CLASS TEST

SN:04DLSKCE_C+D_15102025

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Railway + Airport

CIVIL ENGINEERING

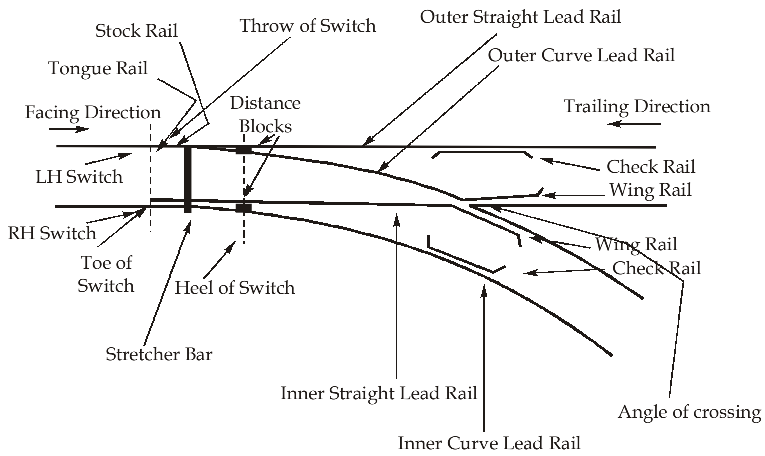
Date of Test : 15/10/2025

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (a)



RIGHT HANDED TURNOUT

Facing direction is that where trains pass over the switches first and then they pass over the crossing. Thus the correct sequence is

Throw of switch, toe of switch, Tongue rain, lead rail and crossing.

2. (b)

Grade compensation = 0.04 × 3 = 0.12%

$$\text{Permissible gradient} = \frac{1}{250} - \frac{12}{10000} = \frac{1}{357}$$

3. (d)

4. (d)

5. (a)

$$e_m = e_{act} + CD$$

$$\frac{GV_{max}^2}{127\,R} = \frac{GV_{max}^2}{127\,R} + CD$$

$$\frac{1.676 \times V_{max}^2}{127 \times \frac{1720}{3}} = \left(\frac{10}{100}\right) + \frac{76}{1000}$$

$$\therefore \quad V_{max} = 87.44 \text{ kmph}$$

6. **(c)**

7. **(a)**

$$\text{Length of each rail, } n = \frac{26}{2} = 13 \text{ m}$$

$$\text{Sleeper density} = n + 6 = 13 + 6 = 19$$

$$\text{Total number of rails required} = \frac{1690}{13} = 130$$

$$\therefore \quad \text{Total number of sleepers} = \text{Number of rails} \times \text{Sleeper density}$$
$$= 130 \times 19 = 2470$$

8. **(b)**

For landing, only elevation correction is required.

$$\text{SAT} = 15 - 0.0065(\text{H})$$
$$\Rightarrow \quad 10 = 15 - 0.0065(\text{H})$$
$$\Rightarrow \quad H = 769.23 \text{ m}$$

Basic runway length should be increased by 7% per 300 m elevation above MSL.

$$\therefore \text{Correction due to elevation} = \frac{0.07}{300} \times 769.23 \times 1800 = 323.08 \text{ m}$$

$$L_{\text{Corrected}} = 1800 + 323.08 = 2123.08 \text{ m}$$

9. **(c)**

$$\text{Grade compensation} = \frac{0.03}{100} \times 3 = 0.0009$$

$$\text{Compensated grade} = \frac{1}{200} - 0.0009 = 0.0041$$
$$= 1 \text{ in } 243.90 \simeq 1 \text{ in } 244$$

10. **(a)**

Gate capacity for single gate,

$$G_C = \frac{1}{\text{Weighted service time}}$$
$$= \frac{1}{(0.2 \times 30) + (0.2 \times 40) + (0.6 \times 60)}$$
$$= 0.02 \text{ aircraft/min/gates}$$

$$\text{Capacity of all gates } C, = G_C \times \text{Number of gate}$$
$$= 0.02 \times 20$$
$$= 0.4 \text{ aircraft/min}$$
$$= 24 \text{ aircraft/hour}$$

