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**Prelims
Through
Questions**

for

ESE 2021

Civil Engineering

Day 7 of 11

Q.271 - Q.320

(Out of 500 Questions)

Surveying + Transportation Engineering

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Q.273 If the weight of an angle $A(40^{\circ}24'24'')$ say is 2, then the weight of the angle $A/3(13^{\circ}25'08'')$ will be

- (a) 4 (b) $\pm\sqrt{3}$
(c) 9 (d) 18

273. (d)

If a quantity of given weight is divided by a factor, the weight of result is obtained by multiplying its given weight by the square of that factor.

Given: Weight of angle, $A = 2$

$$\therefore \text{Weight of } \frac{A}{3} = 2 \times (3)^2 = 18$$

Q.274 The plan of an area drawn with the original scale of 1 cm = 10 m, has shrunk such that a line, originally 15 cm long on the plan, now measures 14.5 cm. The shrunk scale is given by 1 cm is equal to

- (a) 0.97 m (b) 9.70 m
(c) 10.34 m (d) 10.97 m

274. (c)

$$\text{Shrinkage factor} = \frac{\text{Shrunk scale}}{\text{Original scale}} = \frac{14.5}{15}$$

$$\text{Shrunk RF} = \text{Original RF} \times \text{Shrinkage factor}$$

$$= \frac{1}{1000} \times \frac{14.5}{15} = \frac{1}{1034.48}$$

$$\therefore \text{Shrunk scale, 1 cm} = \frac{1034.48}{100} = 10.34 \text{ m}$$

Alternatively,

Original 15 cm line on plan = 15 × 10 = 150 m line on ground.

Now length of line on ground (= 150 m) is constant but on plan, it is 14.5 cm only.

$$\therefore 14.5 \text{ cm} = 150 \text{ m}$$

$$\Rightarrow 1 \text{ cm} = \frac{150}{14.5} = 10.34 \text{ m}$$

Q.275 If the declination of a star is $70^{\circ}10'N$ and the latitude of the observer is $49^{\circ}50'N$, then the values of the zenith distance and the altitude of the star at the lower culmination will respectively be

- (a) 60° and 30° (b) $109^{\circ}50'$ and $60^{\circ}35'$
(c) 120° and 60° (d) $20^{\circ}20'$ and $30^{\circ}16'$

275. (a)

At lower culmination,

$$\text{Zenith distance, } ZA = ZP + PA$$

$$= (90^{\circ} - \theta) + (90^{\circ} - \delta)$$

$$= (90^{\circ} - 49^{\circ}50') + (90^{\circ} - 70^{\circ}10') = 60^{\circ}$$

$$\therefore \text{Altitude} = 90^{\circ} - 60^{\circ} = 30^{\circ}$$

Q.276 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

- A. Isogonic lines
- B. Agonic lines
- C. Isoclinic lines
- D. Aclinic lines

List-II

- 1. Lines joining places of equal magnetic declination
- 2. Lines joining places of zero dip
- 3. Lines joining places of equal dip
- 4. Lines joining places of zero magnetic declination

Codes:

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

276. (b)

Q.277 Consider the following statements:

Reciprocal levelling eliminates the effect of

- 1. error due to Earth's curvature.
- 2. error due to atmospheric refraction.
- 3. mistake in taking leveling staff readings.
- 4. error due to line of collimation.

Which of these statements are CORRECT?

- | | |
|----------------|----------------|
| (a) 1, 2 and 3 | (b) 1, 3 and 4 |
| (c) 2, 3 and 4 | (d) 1, 2 and 4 |

277. (d)

Reciprocal levelling removes error due to refraction, earth's curvature and line of collimation.

Q.278 Consider the following statements:

- 1. The size of a theodolite is defined by the diameter of the graduated circle of lower plate.
- 2. The process of establishing intermediate points, on a given straight line whose ends are intervisible, is done with a theodolite is called centering.
- 3. Removal of parallax may be achieved by refofocussing the eye piece.
- 4. An imaginary line passing through the optical center of the eye-piece in the telescope of a surveying instrument is called the optical axis of the telescope.

Which is wrong?

- | | |
|----------------|----------------|
| (a) 1, 2 and 4 | (b) 2, 3 and 4 |
| (c) 1, 2 and 3 | (d) 1, 3 and 4 |

278. (c)

- 1. The size of theodolite is defined by the diameter of the graduated circle of lower plate.
- 2. The process of establishing intermediate points, on a given straight line whose ends are invisible with a theodolite is called leveling.
- 3. Removal of parallax may be achieved by refocusing the eyepiece and the objective.

