12
CHAPTER

Transition Curve

Q.1 If L is the length of transition curve and R is the radius of circular curve, then the shift of the curve is directly proportional to
(a) R and $1/L^2$ (b) $1/R$ and L^2
(c) $1/R^2$ and L (d) R^2 and $1/L$.

Q.2 Consider the following two statements and select the correct answer
1. Shift bisects the transition curve
2. Transition curve bisects the shift
(a) only 1 is correct
(b) only 2 is correct
(c) both 1 and 2 are correct
(d) neither 1 nor 2 is correct

Q.3 If R is the radius of the main curve, θ the angle of deflection, S is the shift and L is the length of the transition curve, then, total tangent length of the curve, is
(a) $(R - S)\tan\theta/2 - L/2$
(b) $(R + S)\tan\theta/2 - L/2$
(c) $(R + S)\tan\theta/2 + L/2$
(d) $(R - S)\cos\theta/2 + L/2$

Q.4 Match List-I (Transition curve) with List-II (Property of setting the curve) and select the correct answer using the codes given below the lists:

List-I
A. Froude's transition
B. Cubic spiral
C. True or clothoid spiral
D. Lemniscate curve

List-II
1. Length of curve measured on the tangent but y-coordinate calculated with two terms from equation for ideal transition
2. The path actually traced by an automobile turning freely
3. Length of curve measured on tangent with the first term only taken into account for both x & y coordinates from equation for ideal transition curve
4. Length of curve measured on the curve itself with first term from equation for ideal transition curve taken for y-coordinate
5. Length of curve measured on the curve with at least two terms adopted for x & y coordinates from equation for ideal transition curve

Codes:

	A	B	C	D
(a)	2	3	4	1
(b)	3	4	5	2
(c)	4	5	1	3
(d)	5	1	2	3

Q.5 Assertion A : The rate of increase of curvature along the transition curve should be equal to the rate of increase of super elevation
Reason R : The length of the transition curve should be fixed in such a manner that full superelevation is achieved at the junction with the circular curve
(a) both A and R are true and R is the correct explanation of A
(b) both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Q.6 In a parabolic vertical curve, the rising grade $g_1 = +0.80\%$ meets the falling grade $g_2 = -0.70\%$. The rate of change of grade is 0.05% per chain. The length of the vertical curve is
(a) 30 chains (b) 40 chains
(c) 50 chains (d) 60 chains

Q.7 A transition curve on a railway track is required for a circular curve of 200 m radius, the gauge being 1.5 m and maximum superelevation is restricted to 15 cm. The transition is to be designed for a velocity such that no lateral pressure is imposed on the rails and the rate of gain of radial acceleration is 30 cm/s^2. The required length of transition curve will work out to be
(a) 460 m (b) 46 m
(c) 4.6 m (d) 0.46 m

Q.8 If R is the radius of the main curve, Δ the angle of deflection, S the shift, and L the length of the transition curve, the total tangent length of the combined curve is given by
(a) $(R-S)\tan\frac{\Delta}{2}-\frac{L}{2}$ (b) $(R+S)\tan\frac{\Delta}{2}+\frac{L}{2}$
(c) $(R+S)\tan\frac{\Delta}{2}-\frac{L}{2}$ (d) $(R-S)\tan\frac{\Delta}{2}+\frac{L}{2}$

Q.9 Total angle of deflection of a transition curve is given by
(a) α (b) $\alpha/2$
(c) $\alpha/3$ (d) $\alpha/4$
where α = spiral angle

Q.10 The length of the transition curve to be introduced between straight and circular curve of radius 500 m is 90 m. The maximum deflection angle to locate its junction
(a) 1° 43′ 08″ (b) 1° 43′ 18″
(c) 1° 43′ 28″ (d) 1° 43′ 38″

Q.11 If the length of the transition curve to be introduced between a straight and a circular curve of radius of 500 m is 90 m, the maximum perpendicular offset for the transition curve is
(a) 0.70 m (b) 1.70 m
(c) 2.70 m (d) 4.70 m

Q.12 Perpendicular offset from a tangent to the junction of a transition curve and circular curve is equal to
(a) shift (b) 2 × shift
(c) 3 × shift (d) 4 × shift

