7
CHAPTER

Geometric Design

Q.1 If L is length of a rail and R is the radius of curve, the versine (h) for curve is

(a) $h = \dfrac{L}{4R}$ (b) $h = \dfrac{L^2}{4R}$

(c) $h = \dfrac{L^2}{8R}$ (d) $h = \dfrac{L^2}{16R}$

Q.2 Rails are bent to correct the curvature if the degree of curve is more than

(a) 2°   (b) 3°
(c) 4°   (d) 6°

Q.3 If a 0.7% upgrade meets a 0.65% downgrade at a summit and the permissible rate of change of grade per chain length is 0.1%, then the length of vertical curve is

(a) 10 chains   (b) 12 chains
(c) 14 chains   (d) 16 chains

Q.4 Safe speed (V) on a curve of radius 970 metres provided with two transition curves on BG track

(a) 112 kmph   (b) 122 kmph
(c) 132 kmph   (d) 135 kmph

Q.5 If S is the cant deficiency in cm and V is the maximum speed in kmph, then the maximum length of transition curve is

(a) $\dfrac{SV}{13.6}$ (b) $\dfrac{SV}{19.8}$

(c) $\dfrac{SV}{127}$ (d) $\dfrac{SV}{16.8}$

Q.6 The grade compensation on BG tracks on Indian railways is

(a) 0.02%   (b) 0.03%
(c) 0.04%   (d) 0.05%

Q.7 For calculating the length of curve lead, the correct formula is

(a) $G \cot \dfrac{\alpha}{2}$ (b) $\sqrt{2R_0 G}$

(c) $2GN$ (d) All of these

Q.8 Study the following statements regarding creep.
(i) Creep is greater on curves than on straight railway track
(ii) Creep in new rails is more than that in old rails
(iii) Creep is more on steep gradients than on a level track

The correct answer is
(a) only (i)   (b) (i) and (ii)
(c) (ii) and (iii)   (d) (i), (ii) and (iii)

Q.9 Vertical curves are provided where algebraic difference between grades is equal to or
(a) less than 2 mm/m
(b) more than 2 mm/m
(c) less than 4 mm/m
(d) more than 4 mm/m

Q.10 One degree of curve is equivalent to
(a) $1600/R$ (b) $1700/R$
(c) $1750/R$ (d) $1850/R$

Q.11 A triangle is used for
(a) changing the direction of engine
(b) transferring wagons to and from parallel tracks without shunting
(c) separating all the sidings and shunting lines from main lines
(d) preventing the vehicles from running off the track

Q.12 On a single rail track, goods train loaded with heavy iron material starts from A to B and after emptying the wagons returns from B to A. The amount of creep in the rails,
(a) will be more in the direction of B to A
(b) will be more in the direction of A to B

(c) will be maximum at the middle of A & B
(d) cannot be determined from the given data

Q.13 The grade compensation on a 4° curve on a Broad Gauge railway track is
(a) 0.20%   (b) 0.16%
(c) 0.12%   (d) 0.08%

Q.14 List-I and List-II show respectively terms and expressions related to horizontal railway curves. Match the two lists and select the correct answer by using the codes given below the lists:

List-I		List-II
A. Length of back tangent	1.	$\dfrac{\pi R \Delta°}{180°}$
B. Length of curve	2.	$2R \sin \dfrac{\Delta°}{2}$
C. Length of long chord	3.	$R \tan \dfrac{\Delta°}{2}$
D. Length of mid-ordinate	4.	$R \cos \dfrac{\Delta°}{2}$

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	2	3	4	1
(d)	1	4	3	2

Q.15 Match List-I with List-II and select the correct answer by using codes give below the lists:

List-I		List-II
A. Spiral angle	1.	$\dfrac{L^2}{24R}$
B. Shift	2.	$x = \dfrac{y^3}{6RL}$
C. Froud's transition equation	3.	$\dfrac{L}{2R}$ radians
D. Deflection angle for mid-point of the transition curve	4.	$\dfrac{143.25L}{R}$ minutes

Codes:

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4

(c) 3 4 2 1
(d) 1 3 4 2

Q.16 Match List-I (Gradient) with List-II (Location) and select the correct answer by using codes give below the lists:

List-I	List-II
A. 1 in 6	1. Station yards and sharp curves
B. 1 in 8$\frac{1}{2}$	2. Turnout of main line in station yards
C. 1 in 12	3. Symmetrical split
D. 1 in 16	4. High speed turn outs

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	3	1	2	4
(d)	1	2	4	3

Q.17 As per percussion theory, creep increases due to
1. weak and loose fish bolts
2. wide expansion gap
3. loose packing of joints
4. worn out fish plates
The correct answer is
(a) 1, 2 and 3   (b) both 3 and 4
(c) 2, 3 and 4   (d) 1, 2, 3 and 4

Q.18 If a 8° curved track diverges from the main track of 5° in an opposite direction in the layout of B.G. yard, the super elevation on the branch line if maximum speed permitted on mainline is 45 kmph is?
(a) −0.180 cm   (b) +0.180 cm
(c) −2.89 cm   (d) +2.89 cm

Q.19 In design of railways, if α is the switch angle and R is the radius of curve at turnout, which one of following expression would give correctly the length of the tongue rail?

(a) $R \sin \alpha$ (b) $R \sin \dfrac{\alpha}{2}$

(c) $R \tan \alpha$ (d) $R \tan \dfrac{\alpha}{2}$

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Explanations Geometric Design

3.   (c)

No. of chain lengths

$$= \frac{g_1-(-g_2)}{r} = \frac{0.7+0.65}{0.1}$$

$$= 3.15 \approx 14$$

4.   (c)

For B.G., safe speed is given as

$$V = 4.4\sqrt{R-70}$$

$$= 4.4\sqrt{970-70} = 132 \text{ kmph}$$

6.   (c)

Grade compensation for $BG = 0.04\%$

Grade compensation for $MG = 0.03\%$

13.   (b)

For BG, grade compensation is given as 0.04%
per degree of curvature.

$$\because \quad D = 4°$$

$$\therefore \quad \text{Grade compensation} = 0.04 \times 4 = 0.16\%$$

18.   (a)

Equilibrium cast for 45 kmph speed

$$= \frac{GV^2}{1.27R}$$

$$\therefore \quad R = \frac{1720}{5}$$

$$\Rightarrow \quad e = \frac{1.676\times(45)^2}{1.27}\times\frac{5}{1720} = 7.78 \text{ cm}$$

For BG, the cast deficiency for mainline = 7.6 cm permitted

So cast for main track

$$= (7.78 - 7.6) = 0.18 \text{ cm}$$

Therefore, negative cast for branch line

$$= -0.18 \text{ cm}$$

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