Ref. No. Ex/CE/PE/B/T/315/2025

B.E. CIVIL ENGINEERING EXAMINATION 2025

[3rd Year; 1st Semester]

Transportation Engineering - I

Total Time: Three Hours

Full Marks 100
(Part I: 50 + Part II: 50)

Part I (50 Marks)

Use a separate Answer-Script for each part

Answer All

1 Explain the necessity of 'Highway Re-Alignment'. [5] CO1

2 Briefly explain the factors that control the Highway Alignment. [5] CO1

3 Three new roads, A, B, and C, are to be constructed in a district during a five-year plan period. Work out the work priority for phasing the plan programme by maximum utility principle from the data below. Adopt utility unit of 1.0, 0.5, and 2.0 for serving a village with population range 2000 to 5000, <2000, and > 5000. Use utility unit for agricultural product at 1.0 per 1000t; whereas, the same for Industrial products at 10.0 per 1000t. [7.5] CO1

Road	Length, km	No. of village served population			Productivity in 1000t	
		< 2000	2000-5000	> 5000	Agricultural	Industrial
A	15	10	8	3	15	1.2
B	12	16	3	1	11	0.0
C	18	20	10	2	20	0.8

4 Describe the tests on aggregates required to be performed for selection as a road material. [5] CO3

5 Two Load-Penetration data are given below for CBR tests. Determine the CBR values of the samples if the proving ring reads 10 kN for the total 966 dial gauge divisions. Take the standard loads as 1370 kgf and 2055 kgf for 2.5 and 5.0 mm penetration, respectively. [7.5] CO3

		Penetration (mm)											
		0	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	7.5	10.0	12.5
Soil Specimen	A	0	8	15	23	29	34	37	43	48	57	63	67
	B	0	0.5	1.5	2.5	6.0	13	20	30	38	50	58	63

6 What are skid and slip? What are the factors associated with friction/skid resistance? [5] CO3

7 Explain and compare different types of transportation systems. [5] CO1

8 Explain the PIEV theory. [5] CO3

9 Design the rate of super-elevation for a horizontal highway curve of radius 240 m and speed 120 kmph. Assume standard values/components/limits if required. [5] CO3

[Turn over

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B.E. CIVIL ENGINEERING THIRD YEAR FIRST SEMESTER EXAM 2025
TRANSPORTATION ENGINEERING I

Time: 3 Hours **Full Marks: 100**
[50 Marks for each part]

Part - II

Use Separate Answer scripts for each Part
Answer brief & to the point. Assume standard value for any parameter, if required

Group: I [CO2]

1. Explain any four of the following in context to Highway Engineering – 5×4
   a. Field of vision and its significance
   b. Length and Height Characteristics of Vehicle
   c. Capacity as per HCM 1950
   d. Road surface characteristics
   e. Turning Capacity and Braking Capacity as relevant to vehicular characteristics
   f. Level of Service and its application in traffic engineering
2. Considering the mean free speed of a highway as 100KmpH and jam density of 200 pcu/Km, determine the minimum number of lanes required against design traffic of 6000pcu/Hr for –
   a. Basic Capacity condition
   b. Design speed of 75Kmph following HCM 1950
   c. LoS condition with flow-capacity ratio of 0.6 and design speed of 80% of v_{fs} 15

Group: II [CO5] – Answer any ONE Questions

3. State the following in context with flexible pavement design –Subgrade Ruting Criteria & Fatigue Cracking Criteria 2+2

   Compute the design traffic for a flexible pavement section for a 4-lane single carriageway 2-way street AB following IRC:37-2018; with annual growth rate of 5%, design life of 15 years from present day, Lane Distribution Factor as 40% and standard axle load 80kN.

Single Axle Dual Wheel Load (kN)	100	80	60	50	30
Traffic Volume in veh/day (A to B)	600	1000	9250	9400	1850
Traffic Volume in veh/day (B to A)	550	1250	9150	10600	1800

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4. Following the IRC recommended method, design the longitudinal joints and the wheel load stresses at critical points for a rigid pavement considering Design Wheel Load= 8.1t, Width of Expansion Joint Gap= 25mm, Maximum variation in temperature between summer and winter= 35°c, Modulus of Sub-grade reaction= 8kg/cm^3, Width of Slab= 3.5m, Coefficient of Surface Friction= 1.5, Radius of Equivalent Contact Area= 15cm, Modulus of Elasticity of Concrete= 3×10^5kg/cm^2, Thermal Coefficient of Concrete= 1×10^{-5}/°c, Unit Weight of Concrete= 2400kg/cm^3, Poisson Ratio of Concrete= 0.15, Flexural Strength of Concrete= 40kg/cm^2, Tensile Strength of Concrete= 0.8kg/cm^2, Bearing Strength of Concrete= 100kg/cm^2. The following expressions may be used–

Stress at Edge = $S_e = 0.529\frac{P}{t^2}(1+0.54\nu)\left(4\log_{10}\frac{l}{b}+\log_{10}b-0.4048\right)\text{kg/cm}^2$

Stress at Corner = $S_c = \frac{3P}{t^2}\left[1-\left(\frac{a\sqrt{2}}{l}\right)^{1.2}\right]\text{kg/cm}^2$

Stress at Inside = $S_i = 0.316\frac{P}{t^2}\left(4\log_{10}\frac{l}{bl}+1.069\right)\text{kg/cm}^2$

$b=\sqrt{1.6a^2+t^2}$, when $\frac{a}{t}\le 1.724$; $b=a$, when $\frac{a}{t}>1.724$

$l=\left[\frac{E.t^3}{12k(1-\nu^2)}\right]^{\frac{1}{4}}$

$L_c=\frac{2\times10^4 f_w}{\gamma_c\mu}$ and $L_e=\frac{\delta}{200\times T_c t_s}$