CLASS TEST

S.No.:01DLSK_CE_ABC_160426

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HIGHWAY

CIVIL ENGINEERING

Date of Test : 16/04/2026

ANSWER KEY

1.	(a)	7.	(c)	13.	(a)	19.	(c)	25.	(b)
2.	(a)	8.	(b)	14.	(d)	20.	(d)	26.	(d)
3.	(b)	9.	(b)	15.	(a)	21.	(c)	27.	(b)
4.	(a)	10.	(d)	16.	(b)	22.	(a)	28.	(d)
5.	(b)	11.	(d)	17.	(c)	23.	(b)	29.	(c)
6.	(c)	12.	(c)	18.	(d)	24.	(c)	30.	(c)

DETAILED EXPLANATIONS

1. (a)

2.5 sec is 90th percentile of reaction time.

2. (a)

$$\text{ISD - SSD} = 93.2 \text{ m}$$

But $\text{ISD} = 2\,\text{SSD}$

So, $\text{SSD} = 93.2 \text{ m}$

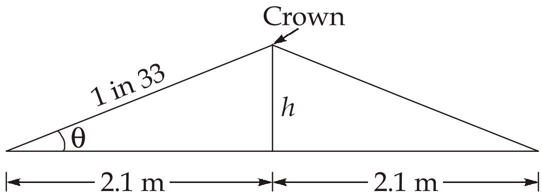
(Headlight sight distance = Stopping sight distance)

$$\therefore \quad \text{SSD} = 0.278V \times t + \frac{(0.278 \times V)^2}{2gf}$$

$$\Rightarrow \quad 93.2 = 0.278 \times 65 \times 2.5 + \frac{(0.278 \times 65)^2}{2 \times 9.81 \times f}$$

$$\Rightarrow \quad f = 0.3465 \simeq 0.35$$

3. (b)



$$\tan\theta = \frac{1}{33} = \frac{h}{\left(\frac{4.2}{2}\right)}$$

$$\Rightarrow \quad h = 0.06364 \text{ m}$$

$$= 63.64 \text{ mm}$$

4. (a)

For supersonic, $R \geq 180$ m

$$\therefore \quad \text{Radius of taxiway} = \frac{V^2}{125f} = \frac{85^2}{125 \times 0.13} = 444.625 \text{ m} \simeq 444.62 \text{ m}$$

5. (b)

$$\text{Space mean speed} = \frac{nL}{\Sigma\,\text{time}} = \frac{4 \times 400 \times 10^{-3}}{\left(\frac{400}{25} + \frac{400}{35} + \frac{400}{42} + \frac{400}{48}\right)10^{-3}} = 35.33 \text{ km/hr}$$

6. (c)

$$\text{Daily expansion factor, DEF} = \frac{\text{Average traffic volume per week}}{\text{Average traffic volume per day}}$$

$$= \frac{250500}{32000} = 7.828$$

7. **(c)**

The deformation at the failure point expressed in units of 0.25 mm is called the Marshall flow value of the specimen.

8. **(b)**

$$\text{Jam density} = K_j = \frac{1000}{7} \text{ veh/km}$$

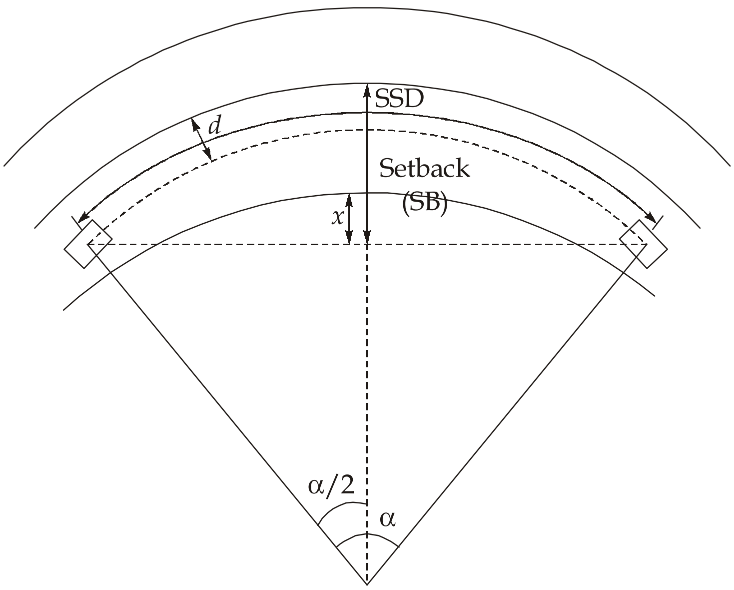
$$\text{Maximum flow} = \left(\frac{V_{S_f} \times K_j}{4}\right) = \frac{84 \times \frac{1000}{7}}{4} = 3000 \text{ veh/hr}$$

9. **(b)**

CBR method, Group index method, McLeod and Burmister method are same of the methods which are used in the design of flexible pavements.