11. (c)

Given, One metric chain = 20 m

Let the reference elevation of start point = 100 m

$$2^{nd} \text{ elevation} = 100 + (5-0) \times 20 \times \frac{1}{100} = 101 \text{ m}$$

$$3^{rd} \text{ elevation} = 101 + (15-5) \times 20 \times \left(\frac{-1}{100}\right) = 99 \text{ m}$$

$$4^{rd} \text{ elevation} = 99 + (30-15) \times 20 \times \left(\frac{0.8}{100}\right) = 101.4 \text{ m}$$

$$5^{rd} \text{ elevation} = 101.4 + (40-30) \times \left(\frac{0.2}{100}\right) \times 20 = 101.8 \text{ m}$$

Maximum difference in elevation = 101.8 – 99 = 2.8 m

Chainage	0	5	15	30	40
Elevation (m)	100	101	99	101.4	101.8

Total turning length, L = 40 × 20 = 800 m

$$\therefore \quad \text{Effective gradient} = \frac{2.8}{800} \times 100 = 0.35\%$$

12. (d)

13. (c)

$$\text{Internal force developed, } F = \alpha TEA = 2 \times 10^{-5} \times 30 \times 20 \times 10^5 \times 60$$

$$= 72000 \text{ kg}$$

$$\text{Resistance of track} = 720 \text{ kg/km}$$

$$\therefore \quad \text{Length to resist at one end} = \frac{72000}{720} \text{ km}$$

$$= 100 \text{ km}$$

$$\therefore \quad \text{Total breathing length required} = 2 \times 100 = 200 \text{ km}$$

14. (a)

Radius of broad gauge curve,

$$R = \frac{1146}{3} = 382 \text{ m}$$

$$e_{eq} = \frac{GV^2}{127R} = \frac{1.676 \times 70^2}{127 \times 382} = 0.169 \text{ m} > 0.165 \text{ m}$$

Adopt $e_{eq} = 0.165$ m

$$e_{th} = e_{eq} + \text{CD} = 16.5 + 7.6 = 24.1 \text{ cm}$$

$$\therefore \quad 24.1 = \frac{1.676 \times V_m^2}{127 \times 382} \times 100$$

$$\Rightarrow \quad V_m = 83.52 \text{ kmph}$$

15. (c)

Since, V_{avg} = Weighted average of given movement of trains

$$\Rightarrow \quad V_{avg} = \frac{5(60)+8(80)+12(90)+6(110)}{5+8+12+6} = 86.45 \text{ kmph}$$

Now, $e_{th} = e_{act} + CD$

$$\Rightarrow \quad \frac{GV_{max}^2}{127R} = \frac{GV_{avg.}^2}{127R} + CD$$

$$\Rightarrow \quad \frac{1.750 \times 130^2}{127 \times \frac{1750}{2}} = \frac{1.750 \times 86.45^2}{127 \times \frac{1750}{2}} + CD$$

$$\Rightarrow \quad 0.2661 = 0.1177 + CD$$

$$\Rightarrow \quad CD = 0.1484 \text{ m} = 14.84 \text{ cm} \not> 10 \text{ cm}$$

Provide CD = 10 cm and calculate V_{max} again

$$\frac{GV_{max}^2}{127R} = \frac{GV_{avg}^2}{127R} + CD$$

$$\Rightarrow \quad \frac{1.750 \times V_{max}^2}{127 \times \frac{1750}{2}} = \frac{1.750 \times 86.45^2}{127 \times \frac{1750}{2}} + \left(\frac{10}{100}\right)$$

$$\Rightarrow \quad V_{max} = 117.574 \text{ kmph} \simeq 118 \text{ kmph}$$

16. (c)

