PRACTICE QUESTIONS

for SSC-JE : CBT-2

Transportation Engineering

Civil Engineering

05 Transportation Engineering

Q.1 Which one of the following is NOT a road pattern?
(a) Hexagonal Pattern
(b) Diamond Pattern
(c) Star and Block Pattern
(d) Block Pattern

Q.2 The sequence of four stages of survey in a highway alignment is :
(a) Reconnaissance, map study, preliminary survey and detailed survey
(b) Map study, preliminary survey, reconnaissance and detailed survey
(c) Map study, reconnaissance, preliminary survey and detailed survey
(d) Preliminary survey, map study, reconnaissance and detailed survey

Q.3 While aligning a hill road with a ruling gradient of 6%, a horizontal curve of radius 50 m is encountered. The grade compensation to be provided for this case would be
(a) 1% (b) 1.5%
(c) 4.5% (d) 4%

Q.4 Safe stopping sight distances for design speed of 60 kmph, coefficient of friction 0.36, reaction time of driver 2.5 seconds for two way traffic in a two lane road is
(a) 63.60 m (b) 81.05 m
(c) 84.50 m (d) 91.51 m

Q.5 The superelevation needed for a vehicle travelling at a speed of 60 kmph on a curve of radius 128 m on a surface with a coefficient of friction 0.15 is :
(a) 0.71 (b) 0.15
(c) 0.22 (d) 0.071

Q.6 If an ascending gradient of 1 in 50 meets another ascending gradient of 1 in 30 then the deviation angle is
(a) $\frac{1}{50}$ (b) $\frac{1}{75}$
(c) $\frac{1}{30}$ (d) $\frac{8}{150}$

Q.7 Highway Geometrics are designed for
(a) 50^{th} percentile speed
(b) 85^{th} percentile speed
(c) 95^{th} percentile speed
(d) 98^{th} percentile speed

Q.8 The maximum number of vehicles beyond which the rotary may not function effectively is :
(a) 500 vehicles per hour
(b) 300 vehicles per hour
(c) 5000 vehicles per hour
(d) 3000 vehicles per hour

Q.9 Ring and ball apparatus is used for which of the following tests of bitumen?
(a) Penetration (b) Softening point
(c) Ductility (d) Malleability

Q.10 The corrected modulus of subgrade reaction for standard diameter plate is 6.0 kg/cm^3. What would be the modulus of subgrade reaction of the soil when tested with a 30 cm diameter plate?

(a) 15 kg/cm^3 (b) 25 kg/cm^3
(c) 30 kg/cm^3 (d) 60 kg/cm^3

Q.11 Paving bitumen from sources other than Assam Petroleum is denoted as :
(a) A-type (b) Q-type
(c) B-type (d) S-type

Q.12 The pavement which transfer the load on subgrade and carried it by flexural strength called as :
(a) Flexible Pavement
(b) Rigid Pavement
(c) Structural Pavement
(d) Sleeve Pavement

Q.13 Benkelman beam deflection method is used for design of :
(a) Flexible overlay over flexible pavement
(b) Flexible overlay over rigid pavement
(c) Rigid overlay over flexible pavement
(d) Rigid overlay over rigid pavement

Q.14 Which one of the following defects indicates progressive disintegration of bituminous premix carpet surfacing by loss of aggregates?
(a) Potholes (b) Ravelling
(c) Edge breaking (d) Rutting

Q.15 Which of the following is the correct relationship between tyre pressure (P), contact pressure (P_C) and rigidity factor (R)?
(a) $\frac{P}{P_C} = R$ (b) $\frac{P_C}{P} = R$
(c) $P \times P_C = R$ (d) $\sqrt{P \times P_C} = R$

Q.16 Radius of relative stiffness of cement concrete pavement does not depend upon which one of the following?
(a) Modulus of subgrade reaction
(b) Wheel load
(c) Modulus of elasticity of cement concrete
(d) Poisson's ratio of concrete

Q.17 As per ICAO, basic runway length should increased at a rate of P% per Q metre rise in elevation from MSL. The value of P and Q are respectively.
(a) 7 and 300 (b) 7 and 250
(c) 5 and 300 (d) 5 and 250

Q.18 Minimum turning radius for sub-sonic aircraft is :
(a) 100 m (b) 120 m
(c) 150 m (d) 180 m

Q.19 The monthly mean of maximum daily temperature and monthly mean of average daily temperature of the hottest month of year are 49°C and 40°C respectively. The airport reference temperature is :
(a) 43°C (b) 69.6°C
(c) 37°C (d) 52°C

Q.20 For a sleeper density of $(n + 5)$, the number of sleepers required for constructing a broad gauge railway track of length 650 m is given by
(a) 1000 (b) 900
(c) 800 (d) 700