Q.279 Consider the following statements :

1. Igneous rocks do not occur in strata.
2. Granite is intrusive igneous rock.
3. Acid igneous rocks are denser than basic igneous rocks.

Which of the above statements are CORRECT?

- | | |
|-------------|----------------|
| (a) 1 and 2 | (b) 2 and 3 |
| (c) 1 and 3 | (d) 1, 2 and 3 |

279. (a)

Acid igneous rocks are lighter than basic igneous rocks. The specific gravity of acid igneous rocks is 2.7 and for basic igneous rocks it is 3.

Q.280 An image of a hilltop is 87.5 mm from the centre of a photograph. The elevation of the hill is 665 m and the flight altitude is 4660 m from the same datum. The image displacement due to elevation of the hill will be

[Take $f = 210$ mm]

- | | |
|-------------|-------------|
| (a) 61.3 mm | (b) 8.5 mm |
| (c) 87.5 mm | (d) 12.5 mm |

280. (d)

$$\therefore d = \frac{rh}{H} = \frac{87.5 \times 665}{4660} = 12.48 \text{ mm}$$

Q.281 Consider the following statements:

1. MSL at a place is the average datum of the hourly tidal height observed over a period of 19 years.
2. The permissible closing error in ordinary level is 12 seconds.
3. In a dumpy level, the sensitivity of level tube is generally 20" per 2 mm.
4. The correction due to refraction is $1/7^{\text{th}}$ of that due to curvature correction but opposite in nature.

Which of the above statements are CORRECT?

- | | |
|----------------|----------------|
| (a) 1, 2 and 3 | (b) 2, 3 and 4 |
| (c) 1, 3 and 4 | (d) 1, 2 and 4 |

281. (c)

Q.282 Which of the following characteristic features may be used while plotting a contour plan?

1. Two contour lines having the same elevation cannot unite and continue as one line.
2. Contour lines close together indicate a gentle slope.
3. Contour lines cross a valley line at right angles.

Select the correct answer using the codes given below

- | | |
|----------------|-------------|
| (a) 1, 2 and 3 | (b) 1 and 2 |
| (c) 2 and 3 | (d) 1 and 3 |

282. (d)

Contour line close together indicate steep slopes. Contour line cross a valley line at right angles.

Q.283 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

- A. Fathometer
- B. Passometer
- C. Tellurometer
- D. Altimeter

List-II

- 1. Microwave instrument
- 2. Sounding instrument
- 3. Distance measuring instrument
- 4. Height measuring instrument
- 5. Pressure measuring instrument

Codes:

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

283. (a)

Tellurometer is a microwave electronic distance measurement equipment.

Q.284 Match **List-I** (Characteristics of contour map) with **List-II** (Type of structure on ground) and select the correct answer using the codes given below the lists:

List-I

- A. Higher value inside the loop
- B. Widely spaced contour lines
- C. Overlapping contour lines
- D. Intersecting contour lines

List-II

- 1. Ridge line
- 2. Vertical cliff
- 3. Flatter slope
- 4. Overhanging cliff

Codes:

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

284. (c)

Q.285 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

- A. Most probable error
- B. Standard deviation
- C. Standard error of the mean
- D. Most probable error of the mean

List-II

- 1. $\pm \frac{\sigma}{n}$
- 2. $\pm 0.6745 \sigma$
- 3. $\pm 0.6745 \frac{\sigma}{\sqrt{n}}$
- 4. $\sqrt{\frac{\sum(\text{Residual})^2}{n-1}}$

288. (b)

$$A = d \left[\left(\frac{0_0 + 0_n}{2} \right) + o_1 + o_2 + o_3 + \dots o_{n-1} \right]$$

d is not constant.

$$\therefore A_1 = 5 \left[\frac{3+6}{2} + 4 + 5.5 + 5 \right] = 75 \text{ m}^2$$

$$A_2 = 10 \left[\frac{6+4.5}{2} + 4 \right] = 92.5 \text{ m}^2$$

$$\text{Total area} = A_1 + A_2 = 187.5 \text{ m}^2$$

Q.289 Pick up the correct statement.

- (a) A four-screw levelling head is better than the three screw one.
- (b) Centering in a theodolite is facilitated by a moveable head.
- (c) Two plate-levels on a horizontal circle assembly are provided so that if one becomes sluggish, the other can be used.
- (d) It is better to provide a bubble tube on the telescope rather than on the index frame.

