Ref. No.: Ex/CE/PC/B/T/315/2024

B.E. CIVIL ENGINEERING THIRD YEAR FIRST SEMESTER EXAM 2024
TRANSPORTATION ENGINEERING I

Time: 3 Hours **Full Marks: 100**

[50 Marks for each part]

Part I

Use Separate Answer scripts for each Part

Answer brief & to the point. Assume standard value for any parameter, if required

Group: I [CO2] – Answer any two question

1. Explain the following in context to Highway Engineering – 5×3
   a. Level of Service and its application in traffic engineering
   b. Visual Acuity and Hearing ability as relevant to traffic characteristics
   c. Turning Capacity and Braking Capacity as relevant to vehicular characteristics
2. Explain the following highlighting how each of the following influences the highway geometric design parameters - 3×5
   a. Length Characteristics of Vehicle
   b. Field of Vision of Road user
   c. Reaction time of driver
   d. Practical Capacity as per HCM 1950
   e. Passenger Car Unit
3. Considering the mean free speed of a highway as 80KmpH, catering to vehicles of average 4.0m length, determine the minimum number of lanes required against design traffic of 3000pcu/Hr for –
   a. Basic Capacity condition
   b. Design speed of 60Kmph following HCM 1950
   c. LoS condition with flow-capacity ratio of 0.6 and design speed of 75% of v_{fs} 15

Group: II [CO5] – Answer any ONE Questions

4. Explain the following in context with flexible pavement design – Vehicle Damage Factor & Lane Distribution Factor 3+3

   Compute the design traffic for a flexible pavement section for a 6-lane dual carriageway 2-way street AB following IS:37-2018; with annual growth rate of 5%, design life of 15 years from present day and Lane Distribution Factor as 60%.

Single Axle Dual Wheel Load	10t	8.0t	6.0t	5.0t	3.0t
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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5. 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** = $S_i = 0.316\frac{P}{t^2}\left(4\log_{10}\frac{l}{b}+1.069\right)\text{kg/cm}^2$

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

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

$L_c=\frac{2\times10^4 f_{ic}}{\gamma_c\mu}$ and $L_s=\frac{\delta}{200\times T_c t_s}$

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B.E. CIVIL ENGINEERING EXAMINATION 2024

[3rd Year; 1st Semester]

Transportation Engineering - I

Total Time: Three Hours | Full Marks 100 (Part I: 50 + Part II: 50)

Use a separate Answer-Script for each part

Part II (50 Marks)

Answer All: (5 × 10 = 50)

1	Derive the necessary expression for OSD on 2-lane 2-way traffic with a neat sketch and proper assumptions.	CO3
2	What is 'Super-elevation'? Derive the necessary expression for calculating the super-elevation. What is the 'Centrifugal Ratio'?	CO3
3	"Judging the quality of aggregate through 'Combined FI and EI Index' is more reasonable than refereeing it through individual 'EI and FI Index'". – Justify the statement.	CO3
4	What are the special considerations for highway alignment that are to be considered for hilly areas? Explain in brief.	CO1
5	Calculate the stopping sight distance for a design speed of 100 kmph. Take the total reaction time as 2.5 seconds and the coefficient of friction as 0.35. Also, find the stopping sight distance for an ascending and descending gradient when the gradient is 1 in 40.	CO3
6	What are skid and slip? What are the factors associated with friction/skid resistance?	CO3
7	Explain and compare different types of transportation systems.	CO1
8	Mention and explain in brief the factors that control the highway alignment. What are the maps that are required to be prepared for a highway alignment report?	CO1
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.	CO3
10	Mention the roles of 'obligatory points' in highway alignment.	CO1