Q.13 The approximate formula for radial or perpendicular offset from the tangent is
(a) $\frac{x}{2R}$ (b) $\frac{x^2}{2R}$
(c) $\frac{x}{R}$ (d) $\frac{x^2}{R}$

Q.14 A lemniscate curve between tangents will be transitional throughout if the polar deflection angle of its apex is
(a) $\frac{\Delta}{3}$ (b) $\frac{\Delta}{4}$
(c) $\frac{\Delta}{2}$ (d) $\frac{\Delta}{6}$

Q.15 A lemniscate curve will not be transitional throughout, if its deflection angle is
(a) 45° (b) 60°
(c) 90° (d) 120°

Q.16 In a lemniscate curve, the ratio of the angle between the tangent at the end of the polar ray and the straight, and angle between the polar ray and straight is
(a) 3/2 (b) 3
(c) 2 (d) 2/3

Q.17 If 'a' is the angle between the polar ray and the tangent at the point commencement of a leminscate curve, the equation of the curve is
(a) $k\sqrt{\sin a}$ (b) $k\sqrt{\sin 2a}$
(c) $k\sqrt{\tan 2a}$ (d) $k\sqrt{\cos 2a}$

Q.18 An ideal transition curve is
(a) cubic parabola (b) cubic spiral
(c) clothoid spiral (d) true spiral

Q.19 If the rate of gain of radial acceleration is 0.3 m/sec^3 and full centrifugal ratio is developed on the curve, the ratio of the length of the transition curve of same radius on road and railway is
(a) 2.828 (b) 3.828
(c) 1.828 (d) 0.828

Q.20 Which of the following statements are correct?
(i) Bernoulli's leminiscate is ideal transition curve.
(ii) Cubic spiral is more mostly used than cubic parabola since the farmer is simple to set out.

(*iii*) In equation of cubic spiral, only one approximation is made whereas in the equation of cubic parabola, two approximations are made, which makes cubic spiral superior to cubic parabola.

(a) (*i*) and (*ii*) only (b) (*ii*) and (*iii*) only
(c) (*ii*) only (d) (*i*) only

■■■■

Answers : **Transition Curve**

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

Explanations : **Transition Curve**

1. (b)

Shift $S = \frac{L^2}{24R}$

$\therefore \quad S \propto \frac{1}{R}$

and $S \propto L^2$

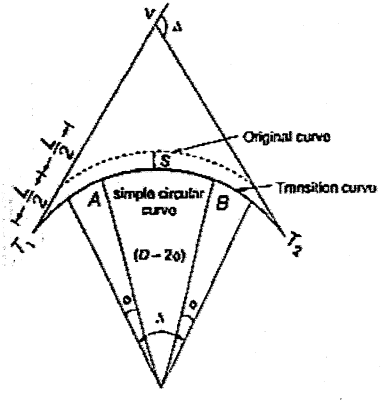
6. (a)

The length of vertical curve

$$= \frac{g_1 - (-g_2)}{r} = \frac{0.8 - (-0.7)}{0.05}$$

$$= \frac{1.5}{0.05} = 30 \text{ chains}$$

8. (b)



Δ = deflection angle between the tangents.

ϕ = spiral angle for transition curve

$$V_1 = \frac{L}{2} + (R+S)\tan\frac{\Delta}{2}$$

10. (a)

Maximum deflection angle

$$= \frac{L^2}{6LR} = \frac{L}{6R}$$

$$= \frac{90}{6 \times 500} \text{ radian} = 0.03 \text{ radian}$$

$$= 1°\,43'\,08''$$

11. (c)

Maximum perpendicular offset

$$= \frac{L^2}{6R} = \frac{(90)^2}{6 \times 500} = 2.70 \text{ m}$$

12. (d)

$$\text{Shift} = \frac{L^2}{24R}$$

Perpendicular offset

$$= \frac{L^2}{6R} = 4 \times \text{shift}$$

20. (c)

Cubical spiral is ideal transition curve and Bernoulli's leminiscate is autogenous curve. Cubic parabola is simple to set out as compared to cubic spiral.

■■■■