Q.21 For a broad gauge railway track on a horizontal curve of radius R (in m), the equilibrium cant e required for a train moving at a speed of V (in kmph) is _____ V^2/R cm
(a) 1.676 (b) 1.319
(c) 0.810 (d) 0.415

Q.22 The shift of the transition curve of radius 300 m and length 48 m is
(a) 0.32 m (b) 0.42 m
(c) 0.52 m (d) 0.62 m

Q.23 Crushed stone or layer of gravel on which sleepers are placed is called as
(a) Ballast (b) Bitumen
(c) Pavement (d) Fixture

Q.24 Which one of the following is not related to theories of creep of rails?
(a) Wave theory (b) Percussion theory
(c) Drag theory (d) Reversal theory

Q.25 The yard, where trains are received, sorted out and new trains formed and dispatched is known as
(a) Good yard (b) Locomotive yard
(c) Station yard (d) Marshalling yard

Q.26 Subsidence is a pavement deficiency which is caused by
(a) removal of larger surface aggregates leaving craters.
(b) abrupt lowering of the road surface due to poor drainage.
(c) progressive disintegration of bituminous premix carpet surfacing by loss of aggregate.
(d) a general lowering of the road surface.

Q.27 The number of conflict points for two way traffic on T-intersection is
(a) 24 (b) 11
(c) 18 (d) 6

Q.28 Green-Shield traffic analysis model for speed(v) and density(k) is given by:
(a) $v = v_f\left(1 - \frac{k_j}{k}\right)$ (b) $v_f k_j + vk = vk_j$
(c) $vk_j + kv_f = v_f k_j$ (d) $v = v_f\left(1 + \frac{k}{k_j}\right)$

Q.29 A rigid plate bearing test was conducted with 30 cm plate on soil subgrade. The deflection for yielded pressure of 1.25 kg/cm^2 will be
[Take E_s = 45 kg/cm^2]
(a) 0.25 cm (b) 0.625 cm
(c) 0.5 cm (d) 0.75 cm

Q.30 Which of the following methods are used for flexible pavement design?
1. Group index method
2. McLeod method
3. Burmister method
4. Westergaard's method
(a) 2, 3 and 4 (b) 1 and 2
(c) 1, 2 and 3 (d) 1 and 3

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Answer Keys

1. (b)	2. (c)	3. (b)	4. (b)	5. (d)	6. (b)	7. (d)
8. (d)	9. (b)	10. (a)	11. (d)	12. (b)	13. (a)	14. (b)
15. (b)	16. (b)	17. (a)	18. (b)	19. (a)	20. (b)	21. (b)
22. (a)	23. (a)	24. (d)	25. (d)	26. (b)	27. (c)	28. (c)
29. (c)	30. (c)					

Detailed Solutions

1. (b)

The various road patterns may be classified as :

- Rectangular or block pattern
- Radial or star and block pattern
- Radial or star and circular pattern
- Radial or star and grid pattern
- Hexagonal pattern
- Minimum travel pattern

2. (c)

Before a highway alignment is finalised in highway project, the engineering surveys are to be carried out. The stages of engineering surveys are :

- Map study
- Reconnaissance
- Preliminary survey
- Final location or detailed survey

3. (b)

Grade compensation

$$\text{G.C.} = \left(\frac{30+R}{R}\right)\% \nearrow \left(\frac{75}{R}\right)\%$$

$$= \frac{30+50}{50}\%$$

$$= 1.6\% \nearrow \left(\frac{75}{60}\right) = 1.5\%$$

$\therefore$ G.C. = 1.5%

4. (b)

$$\text{SSD} = 0.278Vt_r + \frac{V^2}{254f} \qquad (V \text{ in km/h})$$

Given : $V = 60$ km/h, $f = 0.36$, $t_r = 2.5$ sec

$\therefore$ $$\text{SSD} = 0.278 \times 60 \times 2.5 + \frac{(60)^2}{254 \times 0.36}$$

$$= 81.05 \text{ m}$$

5. (d)

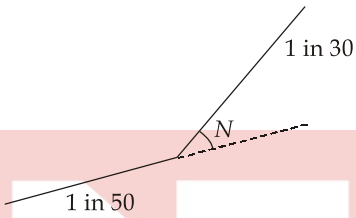
$$e + f = \frac{V^2}{127R}$$

V = 60 km/h; R = 128 m; f = 0.15

$$\Rightarrow \quad e = \frac{(60)^2}{127 \times 128} - 0.15$$

$$= 0.071$$

6. (b)



N = Deviation angle

$$= |n_1 - n_2| = \left|\frac{1}{50} - \frac{1}{30}\right|$$

$$N = \left|\frac{3-5}{150}\right| = \left|\frac{-2}{150}\right| = \frac{1}{75}$$

7. (d)

For the purpose of highway geometric design, 98th percentile speed is taken.