Hauling capacity = $\mu n w_d$

= 0.2 × 3 × 20 = 12 tonnes

For train moving on straight and level track,

Hauling capacity = Total train resistance

Total train resistance = $R_{T1} + R_{T2} + R_{T3} + R_g$ $\quad (\because R_g = W + \tan\theta = 0)$

R_{T1} = resistance independent of speed = $0.0016w$

R_{T2} = resistance dependent of speed = $0.00008wv$ = $(0.00008 \times 100)w = 0.008w$

R_{T3} = atmospheric resistance = $0.0000006wv^2$ = $(0.0000006 \times 100^2)w = 0.006w$

$\therefore \quad 12 = 0.0016w + 0.008w + 0.006w$

$\Rightarrow \quad 12 = 0.0156w$

$\Rightarrow \quad w = 769.23 \text{ tonnes} \simeq 769 \text{ tonnes}$

17. (d)

Total weight of train = Weight of locomotive + Weight of wagons

$\Rightarrow \quad W = 120 + 25 \times 20 = 620$ tonnes

Rolling resistance of each wagon = 20 × 2.2 = 44 kg

Rolling resistance of all wagons = 25 × 44 = 1100 kg = 1.1 tonnes

Rolling resistance of locomotive = 120 × 3 = 360 kg = 0.36 tonnes

$\therefore$ Total rolling resistance of train = 0.36 + 1.1 = 1.46 tonnes

Resistance depending upon speed = 0.00008WV

$$= 0.00008 \times 620 \times 50$$
$$= 2.48 \text{ tonnes}$$

$$\text{Atmosphere resistance} = 0.0000006\ WV^2$$
$$= 0.0000006 \times 620 \times 50^2$$
$$= 0.93 \text{ tonnes}$$

$\therefore$ Train resistance = Rolling resistance + Resistance dependent on speed + Atmospheric resistance + Resistance due to gradient.

$$\Rightarrow \quad 18 = 1.46 + 2.48 + 0.93 + \frac{620}{n} \quad \text{[where gradient is 1 in } n]$$

$$n = 47.22 \simeq 48 \text{ (approx)}$$

$\therefore$ Steepest gradient permissible is 1 in 48.

18. (b)

$$\text{A.R.T.} = T_a + \frac{1}{3}(T_m - T_a)$$
$$= 25 + \frac{1}{3}(35 - 25) = 28.33°\text{C}$$

19. (d)

(i) Turning radius, $R = \dfrac{V^2}{125 \times f} = \dfrac{50^2}{125 \times 0.15} = 133.33 \text{ m}$

(ii) From Horonjeff's equation,

$$R = \frac{0.388W^2}{\left[\frac{T}{2} - S\right]} = \frac{0.388 \times 18^2}{\frac{22.5}{2} - \left(6 + \frac{6.5}{2}\right)} = 62.86 \text{ m}$$

(iii) For super-sonic jet,

$$R = 180 \text{ m}$$

$$\therefore \quad R_{\min} = \text{[Maximum of (i), (ii) and (iii)]} = 180 \text{ m}$$

20. (b)

$$R = 250 \text{ m}$$
$$e = 20 \text{ cm}$$
$$V_{max} = 58.84 \text{ kmph}$$

$$\therefore \quad \text{Length of transition curve} = \max \begin{cases} 7.2e = 7.2 \times 20 = 144 \text{ m} \\ 0.073(e)V_{\max} = 0.073 \times 20 \times 58.84 = 85.91 \text{ m} \end{cases}$$

$$= 144 \text{ m}$$

21. (c)

22. (c)

23. (c)

$$\text{Curve resistance} = 0.0004\ \text{DW}$$
$$= 0.0004 \times 4 \times 50 = 0.08\ \text{tonnes}$$

24. (b)

25. (c)

$$R = \frac{0.388\,w^2}{\frac{T}{2} - s} = \frac{0.388 \times 20^2}{\frac{22.5}{2} - \left[6 + \frac{7}{2}\right]} = 88.38\ \text{m}$$

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