

**BACHELOR OF ENGINEERING (CIVIL ENGINEERING)**  
**FOURTH YEAR FIRST SEMESTER EXAMINATION 2019**  
**TRANSPORTATION ENGINEERING -II**

Time: 3 Hours

Full Marks: 100

## Part I

(50 marks for each part)

Use Separate Answer scripts for each Part

Answer Question No. 1 and any TWO questions from the rest

1. Write short notes on the following – 4×5=20
- Running & Cruising speed of a highway
  - External Cordon Line
  - Traffic volume growth factors
  - Off-street parking
  - Capacity following HCM 1950

2. The observations of a moving car study over a length of AD are as follows. Determine the total volume of traffic, journey time and running time over the section AD. 15

Section	AB	B	BC	C	CD	D	DC	C	CB	B	BA	
Time Taken in secs	152	15	172	10	138	20	132	12	160	18	145	
Vehicles	Opposite	25	8	31	3	28	12	50	4	55	6	45
	Overtaking	8	--	5	--	3	--	12	--	6	--	7
	Overtaken	6	--	2	--	6	--	11	--	7	--	2

3. Design a 4-phase (without any pedestrian phase) traffic signal for perpendicular intersection of two 6-lane dual carriageway roads AB and CD both having 2m wide refuge islands on them. Assume starting delay of 3 secs, and Amber period of 4secs applicable in all phases. Consider the movement from A to C as left turn, intersection characteristics as good and right turning radius, if required, as 30m using the following traffic data given in pcu/hr. 15

From	A		B		C		D					
To	C	B	D	D	A	C	B	A	A	C	B	
flow	38	785	169	91	611	162	37	630	159	57	832	153

4. The parking survey data collected from a 10-bay parking lot by license plate method is as shown below. Determine Overall Parking Load, Average Parking Index, Parking Volume, Average Turnover, and Average Duration of the parking lot. 15

Time	Bays									
	1	2	3	4	5	6	7	8	9	10
0-10	3473	3741	1884	-	-	8932	7653	7321	1213	5678
10-20	6056	3741	1884	4664	9411	8932	7653	5652	1213	5684
20-30	5463	0085	4207	7357	4895	8932	2811	-	0921	6678
30-40	5463	9758	-	-	4895	5674	8998	2789	3212	7778
40-50	5463	5869	5972	6871	4895	7810	3419	2789	9924	0775
50-60	0305	4825	7594	7893	7738	-	4821	5734	4778	8888

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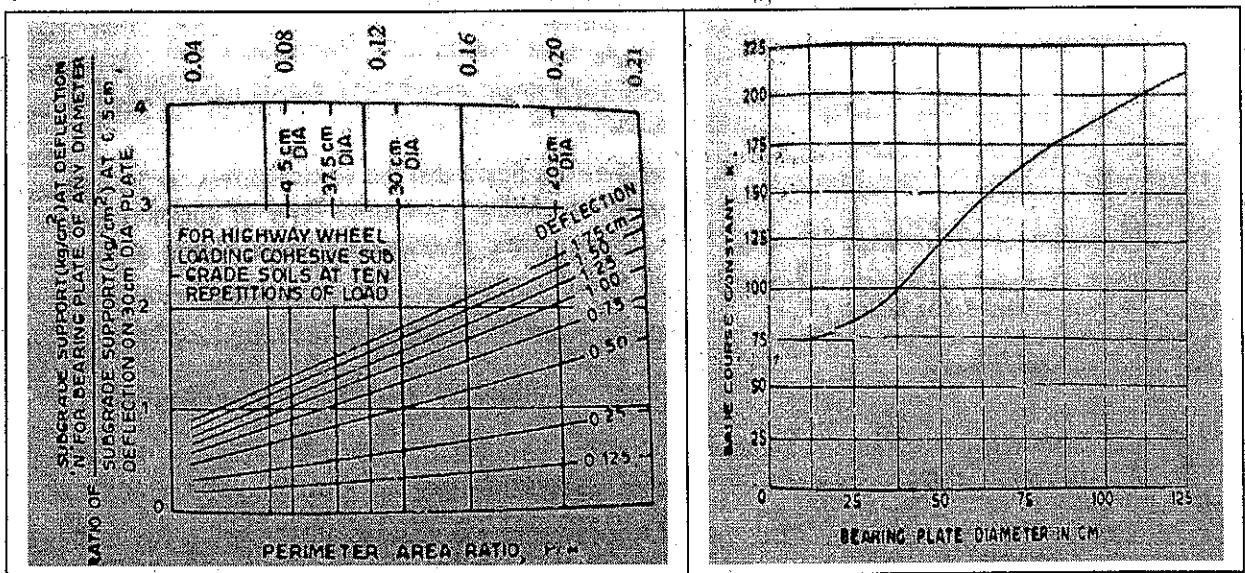
Part – II

Instructions: Use Separate Answer Scripts for each Part

No code or chart is allowed.

Answer Question 1, 2. Answer any one from 3 and 4.

1. (a) Design a highway pavement for a wheel load of 4100 kg with a tyre pressure of 6 kg/cm<sup>2</sup> by McLeod method. The plate bearing test carried out on subgrade soil using 30 cm diameter plate yielded a pressure of 3 kg/cm<sup>2</sup> after 10 repetitions of load at 0.5 cm deflection. (10)



2. (a) Calculate ESWL of a dual wheel assembly carrying 2100 kg each for pavement thickness of 20, 25 and 30 cm. Centre to centre tyre spacing = 28 cm and distance between the walls of the tyres = 12 cm. (10+10)

(b) Discuss thermal stress generation of Rigid Pavement in details.

3. (a) Describe Fatigue and Rutting of Flexible Pavement in details (with figures). (8)

(b) Design dowel bar of a Rigid Pavement for the data given below:

Slab thickness = 350mm, Expansion joint width = 25mm, Contraction Joint width = 5mm, Modulus of Subgrade Reaction = 80 MPa/m, Radius of Relative Stiffness = 1030.5 mm, E of Dowel Bar = 2 × 10<sup>5</sup>MPa, Modulus of dowel support = 415000 MPa/m, Design Single axle load = 200 kN, Lane width = 6.0m, coefficient of friction = 1.5, Allowable tensile stress in deformed bars = 200MPa, Allowable bond stress for deformed bar = 2.46 MPa. (12)

$$F_{b\max} = \frac{k_{m\text{ds}} P_1 (2 + \beta Z)}{4\beta^3 EI}$$

$$F_b = \frac{(101.6 - b_d) f_{ck}}{95.25}, \text{ Where all the notations have their usual meaning.}$$

4. (a) The width of expansion joint gap is 2.0 cm in a cement concrete pavement. If the laying temperature is  $12^{\circ}\text{C}$ , and the maximum slab temperature in summer is  $55^{\circ}\text{C}$ , calculate the spacing between expansion joints. Assume coefficient of thermal expansion of concrete as  $10^{-5}$  per  $^{\circ}\text{C}$ . (6)

(b) Discuss the relative differences of dowel and tie bar. (4)

(c) Design the pavement according to IRC: 37 (2012) for a new road in plain terrain with a two-lane single carriageway; given the following data (do not consider fatigue and rutting failure): (10)

Traffic volume in the year of last vehicle count in both direction = 2000 commercial vehicles per day (CVPD)

Traffic growth rate per annum = 7.5%

Design life = 15 years

Design CBR value of subgrade soil = 3.5%

Vehicle Damage Factor = 3.5

Construction period = 5 years.

Assume any other data.