10. **(d)**

11. **(d)**



$R = 400$ m
$l = 225$ m
$S = 90$ m
$l > S$
$d = \frac{3.8}{2} = 1.9$ m

$\therefore$ L_c (225 m) > SSD (90 m)

$\therefore$ Setback distance, $\text{SB} = R - (R-d)\cos\frac{\alpha}{2}$

$$\frac{\alpha}{2} = \frac{SSD}{(R-d)} \times \frac{180}{2\pi}$$

$$= \frac{90}{(400-1.9)} \times \frac{180}{2\pi} = 6.48°$$

12. (c)

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

$$= \frac{280\times 15\times\left(1+\frac{5.2}{15}\right)\left(1-\frac{0.69}{3}\right)}{1+\frac{15}{82}}$$

$$= 3681.5 \simeq 3681 \text{ PCU/hr}$$

13. (a)

Vehicle Damage Factor (VDF),

$$= 0.08\left[\frac{20}{8.2}\right]^4 + 0.16\left[\frac{18}{8.2}\right]^4 + 0.36\left[\frac{16}{8.2}\right]^4 + 0.15\left[\frac{12}{8.2}\right]^4 + 0.25\left[\frac{8}{8.2}\right]^4$$

$= 2.831 + 3.715 + 5.218 + 0.688 + 0.226$

$= 12.678$

$$N_s = \frac{365A\left[(1+r)^n - 1\right]\times D\times F}{r}$$

$$= \frac{365\times 6000\left[(1+0.08)^{20} - 1\right]\times 1.3\times 12.676}{0.08}$$

$= 1651.7 \simeq 1652$ msa

14. (d)

Theoretical specific gravity, G_t

$$= \frac{w_1+w_2+w_3+w_4}{\frac{w_1}{G_1}+\frac{w_2}{G_2}+\frac{w_3}{G_3}+\frac{w_4}{G_b}}$$

$$= \frac{45+40.8+4.2+10}{\frac{45}{2.65}+\frac{40.8}{2.72}+\frac{4.2}{2.60}+\frac{10}{1.10}}$$

$= 2.34$

Effective specific gravity of aggregates (coarse + fine) is given by

$$G' = \frac{(45\times 2.65)+(40.8\times 2.72)}{45+40.8}$$

$= 2.68$

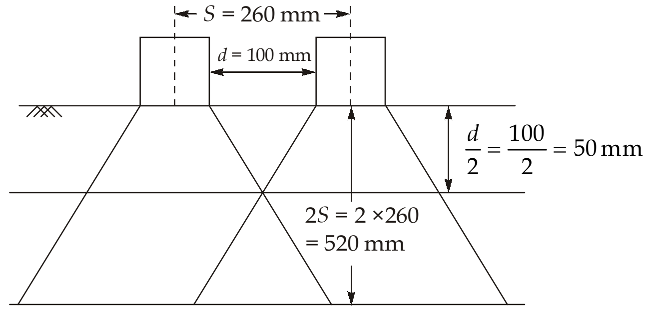
15. (a)

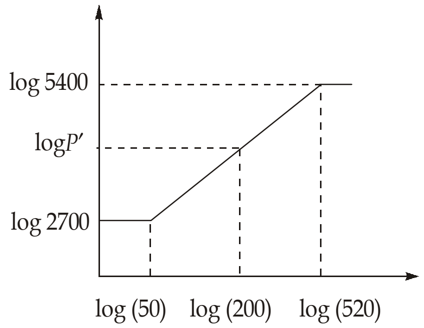
Given, $h = 25$ cm, $E = 3\times 10^5$ kg/cm^2, $\mu = 0.15$, $k = 6$ kg/cm^3

$$L = \left[\frac{Eh^3}{12k\left(1-\mu^2\right)}\right]^{1/4} = \left[\frac{3\times 10^5\times 25^3}{12\times 6\left\{1-(0.15)^2\right\}}\right]^{1/4}$$

