CLASS TEST

SN:03DLSKCE_OMNPQ_08102025

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Railway + Airport

CIVIL ENGINEERING

Date of Test : 08/10/2025

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (d)

The basic runway length is determined from the performance characteristics of the aircraft using the airport. The following cases are usually considered :

(i) Normal landing case requires that aircraft should come to a stop within 60% of the landing distance.

(ii) Normal take-off case requires a clearway

(iii) Engine failure case may require either a clearway or a stopway or both.

The basic length is corrected for (in the same order) :

(i) Elevation at the rate of 7% for every 300 m rise in elevation of airport above the MSL.

(ii) Temperature at the rate of 1% for every 1°C rise in airport reference temperature above the standard atmospheric temperature at that elevation.

(iii) Gradient at the rate of 20% for every 1% of the effective gradient.

2. (c)

The types of railway yards are:

(i) Goods yard : The main function is to provide facilities for receiving, loading, unloading and delivery of goods and the movement of goods vehicle.

(ii) Marshalling yard : The main function is breakup, reform and despatch of trains onwards. i.e., reception, sorting and departure.

(iii) Locomotive yard : Locomotive yard for housing locomotive. All the facilities for oil filing, watering repairing, cleaning, etc. are provided.

(iv) Passenger bogie yard : Passenger bogie yard provide facilities for safe movement of passenger and vehicles for the passengers.

3. (c)

The standard temperature at the airport site can be determined by reducing the standard mean sea level temperature of 15°C at the rate of 6.5°C per thousand metre rise in elevation.

Standard temperature = 15 – 6.5 = 8.5°C

Rise in temperature = 16 – 8.5 = 7.5°C

4. (d)

5. (b)

Length of BG rail = 12.8 m

Number of BG rails in 650 m = $\frac{650}{12.8} \simeq 51$

Sleeper density = 13 + 5 = 18 per rail

Number of sleepers = 18 × 51 = 918

6. (c)

Hauling capacity = 0.2 × 22 × 3 = 13.1 t

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7. (c)

The elevation correction is 7% per 303 m rise in elevation of airport above MSL.
For 450 m elevation the correction will be

$$= \frac{450}{303} \times 7 = 10.4\%$$

So the corrected runway length will be

$$= 1800 + \frac{10.4}{100} \times 1800 = 1987.2 \text{ m}$$

8. (b)

Grade compensation = 0.04 × 3 = 0.12%

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

9. (d)

10. (d)

The runway is usually oriented in the direction of the prevailing winds. During landing it provides breaking effect and the aircraft comes to a stop in a short length of the runway. During take off, it provides greater lift on the wings of the aircraft.

11. (d)

12. (b)

13. (a)

$$\text{Crossing number, } N = 12$$
$$\text{Gauge, } G = 1.676 \text{ m}$$
$$\text{Outer radius, } R_0 = 1.5\,G + 2\,GN^2$$
$$R_0 = 1.5 \times 1.676 + 2 \times 1.676 \times 12^2 = 485.2 \text{ m}$$
$$\text{Central radius, } R = R_0 - \frac{G}{2} = 485.2 - \frac{1.676}{2} = 484.4 \text{ m}$$

14. (a)

Gate capacity for single gate,

$$G_C = \frac{1}{\text{Weighted service time}}$$
$$= \frac{1}{(0.2 \times 30) + (0.2 \times 40) + (0.6 \times 60)}$$
$$= 0.02 \text{ aircraft/min/gates}$$
$$\text{Capacity of all gates } C = G_C \times \text{Number of gate}$$
$$= 0.02 \times 20$$
$$= 0.4 \text{ aircraft/min}$$
$$= 24 \text{ aircraft/hour}$$

15. (c)

$$\text{Hauling capacity} = \mu n w_d$$
$$= 0.2 \times 3 \times 20 = 12 \text{ tonnes}$$

For train moving on straight and level track,

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

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 = $0.0000006wv^2$ = $(0.0000006 \times 100^2)w = 0.006w$

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

$\Rightarrow \quad 12 = 0.0156w$

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

16. (b)

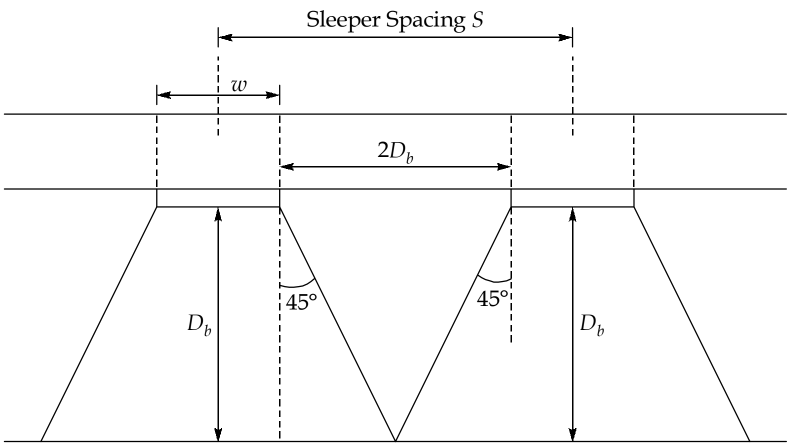
17. (b)

$$\text{CL} = 2 \text{ GN}$$
$$= 2 \times 1.676 \times 16$$
$$= 53.63 \text{ m}$$

18. (c)

$$w = \frac{13(B+L)^2}{R} = \frac{13(6+0.05)^2}{250}$$
$$= 1.903 \text{ m}$$

19. (d)



From figure,

$$S = 2D_b + w$$
$$D_b = \frac{S-w}{2} = \frac{65-25}{2} = 20 \text{ cm}$$

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20. (c)

$$\text{Internal force developed, } F = \alpha TEA = 2 \times 10^{-5} \times 30 \times 20 \times 10^{5} \times 60$$
$$= 72000 \text{ kg}$$
$$\text{Resistance of track} = 720 \text{ kg/km}$$
$$\therefore \quad \text{Length to resist at one end} = \frac{72000}{720} \text{ km}$$
$$= 100 \text{ km}$$
$$\therefore \quad \text{Total breathing length required} = 2 \times 100 = 200 \text{ km}$$

21. (c)

- Zero fuel weight is the sum of empty operating weight and maximum payload.
- Maximum landing weight is less than maximum takeoff weight because fuel is burned during flight.
- Maximum ramp weight is greater than maximum takeoff weight because extra fuel is also required for taxing.

22. (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

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

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

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

23. (c)

$$\text{Hauling capacity} = \mu n w_d$$
$$= 0.2 \times 3 \times 20 = 12 \text{ tonnes}$$

For train moving on straight and level track,

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

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 = $0.0000006wv^2$ = $(0.0000006 \times 100^2)w$ = $0.006w$

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

$\Rightarrow \quad 12 = 0.0156w$

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

24. (b)

25. (b)

Grade resistance + Curve resistance = Gradient resistance

$$\Rightarrow \quad W \tan\theta + 0.04\% \times 4 \times W = \frac{W}{200}$$

$$\Rightarrow \quad W \tan\theta + 0.0004 \times 4° \times W = \frac{W}{200}$$

$$\Rightarrow \quad \tan\theta = \frac{1}{200} - 0.0004 \times 4$$

$$= 3.4 \times 10^{-3} = \frac{1}{294}$$

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