

Determine the average value of traffic volume, journey speed and running speed of the traffic stream along each direction.

- (b) List down the types of on-street and off-street parking. Explain the need for parking facilities especially off-street parking facilities.

8 + 4 = 12

9. (a) Explain the concept of PCU.

- (b) The average normal flow of traffic on cross roads A and B during design period are 550 and 300 PCU per hour, the saturation flow on these roads are estimated as 1340 and 1100 PCU per hour respectively. The all red time required for pedestrian crossing is 12 sec. Design two phase traffic signal with pedestrian crossing by Webster's method.

- (c) Write about the advantages and disadvantages of traffic signals.

2 + 6 + 4 = 12

HIGHWAY & TRAFFIC ENGINEERING (CIVL 3103)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A (Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) As per IRC specification, the height of the driver's eye above the pavement surface is
(a) 0.12 m (b) 0.15 m (c) 1.2 m (d) 1.0 m.
- (ii) A vehicle has a wheel base of 6.5 m. While negotiating a curved path of radius 32 m, the off-tracking is
(a) 0.66 m (b) 0.55 m (c) 1.0 m (d) 0.75 m.
- (iii) The unit of Westergaard's modulus of subgrade reaction (K) is
(a) kg/cm (b) kg/cm² (c) kg/cm³ (d) none of these.
- (iv) Maximum number of vehicles that can pass a given point on a road per unit time under the reasonable traffic conditions, is known as traffic
(a) density (b) flow (c) capacity (d) volume.
- (v) Penetration grade of bitumen like 30/40 is preferred in
(a) cold climate (b) hot climate
(c) arctic climate (d) mild climate.
- (vi) Speed regulations on roads is decided on the basis of the cumulative frequency of
(a) 98th percentile (b) 85th percentile
(c) 60th percentile (d) 30th percentile.
- (vii) Intermediate sight distance can be calculated by
(a) ISD = SSD (b) ISD = OSD
(c) ISD = 2 × SSD (d) ISD = 2 × OSD.
- (viii) Hardness property of road aggregates can be determined by
(a) impact test (b) abrasion test
(c) crushing test (d) shape test.

- (ix) Warping stress occurs due to the variation in
 (a) day-night temperature (b) seasonal temperature
 (c) wheel load (d) none of these.
- (x) 'First 20-year Road Development Plan' in India is also known as
 (a) Bombay Road Plan (b) Nagpur Road Plan
 (c) Lucknow Road Plan (d) Kolkata Road Plan.

Group - B

2. (a) Design the length of transition curve if the rate of superelevation of 0.06 is to be provided at horizontal curve with minimum ruling radius on a four-lane two-way highway passing through a plain terrain. Assume suitable data whenever necessary.
 (b) Derive the general expression of superelevation. **8 + 4 = 12**
3. (a) A vertical summit curve is formed at the intersection of two gradients, +3.0 and -5.0 percent. Design the length of summit curve to provide a SSD for a design speed of 80 kmph. Assume the necessary data.
 (b) What are the ideal requirements of the highway alignment?
 (c) While aligning a hill road with a ruling gradient of 6 percent, a horizontal curve of 60 m is encountered. Find the compensated gradient at the curve. **6 + 2 + 4 = 12**

Group - C

4. (a) Design a new flexible pavement as per IRC:37-2012 for two-lane undivided carriageway using the data given below.
 Design CBR value of subgrade = 6.0%, initial traffic on completion of construction = 450 CV per day, average growth rate = 7.5% per year, design life = 10 years, VDF value = 2.5, Lane distribution factor, D = 0.50.

CBR	CSA, msa	Total Pavement Thickness, mm	Granular sub-base course, mm	Granular Base course, mm	DBM, mm	BC/SDBC (upto 5msa), mm
6%	2	470	175	225	50	20
	5	535	210	250	50	25
	10	615	260	250	65	40
	20	640	260	250	90	40
	30	655	260	250	105	40
	50	660	260	250	110	40
	100	685	260	250	125	50
	150	700	260	250	140	50

- (b) Discuss the importance of different types of joints, dowel bar and tie bar in cement concrete pavement. **8 + 4 = 12**
5. (a) Calculate the wheel load stresses at interior, edge and corner regions of cement concrete pavement using Westergaard's stress equations and also the probable location where crack is likely to develop due to corner loading using the data given below:
 Wheel load = 5250 kg; Modulus of elasticity of cement concrete = 3×10^5 kg/cm²; pavement thickness = 18 cm; Poisson's ratio of concrete = 0.15; Modulus of subgrade reaction = 6.0 kg/cm³; Radius of contact area = 15 cm.
 (b) Write a short note on 'ESWL'. **8 + 4 = 12**

Group - D

6. (a) Briefly discuss about different types of distress in rigid pavement.
 (b) What is road safety audit (RSA)? Why is road safety audit needed to be done and for what type of projects?
 (c) Write down the differences between tack coat and prime coat. **4 + (2 + 4) + 2 = 12**
7. (a) Briefly discuss about the cross-drainage structures and works.
 (b) Write short notes on (i) WBM road and (ii) Mud pumping. **6 + (3 + 3) = 12**

Group - E

8. (a) The consolidated data collected from speed and delay studies by floating car method on Rush Behari Avenue within a length of 4.0 km, running East-West are given below.

Trip No.	Direction of trip	Journey time, min-sec	Total stop delay, min-sec	No. of vehicle overtaking	No. of vehicle overtaken	No. of vehicles from opposite direction
1	E - W	6 - 40	1 - 45	2	6	260
2	W - E	7 - 25	1 - 35	3	2	185
3	E - W	7 - 15	1 - 20	6	4	300
4	W - E	7 - 30	1 - 55	4	2	235
5	E - W	6 - 20	1 - 40	2	5	260
6	W - E	7 - 50	2 - 20	3	2	200