$\Rightarrow$ $L = 90.34$ cm

16. (b)





Using interpolation,

$$\log P' = \log 2700 + \left(\frac{\log 5400 - \log 2700}{\log 520 - \log 50}\right) \times [\log 200 - \log 50]$$

$\therefore \quad P' = 4069.74 \text{ kg} \simeq 4070 \text{ kg}$

17. (c)

Braking duration, $t = 1.5$ sec

Braking distance $= 7.8$ m

$v = u + at$

As final velocity, $v = 0$

$\therefore \quad u = -at \quad \text{...(i)}$

Also, $\quad v^2 - u^2 = 2as$

$\Rightarrow \quad -u^2 = -2as \quad \text{...(ii)}$

Using (i) and (ii), we get

$\Rightarrow \quad a^2t^2 = 2as$

$$\Rightarrow \quad a = \frac{2s}{t^2} = \frac{2 \times 7.8}{(1.5)^2}$$

Average skid resistance developed,

$$f = \frac{a}{g} = \frac{2 \times 7.8}{9.81 \times (1.5)^2} = 0.7068$$

$$\text{Brake efficiency} = \frac{0.7068}{0.8} \times 100 = 88.35\% \approx 88.4\%$$

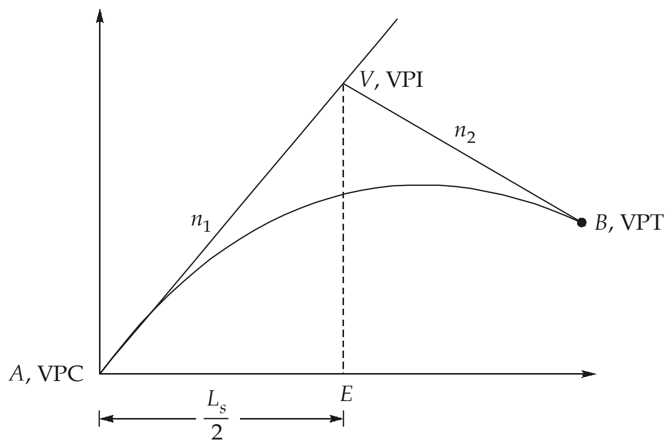
18. (d)

Assume $S < L$,

$$L = \frac{Ns^2}{\left(\sqrt{2H} + \sqrt{2h}\right)^2}$$

$N = n_1 - n_2 = 1.5 - (-0.5) = 2\%$; $H = 1.125$ m; $h = 0.1$ m

$$L = \frac{0.02 \times 300^2}{\left(\sqrt{2 \times 1.125} + \sqrt{2 \times 0.1}\right)^2} = 474.73\,\text{m} > 300\text{ m} \qquad \therefore \text{OK}$$



$$RL_A = RL_V - \frac{L_s}{2} \times n$$

$$= 75 - \frac{474.73}{2} \times 0.015 = 71.44\text{ m}$$

$$\text{RL of VPT (RL of } B) = RL_A + \frac{L_s}{2}(n_1 + n_2)$$

$$= 71.44 + \frac{474.73}{2}\frac{(1.5 - 0.5)}{100} = 73.81\text{ m}$$

19. (c)

$$\text{Width of the pavement} = W + W_e$$

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

Length of wheel base = 6.1 m (as per IRC)

$$W_e = \frac{2 \times (6.1)^2}{2 \times 280} + \frac{80}{9.5\sqrt{280}} = 0.636\text{ m} \simeq 0.64\text{ m}$$

$\therefore$ Width of pavement = 7.0 + 0.64 = 7.64 m

Distance between centre line of highway and centre line of inner lane = $\frac{W + W_e}{4} = \frac{7.64}{4} = 1.91$ m

Given : Length of the curve = 180 m; Sight distance = 250 m

L.C < S.D

$\therefore$Set back distance from centre line of road,

$$m = R-(R-d)\cos\frac{\alpha}{2}+\left(\frac{S-L}{2}\right)\sin\frac{\alpha}{2}$$

$$L = (R-d)\alpha$$

$$\alpha = \left(\frac{180}{280-1.91}\right)\times\frac{180}{\pi} = 37.086°$$

$$\therefore \quad m = 280-(280-1.91)\cos\left(\frac{37.086}{2}\right)+\left(\frac{250-180}{2}\right)\sin\left(\frac{37.086}{2}\right)$$

$$= 280-278.09\cos\left(\frac{37.086}{2}\right)+35\times\sin\left(\frac{37.086}{2}\right)$$

$$= 27.48 \text{ m}$$

Set back distance required from outer edge of pavement = $(m + 2d)$

$= (27.48 + 2 \times 1.91) = 31.3$ m

20. **(d)**

$$\text{Grade compensation} = \text{Minimum of}\begin{cases}\dfrac{30+R}{R} = \dfrac{30+60}{60} = 1.5\% \\ \dfrac{75}{R} = \dfrac{75}{60} = 1.25\%\end{cases}$$