289. (b)

Three screw levelling head is better than the four screw levelling.

Firstly centering is done by displacing the legs of tripod stand and finally, exact centering is done by using the shifting head of the instrument.

Q.290 Which of the following represents a metamorphic rock?

- 1. Slate
- 2. Shale
- 3. Quartzite

- (a) Only 3
- (b) Both 1 and 3
- (c) Both 2 and 3
- (d) All of these

290. (b)

Shale → Sedimentary Rock.

Q.291 Which of the following error is not eliminated by the method of repetition for horizontal angle measurement?

- (a) Error due to eccentricity of verniers.
- (b) Error due to eccentricity of verniers.
- (c) Error due to wrong adjustment of line of collimation and trunnion axis.
- (d) Error due to inaccurate graduations.

291. (b)

Error due to vernier measurement, or due to inaccurate graduations can be corrected by proper measurement correction calculations.

Error due to displacement of station signal are not repetitive and cannot be measured properly.

∴ It can not be corrected or compensated.

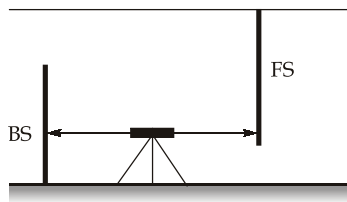
Q.292 The "Back Sight" reading on a vertically held staff at a point A on the floor along the centre line of a railway tunnel is 3.465 m, and the "Fore sight" on the inverted staff held at the roof of the tunnel just vertically above A is 1.155 m. The height of the tunnel along the centre line at floor point A is

- (a) 2.310 m (b) 3.465 m
(c) 4.620 m (d) 6.930 m

292. (c)

$$BS = 3.465 \text{ m}$$

$$FS = 1.155 \text{ m}$$



$$\begin{aligned} \text{Height of tunnel} &= 3.465 \text{ m} + 1.155 \text{ m} \\ &= 4.62 \text{ m} \end{aligned}$$

Q.293 Given that:

Scale of photograph is 1 cm = 100 m

Size of photograph = 23 cm × 23 cm

Area to be covered = 150 sq. km

Longitudinal overlap = 60%

Side overlap = 30%

The total number of photographs required for covering the above area is

- (a) 143 (b) 102
(c) 58 (d) 43

293. (b)

$$\text{Ground length covered} = 100 \times 23 \times (1 - 0.6) = 920 \text{ m}$$

$$\text{Ground width covered} = 100 \times 23 \times (1 - 0.3) = 1610 \text{ m}$$

$$\text{Net ground area covered by one photograph} = 920 \text{ m} \times 1610 \text{ m} = 1.48 \text{ sq. km}$$

$$\text{Hence number of photographs} = \frac{150}{1.48} = 101.35 \simeq 102$$

Q.294 Consider the following statements in respect of a surveyor's compass:

1. The graduated ring is attached to the box and rotates along with line of sight.
2. The sighting and reading can be done simultaneously.
3. The instrument can not be used without a tripod.
4. The graduations have 0° at S, 90° at W, 180° at N and 270° at E.

Which of the above statements are CORRECT?

- (a) 1, 2 and 3 (b) 1, 2, 3 and 4
(c) 3 and 4 (d) 1 and 3

294. (d)

The graduations have 0° at N and S and 90° at E and W. Sighting and reading cannot be done simultaneously in a surveyor's compass. However, it can be done simultaneously in a prismatic compass.

Q.295 A descending gradient of 2% meets an ascending gradient of 1% where a valley curve of length 100 m is to be formed. What will be the distance of the lowest point on valley curve from its first tangent point?

- (a) 57.7 m (b) 80.9 m
(c) 41.2 m (d) 37.8 m

295. (a)

When the gradients are not equal, the lowest point lies on the side of flatter grade, and this

point is at a distance $x = L\sqrt{\frac{n_1}{2N}}$ from the tangent point of the first grade n_1 .

$$N = |n_1 + n_2|$$

$$= \left| \frac{-2}{100} - \frac{1}{100} \right| = 0.03$$

$$\therefore x = 100\sqrt{\frac{0.02}{2 \times 0.03}} = \frac{100}{\sqrt{3}} = 57.7 \text{ m}$$

Q.296 For the design of runways, if the standard atmospheric temperature at mean sea level is 14°C , then the standard temperature at an altitude of 1000 m will be

- (a) 3.5°C (b) 6.5°C
(c) 7.5°C (d) 10.5°C

296. (c)

