frac{22}{4} = 5.5t$$

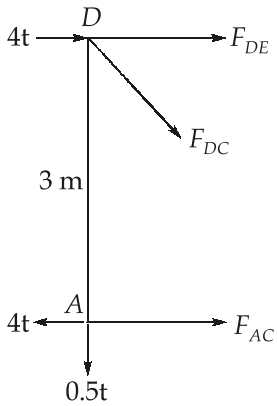
$$V_A = -0.5t$$

and $$H_A = -4t$$

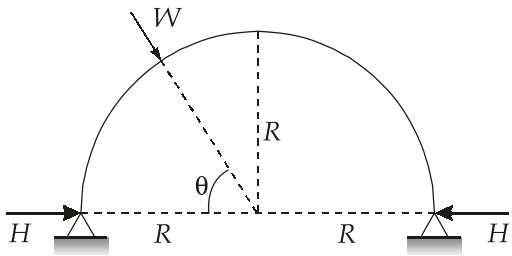
$$\Sigma M_D \circlearrowleft = 0$$

$\Rightarrow$ $$F_{AC} \times 3 = 4 \times 3$$

$$F_{AC} = 4t \text{ (tension)}$$



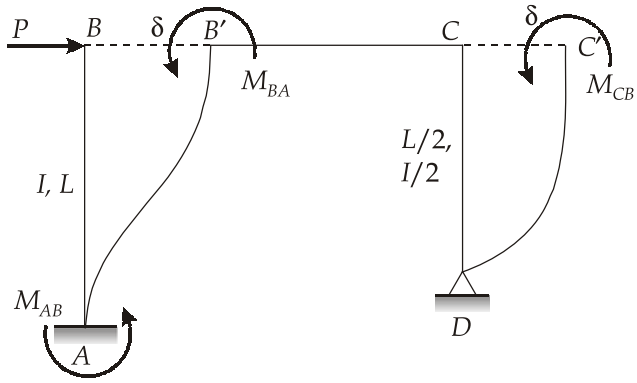
79. (a)



$$H = \frac{W}{\pi}\sin^2\theta$$

If W is at crown, $\theta = 90°$, $$H = \frac{W}{\pi}$$

80. (d)



$$M_{BA} = \frac{6EI\delta}{L^2}$$

$$M_{CD} = \frac{3E(I/2)\delta}{(L/2)^2}$$

$$= \frac{3EI\delta}{L^2} \times 2 = \frac{6EI\delta}{L^2}$$

$$\therefore \quad \frac{M_{BA}}{M_{CD}} = 1$$

86. (b)

Year	Order no.	Distribution factor
1	5	5/15
2	4	4/15
3	3	3/15
4	2	2/15
5	1	1/15
	Σ=15	

Depreciation, $D_m = (C_i - C_s) \times D.F$

$$D_1 = (1,60,000 - 10,000) \times \frac{5}{15} = 50,000$$

$D_2 = 40,000$

$D_3 = 30,000$

$B_1 = C_1 - D_1 = 1,60,000 - 50,000 = \text{Rs. } 1,10,000$

$B_2 = B_1 - D_2 = 1,10,000 - 40,000 = \text{Rs. } 70,000$

$D_3 = B_2 - D_3 = 70,000 - 30,000 = \text{Rs. } 40,000$

$\therefore$ Book value after 3rd year = Rs. 40,000

87. (c)

Given: $LL = 40$ kN/m, $DL = 20$ kN/m, $EL = 80$ kN/m

As per limit state of collapse.

$$\text{Design load} = \max.\begin{cases}1.2(LL+DL+EL)\\ 1.5(LL+DL)\end{cases}$$

$$= \max.\begin{cases}1.2(40+20+80)\\ 1.5(40+20)\end{cases}$$

$$= \begin{cases}168\,\text{kN/m}\\ 90\,\text{kN/m}\end{cases} = 168\,\text{kN/m}$$

As per limit state of serviceability.

$$\text{Design load} = \max.\begin{cases}DL+0.8(LL+EL)\\ (DL+LL)\end{cases}$$

$$= \max.\begin{cases}116\ \text{kN/m}\\ 60\ \text{kN/m}\end{cases} = 116\,\text{kN/m}$$

88. (a)

For uncracked section.

$$\text{Cracking moment} \geq \text{Applied moment}$$

$$f_{cr} \times Z \geq 70 \times 10^6$$

$$\frac{0.7 \times \sqrt{25} \times 400 \times D^2}{6} \geq 70 \times 10^6$$

$$D \geq 547.72 \simeq 548\ \text{mm}$$

89. (c)

In deep beams warping of cross-sections occurs because of shear deformation, hence plane section do not remain plain after bending.

Fracture of reinforcing steel happens due to extremely low amount of reinforcement.

90. (a)

$$M_u = 525\ \text{kNm}$$

$$M_{u,\ \text{lim}} = 0.138\, f_{ck}\, bd^2 = 0.138 \times 25 \times 300 \times 600^2 = 372.6\ \text{kNm}$$

$$A_{sc} = \frac{M_u - M_{u,\text{lim}}}{(f_{sc} - 0.45 f_{ck})(d - d')} = \frac{(525 - 372.6) \times 10^6}{(360 - 0.45 \times 25)}$$

$$= 794.525\ \text{mm}^2 \simeq 795\ \text{mm}^2$$

91. (b)

- If $\tau_v > \tau_{c\ max}$, then section is redesigned.
- If $\tau_v < 0.5\tau_c$, then no shear reinforcement is required.
- $\tau_{c\ max}$ depends grade of concrete only.