$\therefore$ Grade compensation = 1.25%

Compensated gradient = 5 – 1.25 = 3.75% but $\nless$ 4%

$\therefore$ Compensated gradient = 4%

Grade compensation allowed =5 – 4 = 1%

21. **(c)**

By rate of change of centrifugal acceleration

$$C = \frac{80}{75+V} = \frac{80}{75+100} = 0.457 < 0.5$$

$$\therefore \quad C = 0.5$$

$$L_s = \frac{0.0215V^3}{CR} = \frac{0.0215\times(100)^3}{0.5\times400} = 107.5 \text{ m}$$

By rate of introduction of superelevation

$L_s = e \times W \times N$ [$\because$ rotation about inner edge]

$= 0.07 \times 7.6 \times 150$

$= 79.8$ m

By IRC formula:

For plain terrain,

Minimum length of transition curve,

$$L_s = \frac{2.7V^2}{R} = \frac{2.7\times100^2}{400} = 67.5 \text{ m}$$

Adopting highest of the above three values,

$$L_s = 107.5 \text{ m}$$

22. (a)

Given: $E_1 = 120\ MN/m^2 = 120\ N/mm^2$

and $E_2 = 12\ MN/m^2 = 12\ N/mm^2$

$$\frac{E_1}{E_2} = \frac{120}{12} = 10\text{, tyre pressure} = 0.5\ MN/m^2 = 0.5\ N/mm^2$$

$$\text{Radius of contact area, } a = \left[\frac{\text{Wheel load}}{p \times \pi}\right]^{1/2}$$

$$\Rightarrow \quad a = \left[\frac{40 \times 10^3}{0.5 \times \pi}\right]^{1/2} = 159.577\ \text{mm}$$

Now, $$\Delta = \left(\frac{1.5 \times p \times a}{E_2}\right) \times F$$

$$\Rightarrow \quad F = \left(\frac{\Delta \times E_2}{1.5 \times p \times a}\right) = \frac{(0.5 \times 10) \times 12}{1.5 \times 0.5 \times 159.577}$$

$$\Rightarrow \quad F = 0.50$$

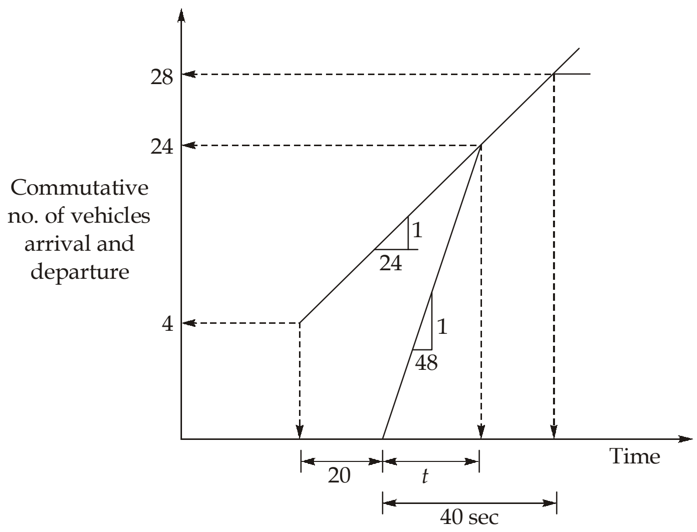
∴ From the given table, thickness of top layer

= 1.0 a

= (1.0 × 159.577) mm

= 15.9577 cm ≃ 16 cm

23. (b)



$$4 + 24 \times \left(\frac{20 + t}{60}\right) = 48\left(\frac{t}{60}\right)$$

$$\Rightarrow \quad 240 + 24(20 + t) = 48t$$

$$\Rightarrow \quad 720 = 24t$$

$$\Rightarrow \quad t = 30\ \text{sec}$$

Number of vehicles discharged in 30 sec = $48 \times \frac{30}{60}$ = 24 vehicles