There are three corrections to be applied to basic runway length:

- (i) Temperature correction in which standard temperature at airport site can be determined by reducing the standard mean sea level temperature of 14°C at the rate of 6.5°C per thousand metre rise in elevation.
- (ii) Gradient correction
- (iii) Elevation correction

$$\therefore \text{Standard temperature at an altitude of 1000 m} = 14 - \frac{6.5}{1000} \times 1000 = 7.5^\circ\text{C}$$

Q.297 The best direction of a runway is

- (a) along the longest line on the windrose diagram.
- (b) along the direction perpendicular to the longest line on the windrose diagram.
- (c) at 30° to the direction of the longest line on the windrose diagram.
- (d) along NW-SE line.

297. (a)

The direction of the longest spike on windrose diagram shows the wind direction with the greatest frequency.

Q.298 In speed and delay study, if the average journey time on a stretch of road length of 3.5 km is 7.55 minutes and the average stopped delay is 1.8 minutes, then the average running speed will be

- (a) 36.5 kmph (b) 37.5 kmph
(c) 38.5 kmph (d) 39.5 kmph

298. (a)

$$\begin{aligned} \text{Average running time} &= \text{Average journey time} - \text{Average stopped delay} \\ &= 7.55 - 1.8 = 5.75 \text{ minutes} \end{aligned}$$

$$\therefore \text{Average running speed} = \frac{3.5 \times 60}{5.75} = 36.5 \text{ kmph}$$

Q.299 Given that the theoretical cant required for 45 kmph speed on a broad gauge main line is 7.78 cm. What is the value of the cant to be provided for a branch track?

- (a) +0.18 cm (b) -0.28 cm
(c) -0.18 cm (d) +0.28 cm

299. (d)

The permissible cant deficiency for main line = 7.6 cm
Equilibrium/Actual cant for main track = 7.78 - 7.6 = 0.18 cm
Cant to be provided on a branch track = -0.18 cm

Q.300 The runway length after correcting for elevation and temperature is 2500 m. If the effective gradient on runway is 1 percent then the revised runway length will be

- (a) 3000 m (b) 2750 m
(c) 2850 m (d) 3200 m

300. (a)

Runway length after having been corrected for elevation and temperature shall be further increased at the rate of 20% for every 1° of effective gradient.

$$\text{So, increase in runway length} = \frac{20}{100} \times 2500 = 500 \text{ m}$$

$$\text{Hence, revised runway length} = 2500 + 500 = 3000 \text{ m}$$

Q.301 The total cycle time of an intersection is 60 seconds, the green time for the phase is 27 seconds and the corresponding yellow time is 4 seconds. If the saturation headway is 2.4 seconds/vehicle, the startup lost time is 2 seconds/phase and the clearance lost time is 1 second/phase then the capacity of the movement is

- (a) 1500 veh/hr/lane (b) 700 veh/hr/lane
(c) 500 veh/hr/lane (d) 300 veh/hr/lane

301. (b)

$$\text{Effective green time} = 27 + 4 - 3 = 28 \text{ sec}$$

$$\text{Saturation flow rate} = \frac{3600}{h} = \frac{3600}{2.4} = 1500 \text{ veh/hr}$$

$$\therefore \text{Capacity} = 1500 \times \frac{28}{60} = 700 \text{ veh/hr/lane}$$

Q.302 As per practice of Indian Railways the grade compensation provided for B.G. on curves is

- (a) 0.05 % per degree (b) 0.2 % per degree
(c) 0.04 % per degree (d) 0.4% per degree.

302. (c)

Grade compensation for B.G. track on curves
= 0.04% per degree

Q.303 The ends of a 4° circular curve are to be joined with the straights, using a transitions curve of 150 m length. The radius of curvature of the curve will be about

- (a) 430 m (b) 286 m
(c) 143 m (d) 586 m

303. (a)

$$\text{Degree of curve} = \frac{1718.9}{R}$$

$$\Rightarrow 4 = \frac{1718.9}{R}$$

$$\Rightarrow R = 429.7 \text{ m} \simeq 430 \text{ m}$$

Q.304 A plain terrain is provided with ruling gradient. At horizontal curve of radius 150 m, grade compensation is to be done. The compensated gradient is

- (a) 2.8% (b) 3.3%
(c) 2.1% (d) 4.1%

304. (b)

As per IRC,

Ruling gradient for plain terrain is 3.3%.

Grade compensation is not required for gradient flatter than 4%.