92. (d)

$$M_1 = 100\ \text{kNm}$$

$$V = 130\ \text{kN},\ \phi = 20\ \text{mm}$$

$$L_0 = \text{anchorage length}$$

As per IS 456 : 2000 anchorage value a bend is taken as 4 times that dia. of bar for each 45° bend. Subjected to a maximum of 16 times the bar diameter. So, for 90° bend.

$$L_0 = 8\phi = 160 \text{ mm}$$

$$L_d \le 1.3\frac{M_1}{V} + L_0$$

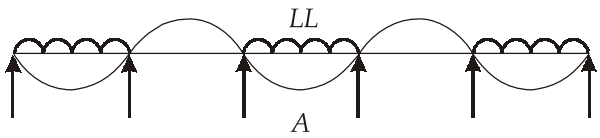
$$L_d \le \frac{1.3\times 100\times 10^6}{130\times 10^3} + 160$$

$$L_d \le 1000 + 160$$

$$L_d \le 1160 \text{ mm}$$

93. (a)

For maximum sagging BM.



Maximum sagging moment at span A.

94. (d)

$$l_{\text{eff}} = 0.85 \times 7000 = 5950 \text{ mm}$$

$$C_r = 1.25 - \frac{l_{\text{eff}}}{160\times r_{\min}}$$

$$r_{\min} = \sqrt{\frac{I_{\min}}{A}} = \sqrt{\frac{1.2\times 10^9}{120000}} = 100 \text{ mm}$$

$$C_r = 1.25 - \frac{5950}{160\times 100} = 0.88$$

97. (b)

Magnet balton, Freyssinet and Glifford-Udall system are used for post tensioning.

98. (c)

$$e_1 = 300 \text{ mm}, \quad e_2 = 150 \text{ mm}$$

Equation of parabola, with origin of support,

$$y = \frac{4h}{L^2}\left(Lx - x^2\right)$$

$$\frac{dy}{dx} = \frac{4h}{L^2}(L - 2x) \qquad (h = e_1 - e_2 = 150 \text{ mm})$$

At $x = 0$, Slope at support $= \left(\frac{dy}{dx}\right)_{x=0} = \frac{4h}{L}$

$$\left(\frac{dy}{dx}\right)\times 20 = \frac{4\times 0.150}{15} = 0.04 \text{ radian}$$

Net change in slope between support

$= 2\alpha$

$= 2 \times 0.04$

$= 0.08$ radian

99. (c)

The rise of a step should not be more than about 200 mm and going not less than 240 mm.

101. (c)

जिन स्वरों के उच्चारण में ओष्ठ गोलाकार हो जाता है, उसे संवृत्त स्वर कहते हैं।

उदाहरण : उ, ऊ, ओ, औ, इत्यादि।

104. (b)

'सम्' उपसर्ग का अर्थ होता है – ''अच्छी तरह/पूर्ण शुद्ध''।

उदाहरण : संकल्प, संयम, सन्तोष, संगठन, संचार, संलग्न, संयोग, संशय, संहार, इत्यादि।

105. (c)

'शेरनी' शब्द में 'नी' प्रत्यय का प्रयोग है।

110. (d)

ओझल – अन्तर्धान, अदृश्य, लुप्त, गायब, तिरोहित, विलुप्त, विलोचन।

112. (d)

जटिल : गहन, घना, गहरा, दुर्गम, दुरूह, इत्यादि।

113. (a)

शुद्ध वाक्य : इसका उत्तरदायित्व मुझ पर है।

115. (b)

दो या दो से अधिक वस्तुओं की विशेषताओं के मिलान को तुलना कहते हैं। इस कार्य को दर्शाने वाले विशेषण को तुलनात्मक विशेषण कहते हैं। इनकी तीन अवस्थाएं होती हैं– मूलावस्था, उत्तरावस्था तथा उत्तमावस्था।

116. (c)

हर्ष, शोक, विस्मय आदि भावों को प्रकट करने वाले अव्यय को विस्मयादिबोधक अव्यय कहते हैं।

जैसे– हाय! वाह–वाह! अहा! ओह! जी! इत्यादि।

117. (a)

अनेक स्वतंत्र उपवाक्यों का समूह जो अर्थ के लिए एक–दूसरे पर आश्रित नहीं होते, संसृष्ट वाक्य कहलाते हैं।

118. (b)

शुद्ध शब्द– अंजलि, प्रदर्शनी, ऊघम।

119. (a)

त्रुटि विराम/हंस पद	^
विस्मय विराम	!
अर्द्ध विराम	;
लोप विराम/वर्जन चिन्ह	...

124. (d)

तत्पुरुष समास का प्रथम पद गौण तथा दूसरा पद प्रधान होता है।
उदाहरण : देशभक्त, राजद्रोह, रसोईघर, धनहीन, इत्यादि।

125. (d)

'लड़की' शब्द जातिवाचक संज्ञा का एक उदाहरण है।

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