Total number vehicles arrival in one cycle = $4 + 24 \times \left(\frac{60}{60}\right)$ = 28 vehicles

$$\text{Average delay} = \frac{\text{Area between arrival and departure per cycle time}}{\text{Cummulative number of vehicles arrival per cycle time}}$$

$$= \frac{\left(\frac{4+24}{2}\right) \times 50 - \frac{1}{2} \times 30 \times 24}{28} = 12.14 \text{ sec.}$$

24. (c)

$$\frac{100}{G_t} = \frac{45}{2.56} + \frac{40}{2.65} + \frac{5}{2.7} + \frac{10}{1.10}$$

$\Rightarrow$ $G_t = 2.29 \approx 2.3$

25. (b)

$$q_A = 400 \text{ PCU /hr}, q_B = 300 \text{ PCU/hr}$$

$$s_A = 1600 \text{ PCU/hr}, s_B = 1200 \text{ PCU/hr}$$

$$y_A = \frac{q_A}{s_A} = \frac{400}{1600} = 0.25$$

$$y_B = \frac{q_B}{s_B} = \frac{300}{1200} = 0.25$$

$$y = y_A + y_B = 0.25 + 0.25 = 0.5$$

Total lost time, $L = 2n + R = 2 \times 2 + 16 = 20$ sec.

Optimum cycle time, $C_0 = \frac{1.5L + 5}{1 - y} = \frac{1.5 \times 20 + 5}{1 - 0.5} = 70$ sec

26. (d)

Stopping sight distance,SSD $= 0.278 \cdot V \cdot t_r + \frac{V^2}{254\left[\eta f - \frac{G}{100}\right]}$

where η is brake efficiency and G is descending gradient

$\therefore$ $$\text{SSD} = 0.278 \times 80 \times 2.5 + \frac{80^2}{254[0.4 \times 0.7 - 0.03]} = 156.39 \text{ m} \approx 157 \text{ m (say)}$$

$\therefore$ Provide stopping sight distance as 157 m.

27. (b)

Speed (in km/hr) $U = 50 - 0.5\,k$

$\Rightarrow$ $$U = 50\left[1 - \frac{k}{\frac{50}{0.5}}\right]$$

Now, free flow speed, V_f = 50 kmph

Jam density, $k_j = \frac{50}{0.5} = 100$ veh/km

Capacity flow, $q_{max} = \frac{V_f \cdot k_j}{4} = \frac{50 \times 100}{4} = 1250$ veh/hr

Now, $$q_{max} = \frac{3600}{h}$$

where h is average time headway in seconds

$$\therefore \quad h = \frac{3600}{1250} = 2.88 \text{ sec}$$

Hence, the average time headway will be 2.88 sec.

28. (d)

Speed (kmph)	Average speed (kmph)	No. of vehicles	Cummulative no. of vehicles	Cummulative vehicles
20 – 30	25	40	40	5.71%
30 – 40	35	50	90	12.86%
40 – 50	45	100	190	27.14%
50 – 60	55	150	340	48.57%
60 – 70	65	200	540	77.14%
70 – 80	75	100	640	91.43%
80 – 90	85	60	700	100%

The upper value of speed limit (i.e 85^{th} percentile speed) is marked on the sign board

$$V_{85} = 65 + \left(\frac{75-65}{91.43-77.14}\right) \times (85-77.14)$$

$$V_{85} = 70.5 \text{ kmph} \approx 70 \text{ kmph}$$

Hence, 70 kmph speed is marked on the sign board.

29. (c)

$$p_{1-2} = \frac{b+c}{a+b+c+d}$$

$$a = V_{12} = 500$$

$$b = V_{13} + V_{14} = 450 + 150 = 600$$

$$c = V_{32} + V_{42} = 600 + 1000 = 1600$$

$$d = V_{43} = 700$$

$$p_{1\text{-}z} = \frac{600+1600}{500+600+1600+700} = 0.647$$

30. (c)

Mean vehicular arrival rate, $\nu = 3$ veh/min

Probability that atleast 1 vehicle will arrive in any given 1 minute

$$= P(n \geq 1) = 1 - [P(n = 0)] = 1 - \left[\frac{(\nu t)^n \cdot e^{-\nu t}}{n!}\right] = 1 - \left[\frac{(3\times 1)^0 \cdot e^{-3\times 1}}{0!}\right] = 1 - e^{-3}$$

$$= 0.9502 \approx 0.95$$

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