∴ Compensated gradient = 3.3%

Q.305 For a certain rotary, the practical capacity was 2500 veh/hr, when weaving ratio was 0.45.

Over the period of time, weaving ratio changed to 0.6, then the rotary capacity will be

- (a) 2353 veh/hr (b) 2251 veh/hr
(c) 2656 veh/hr (d) 2135 veh/hr

305. (a)

Practical capacity of rotary (Q_p),

$$Q_p(\text{veh/hr}) = \frac{280w \left(1 + \frac{e}{w}\right) \left(1 - \frac{P_{\max}}{3}\right)}{\left(1 + \frac{w}{L}\right)}$$

$$\therefore Q_p \propto \left(1 - \frac{P_{\max}}{3}\right)$$

$$\therefore \frac{Q_{P_1}}{Q_{P_2}} = \frac{\left(1 - \frac{P_{\max}}{3}\right)_1}{\left(1 - \frac{P_{\max}}{3}\right)_2}$$

$$\Rightarrow \frac{2500}{Q_{P_2}} = \frac{\left(1 - \frac{0.45}{3}\right)}{\left(1 - \frac{0.6}{3}\right)}$$

$$\Rightarrow Q_{P_2} = 2352.94 \simeq 2353 \text{ veh/hr}$$

Q.306 Consider the following reception signals:

- | | |
|-----------------|-------------------|
| 1. Outer signal | 2. Warner signal |
| 3. Home signal | 4. Starter signal |

Which of the following sequence is correct in respect of reception signals as a train departs from a platform?

- | | |
|-------------|-------------|
| (a) 2-1-3-4 | (b) 4-2-1-3 |
| (c) 1-2-3-4 | (d) 3-2-1-4 |

306. (a)

Q.307 Consider the following statements:

- Penetration test on bitumen is conducted at a temperature of 25°C.
- Ductility test on bitumen is conducted at 27°C and at a rate of pull of 50 mm per minute.
- A minimum ductility value of 75 cm has been specified by the ISI for bitumen of grade 45 and above obtained from sources other than Assam.

Which of the above statements are CORRECT?

- | | |
|-------------|----------------|
| (a) 1 and 2 | (b) 1 and 3 |
| (c) 2 and 3 | (d) 1, 2 and 3 |

307. (d)

Q.308 Which one of the following is not the reason for coning of wheels?

- To reduce the wear and tear of wheel flanges and rails
- To reduce the unit weight of wheel
- To prevent wheels from slipping to some extent
- To provide the possibility of lateral movement of axle

308. (b)

Q.309 The extra-widening required for off tracking due to rigidity of wheel base for a vehicle moving on two lane highway with a speed of 50 kmph on a curve of radius 360 m is

[Take length of vehicle = 6 m]

- | | |
|-------------|------------|
| (a) 0.377 m | (b) 0.1 m |
| (c) 0.327 m | (d) 0.05 m |

309. (b)

Here extra widening for off-tracking means only mechanical widening.

$$\therefore W_m = \frac{nl^2}{2R} = \frac{2 \times 6^2}{2 \times 360} = 0.1 \text{ m}$$

Q.310 At an intersection of two major roads in a metropolitan city, the design speed is 36 kmph and the width of roads is 10 m. If rate of deceleration and perception reaction times are 5m/s^2 and 1 second respectively, then inter-green period is [Take vehicle length = 5 m]

- (a) 2.4 sec (b) 3.5 sec
(c) 4.8 sec (d) 8.4 sec

310. (b)

Speed, $V = \frac{5}{18} \times 36 = 10 \text{ m/s}$

$$a = 5 \text{ m/s}^2$$

Safe stopping distance,

$$S = tv + \frac{v^2}{2a} = 1 \times 10 + \frac{10^2}{2 \times 5} = 20 \text{ m}$$

$$\text{Inter-green period} = \frac{s + w + l}{v} = \frac{20 + 10 + 5}{10} = 3.5 \text{ sec}$$

Q.311 The relation between speed u (in km/h) and density k (number of vehicles/km) for a traffic stream on a road is $u = 70 - 0.7k$. The capacity on this road is

- (a) 7000 veh/hr (b) 3500 veh/hr
(c) 1750 veh/hr (d) 1000 veh/hr

311. (c)

Traffic volume,

$$\begin{aligned} q &= uk \\ q &= (70 - 0.7k)k \\ &= 70k - 0.7k^2 \end{aligned}$$

