CLASS TEST

SN:03DLSK_CE_ABC_17092026

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RAILWAY & AIRPORT

CIVIL ENGINEERING

Date of Test : 17/09/2026

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (d)

There are 4 different types of gauges in Indian railways namely:
broad gauge, meter gauge and 2 narrow gauges.
The sizes of these gauges are:
Broad gauge - 1676 mm
Metre gauge - 1000 mm
Narrow gauge - 762 mm
Narrow gauge - 610 mm.

2. (a)

Concept:

CSI is used to look at the strength characteristics and the suitability of the particular timber used in wooden sleepers.

CSI is given by following formula

$$CSI = \frac{S + 10H}{20}$$

Where S = General strength figure both for green and dry timber at 12% moisture content
H = General hardness figure both for green and dry timber at 12% moisture content
Minimum CSI prescribed on Indian Railways is as follows-
Track sleeper - 783
Crossing sleeper - 1352
Bridge sleeper - 1455

3. (a)

sleeper density = (M + 5) and bottom width = 22.22 cm

Length of one rail = 12.8 m

No of sleepers = 12.8 + 5 = 17.8

$$\text{Spacing of sleepers} = \frac{12.8 \times 100}{17.8} = 71.91 \text{ cm}$$

$$\text{Optimum depth of ballast cushion} = \frac{S - W}{2} = \frac{71.91 - 22.22}{2} = 24.84 \text{ cm} = 25 \text{ cm}$$

4. (b)

Given,

Degree of curve D = 3°

Ruling Gradient = 1 in 250

So for 3° curve, compensation, = 0.04 × 3 = 0.12%

$$\therefore \text{ Ruling gradient} = \frac{1}{250} \times 100 = 0.4\%$$

∴ The actual ruling gradient considering the grade compensation of curvature = 0.4 - 0.12 = 0.28%

5. (d)

Density of sleeper = $M + 5$

For BG track length of one rail (l) = 13 m

Length of track (L) = 1 km = 1000 m

The number of fish plates required (N) = ?

Number of rails required for 1 km of track (n) = $\dfrac{\text{Length of track } (L)}{\text{One rail length } (l)}$

Number of rails required for 1 km of track (n) = $\dfrac{1000}{13} = 76.92 \approx 77$

Number of rails required for 1 km of track (n) = 77

Number of joints on both sides of the track (n'') = 2 × Number of rails required for the track (n)

Number of joints on both sides of the track (n'') = 2 × 77 = 154

Number of joints on both sides of the track (n'') = 154

Number of fish plates required for a given track (N) = 2 × Number of joints on track (n'')

Number of fish plates required for a given track (N) = 2 × 154 = 308

Number of fish plates required for a given track (N) = 308

6. (a)

$N = 8.5$

Gauge length for BG track (G) = 1.676 m

Curve lead = 2 GN = 2 × 1.676 × 8.5 = 28.49 m

7. (a)

The Basic Runway Length is calculated for a balanced sea-level condition with standard atmospheric parameters. To determine the Actual Runway Length at a specific site, three primary corrections are applied in a specific sequential order as recommended by ICAO (International Civil Aviation Organization) and FAA (Federal Aviation Administration).

The corrections are applied to account for the reduction in air density and engine performance due to height above sea level, higher temperatures, and longitudinal slopes.

Sequential Order of Corrections

The standard procedure involves applying the corrections in the following order:

1. Elevation Correction: The basic runway length is increased at the rate of 7% per 300 m rise in elevation above mean sea level.
2. Temperature Correction: This correction is applied to the elevated runway length (length obtained after elevation correction). It accounts for the Airport Reference Temperature.
3. Gradient Correction: This is the final correction applied to the length obtained after temperature correction. It accounts for the effective gradient of the runway, typically at a rate of 20% increase for every 1% effective gradient.

8. (d)

Airport reference temperature is given by

$$\text{ART} = T_a + \frac{T_m - T_a}{3}$$

$$\text{ART} = \frac{25 + (40 - 25)}{3} = 30°\text{C}$$

9. (d)

The radius of the central curve (R) for a high-speed exit taxiway is based on the balance of centrifugal force and lateral friction without superelevation (e = 0):

$$R = \frac{V^2}{125\,f}$$

Where:

V = Maximum turn-off speed = 80 km/h

f = Coefficient of lateral friction = 0.13

Substituting the values into the formula:

$$R = \frac{80^2}{125 \times 0.13} = \frac{6400}{16.25} \approx 393.85 \text{ m}$$

Rounding off to the nearest integer gives 394 m.

10. (d)

The dimensions of a loading apron depend on the following factors:

Statement 1 is TRUE: The dimensions directly depend on the number of loading positions (gate stands) required to handle peak traffic demand.

Statement 2 is FALSE: The dimensions depend on the size of the individual design aircraft (wingspan, length, turning radius) and parking configuration, rather than the overall size of the airport. Service stations/maintenance facilities are located separately at maintenance aprons/hangars, not on the passenger loading apron.

11. (c)

According to International Civil Aviation Organization (ICAO) recommendations, the basic runway length must be increased at the rate of 7% per 300 m rise in elevation above Mean Sea Level (M.S.L.).

Given Data:

Basic runway length (L) = 1500 m

Site elevation = 1100 m

Correction for Altitude:

$$\text{Percentage increase} = \frac{7}{100} \times \frac{1100}{300} = 25.67\%$$

Corrected Runway Length:

$$L_{\text{corrected}} = 1500 + \left(\frac{25.67}{100} \times 1500\right)$$

$$L_{\text{corrected}} = 1500 + 385 \text{ m} = 1885 \text{ m}$$

12. (c)

Composite Sleeper Index (CSI), measures the mechanical strength of timber, derived from its composite properties of strength and hardness

$$\text{CSI} = \frac{S + 10H}{20}$$

where, S = Strength index at 12% moisture content

H = Hardness index at 12% moisture content.

13. (b)

Grade resistance + Curve resistance = Gradient resistance

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

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

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

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

14. (b)

15. (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 = $0.0000006wv^2$ = $(0.0000006 \times 100^2)w$ = $0.006w$

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

$\Rightarrow \quad 12 = 0.0156w$

$\Rightarrow \quad w = 769.23$ tonnes $\simeq 769$ tonnes

16. (a)

Gate capacity for single gate,

$$G_C = \frac{1}{\text{Weighted service time}}$$

$$= \frac{1}{(0.2\times 30)+(0.2\times 40)+(0.6\times 60)}$$

$$= 0.02 \text{ aircraft/min/gates}$$

Capacity of all gates C, $= G_C \times$ Number of gate

$$= 0.02 \times 20$$

$$= 0.4 \text{ aircraft/min}$$

$$= 24 \text{ aircraft/hour}$$

17. (d)

Crosswind is considered to select the correct orientation of runway using wind-rose diagram.

18. (b)

Internal force developed $= (E \times T)A$

$$F = 25 \times 10^5 \times 2 \times 10^5 \times 40 \times 50 = 100000 \text{ kg}$$

Resistance of track $= 1000$ kg/km

Length to resist at one end $= \frac{100000}{1000} = 100$ km

Total breathing length required $= 200$ km

19. (d)

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

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

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

20. (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.

21. (a)

22. (a)

23. (c)

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

$$= 1.903 \text{ cm}$$

24. (b)

25. (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

$$e_{th} = e_{eq} + \text{CD}$$

$$= 16.5 + 7.6 = 24.1 \text{ cm}$$

$\therefore$ $$24.1 = \frac{1.676 \times V_{max}^2}{127 \times 382} \times 100$$

$\Rightarrow$ $V_{max} = 83.52$ kmph

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