MANIPAL INSTITUTE OF TECHNOLOGY
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MANIPAL INSTITUTE OF TECHNOLOGY
SIXTH SEMESTER B.TECH (CIVIL ENGINEERING)
END SEMESTER MAKEUP EXAMINATION, APRIL-MAY 2024
URBAN TRANSPORT PLANNING (CIE 4068)
(25 – 06 - 2024)

TIME: 3 HRS.   **MAX. MARKS: 50**

Note: **1. Answer all questions.**
   2. Any missing data may be suitably assumed.
   3. Use of formula book is permitted

Q. NO	QUESTION	MARKS	CO	BL
1A	Given the utility equation, $U_k = a_k - 0.003X_1 - 0.04X_2$, where X_1 is the travel cost in cents and X_2 is the travel time in minutes. a) Calculate the market shares of the following travel modes: <table><tr><td>Mode, k</td><td>a_k</td><td>X_1</td><td>X_2</td></tr><tr><td>Automobile</td><td>-0.20</td><td>120</td><td>30</td></tr><tr><td>Express bus</td><td>-0.40</td><td>60</td><td>45</td></tr><tr><td>Regular bus</td><td>-0.60</td><td>30</td><td>55</td></tr></table> **b)** Estimate the effect that a 50% increase in the cost of all three modes will have on the modal split.	5	4	3
1B	Illustrate the Bureau of Public Roads Diversion curve with the help of a neat figure.	3	5	3
1C	Making use of examples pertaining to mode choice, compare utility and disutility functions.	2	4	3
2A	The distribution of present trips among 4 zones A, B, C and D are given in the O-D matrix below. Estimate trip distribution among the zones by Fratar Method. (Limit to one iteration.)	5	3	3
2B	Distinguish Drew's technique with other capacity restraint methods. Discuss the merits of this system over other methods.	3	5	4

Table for Question 2A:

O\D	A	B	C	D
A	-	10	12	18
B	10	-	14	14
C	12	14	-	6
D	18	14	6	-
Present Totals	40	38	32	38
Estimated future totals	80	114	48	38

2C	Apply BPR method to estimate the percentage of traffic diverted to a new street. The travel time between zones in the newly constructed street is found to be 20 minutes and the travel time via the existing street is 35 minutes. In an average 5000 vehicles travel between the two zones every hour. Assign the flow between the newly constructed street and the existing street.	2	5	3
3A	The speed and concentration of vehicles in a traffic stream were observed and the following data were obtained. Find the mathematical relationship between flow and speed.	5	2	5

Flow(veh/km)	5	10	15	20	25	30	35	40	45	50
Speed(kmph)	72	68	61	52	47	39	32	27	20	13

3B	List out and explain any five characteristics influencing mode choice.	3	4	2
3C	Discuss the drawbacks of Category analysis.	2	2	2
4A	The cities A and B are planning to introduce a new bus service between them. To understand the population and to estimate the future trip makers of the proposed transportation system, household surveys need to be conducted. As the Zonal Transport Planner of the city, you must design a questionnaire survey form for households residing in the city. Design a household interview survey questionnaire to be carried by the surveyor to houses sampled for data collection.	5	1	6
4B	Discuss the limitations of all or nothing assignments.	3	5	2
4C	List out and explain any five factors governing trip generation.	2	2	2
5A	The city consists of four major zones. The row vector of total employment in each zone is [126,177,64,216] and the row vector of the basic employment in each zone is [100,150,40,200]. Calculate the household vector and service employment vector with the help of the data given below.	5	5	3

$$\text{Journey to home function: } [a'_{ij}] = \begin{bmatrix} 0.35 & 0.30 & 0.20 & 0.15 \\ 0.25 & 0.35 & 0.20 & 0.20 \\ 0.15 & 0.10 & 0.35 & 0.40 \\ 0.10 & 0.25 & 0.20 & 0.45 \end{bmatrix}$$

$$\text{Journey to shop function: } [b'_{ij}] = \begin{bmatrix} 0.50 & 0.25 & 0.10 & 0.15 \\ 0.30 & 0.45 & 0.15 & 0.10 \\ 0.15 & 0.20 & 0.40 & 0.25 \\ 0.20 & 0.25 & 0.35 & 0.20 \end{bmatrix}$$

$$\text{Labour participation rate: } [a_j] = \begin{bmatrix} 0.80 & 0 & 0 & 0 \\ 0 & 0.80 & 0 & 0 \\ 0 & 0 & 0.80 & 0 \\ 0 & 0 & 0 & 0.80 \end{bmatrix}$$

$$\text{Service employment ratio: } [b_i] = \begin{bmatrix} 0.20 & 0 & 0 & 0 \\ 0 & 0.20 & 0 & 0 \\ 0 & 0 & 0.20 & 0 \\ 0 & 0 & 0 & 0.20 \end{bmatrix}$$

5B	Discuss Hansen's accessibility model.	3	4	2
5C	With the help of a neat diagram, illustrate the urban spatial structure.	2	4	3