Maximum possible volume is capacity of road

For maximum volume

$$\frac{dq}{dk} = 0$$

$$\Rightarrow 70 - 1.4k = 0$$

$$\Rightarrow k = 50 \text{ Veh/km}$$

Now, capacity

$$\begin{aligned} C &= (70 - 0.7 \times 50) \times 50 \\ C &= 1750 \text{ veh/hr} \end{aligned}$$

Q.312 Match **List-I** (Harbour structure) with **List-II** (Purpose) and select the correct answer using the codes given below the lists:

List-I

- A. Dolphins
- B. Groynes
- C. Fenders
- D. Slipways

List-II

- 1. To protect the beach or retained earth
- 2. To cushion to absorb shock of ship during loading and un-loading
- 3. Mooring structure in combination with loading platform
- 4. Repairing and building ship

Codes:

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

312. (b)

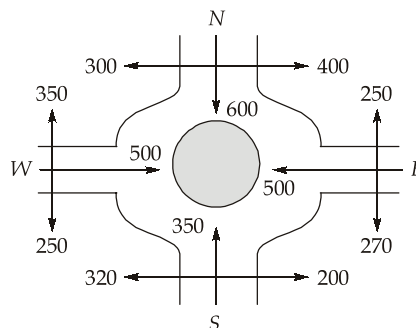
Q.313 Traffic flow in an urban area at right angle intersection of two major roads are given as below. Both roads have a carriageway width of 15 m.

Approach Road	Traffic Road (PCU/hr)		
	Left turn	Straight	Right turn
North	400	600	300
East	270	500	250
South	320	350	200
West	350	500	250

The weaving ratio for North-East direction will be

- (a) 0.33
- (b) 0.41
- (c) 0.71
- (d) 0.83

313. (c)



$$p = \text{Weaving ratio} = \frac{b + c}{a + b + c + d}$$

316. (a)
- Curvature correction is always negative to staff readings.
 - Refraction correction is always positive to staff readings.
 - Total correction is always negative to staff readings.

Q.317 Consider the following data related to a plain cement concrete pavement, friction coefficient, $f = 1.5$, tensile strength of concrete, $\sigma_{tc} = 1.2 \text{ kg/cm}^2$, unit weight of concrete, $\gamma_c = 2400 \text{ kg/m}^3$. The contraction joint spacing of the pavement is

- (a) 2.22 m (b) 4.5 m
(c) 6.7 m (d) 8.8 m

317. (b)

$$L_c = \frac{2\sigma_{tc} \times 10^4}{\gamma_c \times f} = \frac{2 \times 1.2 \times 10^4}{2400 \times 1.5} = 6.67 \text{ m} \simeq 6.7 \text{ m (say)}$$

Spacing of contraction joint $\geq 4.5 \text{ m}$

$$\therefore L_c = 4.5 \text{ m}$$

Q.318 The free mean speed on a roadway is found to be 80 km/h. If the average spacing between vehicles is 7.5 m under jam condition, then the capacity flow is (in vehicles/hour/lane)

- (a) 2500 (b) 2900
(c) 2667 (d) 2100

318. (c)

$$\text{Free mean speed} = 80 \text{ km/h}$$

$$\text{Jam density} = \frac{1000}{7.5} = 133.33 \text{ vehicles/km}$$

$$\begin{aligned} \text{Capacity flow} &= \frac{\text{Free mean speed} \times \text{Jam density}}{4} \\ &= \frac{80 \times 133.33}{4} = 2666.67 \text{ vehicle/hr} \simeq 2667 \text{ vehicle/hr} \end{aligned}$$

Direction: The following items consists of two statements, one labelled as **Statement (I)** and the other labelled as **Statement (II)**. You have to examine these two statements carefully and select your answers to these items using the codes given below:

Codes:

- (a) Both Statement (I) and Statement (II) are true and Statement (II) is the correct explanation of Statement (I).
(b) Both Statement (I) and Statement (II) are true but Statement (II) is not a correct explanation of Statement (I).
(c) Statement (I) is true but Statement (II) is false.
(d) Statement (I) is false but Statement (II) is true.

Q.319 Statement (I): The solutions of a three - point problem in plane - table surveying is aided by Lehmann's rules.

Statement (II): The application of Lehmann's rules reduces the triangle of error and is a controlled trial and error technique.

319. (a)

Q.320 Statement (I): Open cut is economical than tunnelling for depths of over burden less than 20 metres.

Statement (II): Heading and Bench method is suitable for tunnelling in soft soils.

320. (c)

Heading and benching method is used for tunneling in hard rocks.