15th percentile speed : Lower speed limit

85th percentile speed : Higher/upper speed limit

8. (d)

The IRC suggests that the maximum volume of traffic that a rotary can efficiently handle is 3000 vehicles per hour entering from all the legs of the intersection.

9. (b)

The softening point is measured by the 'Ring and Ball' test.

10. (a)

Diameter of standard plate for plate bearing test is 75 cm.

Also, $$K \propto \frac{1}{a}$$

$$\Rightarrow \quad K_1 a_1 = K_2 a_2$$

$$6 \times 75 = K_2 \times 30$$

$$K_2 = \frac{6 \times 75}{30} = 15 \text{ kg/cm}^3$$

11. (d)

The paving bitumen available in India are classified into two categories :

(i) Paving bitumen from Assam Petroleum denoted as A-type.

(ii) Paving bitumen from other sources denoted as S-type.

12. (b)

A rigid pavement (constructed with cement concrete slabs) depends upon the flexural strength or beam action of the slab for withstanding the wheel load.

Note : In flexible pavement layer transmits the vertical or compressive stresses to the lower layer by grain to grain transfers through the points of contact in the granular structure.

13. (a)

Benkelman beam deflection measurements is used to design the overlay thickness over flexible pavement.

14. (b)

Ravelling is most common but easily preventable failure mode of bituminous pavements. It occurs as individual aggregates particle dislodged from the pavement surface downwards.

15. (b)

$$\text{Rigidity factor } (R) = \frac{\text{Contact Pressure}}{\text{Tyre Pressure}}$$

$$= \frac{P_C}{P}$$

16. (b)

Radius of relative stiffness

$$l = \left[\frac{Eh^3}{12K(1-\mu^2)}\right]^{1/4}$$

E = Modulus of elasticity of cement concrete

μ = Poisson's ratio of concrete

K = Modulus of subgrade reaction

h = Slab thickness

17. (a)

According to ICAO, basic runway length should increase at rate of 7% per 300 m rise in elevation above MSL.

18. (b)

For sub-sonic aircraft, minimum turning radius = 120 m

For supersonic aircraft, minimum turning radius = 180 m

19. (a)

$$\text{ART} = T_a + \left(\frac{T_m - T_a}{3}\right)$$

T_a = Mean of average daily temperature
= 40°C

T_m = Mean of maximum daily temperature
= 49°C

$$\therefore \quad \text{ART} = 40 + \frac{49-40}{3} = 43°\text{C}$$

20. (b)

Sleeper density = $n + 5$

For broad gauge track

No. of sleeper per rail length =13 + 5 = 18

$$\text{No. of rails} = \frac{650}{13} = 50$$

∴ Total number of sleepers required =18 × 50 = 900

21. (b)

Equilibrium cant, $e = \frac{GV^2}{127R}$ (V in kmph, R in m)

For B.G. track, $G = 1.676$ m

$$\therefore \quad e = (1.676 \times 100) \times \frac{V^2}{127R} \text{ cm}$$

$$= 1.319\, V^2/R \text{ cm}$$

22. (a)

$$\text{Shift } (S) = \frac{L^2}{24R} = \frac{(48)^2}{24 \times 300}$$

$$= 0.32 \text{ m}$$

23. (a)

Ballast is the granular material usually broken stone or brick, Shingle or Kankar, gravel or sand placed and packed below and around the sleepers to transmit load from sleepers to formation and at the same time allowing drainage of the track.

24. (d)

Creep is defined as the longitudinal movement of rails with respect to sleepers in a track. The various theories propounded for explaining the probable causes of creep in rails are

(i) Wave theory (ii) Percussion theory

(iii) Drag theory

25. (d)

Marshalling yard is one where trains and other loads are received, sorted out and new trains formed and dispatched onwards to their destinations.

27. (c)

For two way traffic on a right angled road intersection, the conflict points are 24 whereas, for two way traffic on T-intersection, the conflict points are 18 only.

28. (c)

Green-Shield model (linear model) is given by

$$v = v_f\left(1 - \frac{k}{k_j}\right)$$

$$\Rightarrow \quad \frac{v}{v_f} + \frac{k}{k_j} = 1$$

$$\Rightarrow \quad vk_j + kv_f = v_f k_j$$

29. (c)

$$\Delta = \frac{1.18pa}{E_s} \quad \text{[For rigid plate]}$$

$$= \frac{1.18 \times 1.25 \times 15}{45}$$

$$= 0.49 \text{ cm} \simeq 0.5 \text{ cm}$$

30. (c)

Westergaard's method is used for design of rigid pavement.

Following are few methods for flexible pavement design :

1. Group index method.
2. California bearing ratio method.
3. California R value or stabilimeter method.
4. Triaxial test method.
5. McLeod method.
6. Burmister method.

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