CLASS TEST

S.No. : 01IG_CE_A+C_140223

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RAILWAY ENGINEERING

CIVIL ENGINEERING

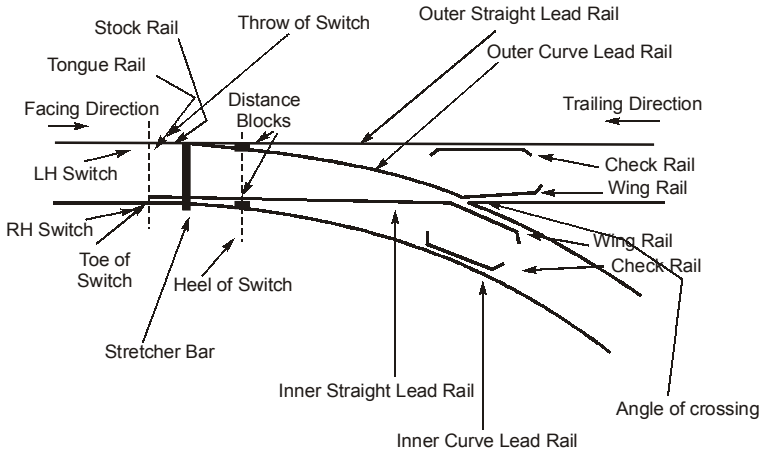
Date of Test : 14/02/2023

ANSWER KEY ➤

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

3. (b)

Grade compensation = 0.04 × 3 = 0.12%

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

4. (c)

$$\text{Landing runway length } 1800 + \frac{0.07}{300} \times 600 \times 1800 = 2052 \text{ m}$$

Number of landing distance = 0.6 × 2052 = 1231.2 m

7. (a)

$$\text{H.C} = \mu W n = \frac{1}{6} \times 22.5 \times 4 = 15 \text{ tonnes}$$

8. (c)

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

9. (a)

The distance at which outer signal is to be placed, is found on the basis of maximum allowable speed. It is 540 m for BG track in India.

11. (a)

Length of BG rail = 12.8 m

Sleeper density = 12.8 + 5 = 17.8

∴ Spacing, $S = \frac{12.8}{17.8} \times 100 \text{ cm} = 71.91 \text{ cm}$

∴ Optimum depth of Ballast Cushion $D_b = \frac{S - W}{2} = \frac{71.91 - 22.22}{2}$

$= 24.84 \text{ cm}$

13. (a)

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

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

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

∴ $V_{max} = 87.44 \text{ kmph}$

14. (c)

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

16. (a)

Length of track, $l = (D - G)\, N + G\,(4N - \sqrt{1 + N^2}\,)$

Given $N = 10$

$D = 5 \text{ m}$

$G = 1.676 \text{ m}$

$l = (5 - 1.676) \times 10 + 1.676\,(4 \times 10 - \sqrt{1 + 10^2})$

$= 83.44 \text{ m}$

The length of straight distance $= l - 4GN$

$= 83.44 - (4 \times 1.676 \times 10) = 16.4 \text{ m}$

17. (c)

Radius of curve, $R = \frac{1750}{D} = \frac{1750}{2} = 875$

where, D is in degree

Superelevation for equilibrium speed,

$$C = \frac{GV^2}{127R} = \frac{1750 \times 80^2}{127 \times 875} = 100.8 \text{ mm}$$

Superelevation for maximum permissible speed

$$C_m = \frac{1750 \times 110^2}{127 \times 875} = 190.6 \text{ mm}$$

Cant deficiency, $C_d = C_m - C = 190.6 - 100.8 = 89.8$ mm

Less than maximum cant deficiency. Hence, OK

Superelevation for booked speed of good trains

$$C' = \frac{1750 \times 50^2}{127 \times 875} = 39.37 \text{ mm}$$

Cant excess, $C_e = 100.8 - 39.37 = 61.43$ mm

Value of less than 75 mm, hence it is permitted

Maximum speed potential,

$$V_m = 0.27\sqrt{(C_a + C_d)R} = 0.27\sqrt{(100.8 + 89.8) \times 875}$$

$= 110.1$ kmph [C_a is lowest value between C and C_m]

Therefore, maximum permissible speed is least of the following

(a) Maximum sanctioned speed = 110 kmph

(b) Speed computed = 110.1 kmph

∴ Allowable maximum permissible speed = 110 kmph

[Assuming that there is no restriction of transition curve length].

21. (a)

$$\text{Radius of curve, } R = \frac{1720}{4} = 430 \text{ m}$$

$$\therefore \quad \text{Extra widening} = \frac{13(B+L)^2}{R} = \frac{13(6+0.34)^2}{430} = 1.22 \text{ cm}$$

24. (a)

Cant deficiency = Theoretical cant – actual cant

Theoretical cant is provided on the basis of equilibrium speed while cant is provided at actual speed. So if actual speed is more than equilibrium speed, cant deficiency is caused.

25. (c)

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

$$= 72000 \text{ kg}$$

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

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

$$= 100 \text{ km}$$

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