Syllabus coverage

Internal Test: 1	Internal Quiz: 1	Academic Year: ODD / 2021-22
Subject: Urban Transport Planning	Sub-Code: 18CV745	Sem: VII A&B'
Date: 19/11/2021	Time: 2:00pm – 3:45pm	Dur: 1:45 min
Internal Test max marks: **50**	Internal Quiz max marks: **10**	
Staff-Incharge: Nisarga P		

CO1	Identify urban transport problems and conduct necessary surveys to provide the data required for transportation planning.
CO2	Develop travel demand models to determine future trip generation rate, trip distribution and model split for specific types of land use development.
CO3	Identify urban transport corridors and validate the developed model for long term transportation plan.

MODULE	SUB TOPICS COVERED	CO mapped
MODULE 1	**Urban transport planning:** Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.	CO1
MODULE 2	**Data Collection and Inventories**: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship	CO1

Staff-Incharge.

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Department of Civil Engineering

INTERNAL ASSESSMENT PAPER (5th Sem)

Internal Test: 1	Internal Quiz: 1	Academic Year: ODD / 2021-22	
Subject : Urban Transport Planning	Sub-Code: 18CV745	Sem: VII A&B'	
Date: 19/11/2021	Time: 2:00pm – 3:45pm	Dur: 1:45 min	
Internal Test max marks: **50**	Internal Quiz max marks: **10**		
Staff-Incharge: Nisarga P			

I. Quiz (Answer all multiple-choice question in first sheet of your answer book)

Q. No	Multiple choice question	BT level	CO Mapped
1	The unplanned growth of city lead to a) Congestion b) Urban Sprawl c) both a and b d) None	L1	CO1
2	The first stage in Transportation planning is a) Evaluation b) Continuing study c) plan synthesis d) Survey and analysis of existing condition	L1	CO1
3	BRTS strands for a) Bus-Rail Transport System b) Bus Rapid Transport System c) Bureau of Road Transport System c) None	L1	CO1
4	Interdependence of the Land use and Traffic was given by a) Mitchell and Rapkin b) Buchannan c) both a and b d) None	L1	CO1
5	The trip distribution method includes a) Gravity Models b) Category Analysis c) Diversion Curves d) Probit model	L1	CO1
6	Study area is represented by a) Internal cordon line b) External Cordon line c) Screen line d) Check lines	L1	CO1
7	A sub zone bearing the 562 belongs to a) sector 5 zone 6 sub-zone 2 b) sub-zone 5 sector 6 zone 2 c) zone 5 sector 6 sub-zone 2 d) sector 5 sub-zone 6 zone 2	L1	CO1
8	If the population in the study area is 50,000-1,50,000, the sample size required is a) 1 in 15 households b) 1 in 10 households c) 1 in 8 households d) 1 in 5 households	L1	CO1
9	Which movement is useful for planning bypass a) Internal to internal b) Internal to external b) External to internal d) External to external	L1	CO1
10	Land use, transportation and rod links are a) Inter linked b) Intra linked c) Not linked d) Depends on network	L1	CO1

II. **Internal Test (Answer any two full questions choosing one from each part)**
(Each full question carries 25 marks)

Main Ques	Sub Ques	Full Question	Marks	BT Levels	CO Outcome
		Part A			
1.	A)	Enumerate the impacts of transportation on environment?	10	L2	CO1
	B)	Explain the merits and demerits of mass transit system.	8	L2	CO1
	C)	Explain with the flow chart system approach to transport planning.	7	L2	CO1
		OR			
2.	A)	Explain the 4-Stage transport planning model.	10	L2	CO1
	B)	Explain the various sources of noise generated from road vehicles causing pollution.	6	L2	CO1
	C)	Write a note on BRTS.	4	L1	CO1
		Part B			
3.	A)	List the various methods available for data collection. Explain a) Home Interview Survey b) Registration Number Survey	10	L2	CO1
	B)	Discuss the various inventory required to collect information related to travel facilities	8	L2	CO1
	C)	Describe how the study area is divided into Zones and mention the factors to be considered while dividing area into zones.	7	L1	CO1
		OR			
4.	A)	Define sampling and explain the methods available for sampling.	10	L2	CO1
	B)	Explain the various stages involved in urban transport planning.	10	L2	CO1
	C)	Define external cordon line and explain various factors considered in selection of external cordon line.	5	L2	CO1

Comments:

Accepted

Signature of Faculty *Scrutinizer* *HOD*

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BGS Health & Education City, Kengeri, Bangalore.

Department of Civil Engineering

Internal Assessment Test – I / ~~II / III~~

Sub: Urban Transport Planning **Sub Code:** 18CV745 **Sem/Sec:** VII 'A & B'
Date: 19/11/2021 **Time:** 2:00pm – 3:45pm **Max marks:** 50 + 10
Duration: 1 hr 45 mins **Staff:** Nisarga.P

Scheme and Solution

Question Number	Solution	Marks
	I MCQ (each question carris 1 mark)	
1.	c) Both a and b	
2.	d) Survey and analysis of existing condition	
3.	b) Bus Rapid Transit system	
4.	c) Both a and b	
5.	d) Probit model	
6.	b) External Cordon line	
7.	a) Sector 5, zone 6, sub-zone 2	
8.	c) 1 in 8 household	
9.	d) External to External	
10.	a) Inter linker	
	II – Internal test	
1.(A)	Impact of transportation on environment. Explain briefly (2M each) • Energy Consumption in transport • Air pollution • Noise pollution • Visual intrusion & degrading aesthetics • Severance & land consumptions	10M
(B)	Mass transit system: Merits: – 4M – a) Reduction in congestion b) Saves time c) Cost effective d) Environment impact e) Social impact f) Economic impact. Demerits – 4M – a) Feasibility b) Expensive to build & operate c) Waiting time d) Crime e) Journey comfort.	8M

Question Number	Solution	Marks
(C)	Interdependence of Land-use & Transport – Need (3) Explain the concept by a) Michel & Raplin – (2) b) Buchnannan – (2)	7M
2. (A)	A stage transport planning model – Definition (2M) Stages – Trip generation Trip distribution Trip assignment Modal split } Definition, methods, Each stage carries – 2M – 2×4 = 8M	10M
(B)	Sources of nois generated from road vehicles, Explain • Noise generated from vehicle parts – 2M • Noise contributed from interaction b/w vehicle & road surface – 2M • Noise dependent on the speed, flow & density of traffic – 2M	6M
(C)	BRTC – Definition, need, current scinario Advantages	4M
3 (A)	Methods of Origin & Destination study. – 4 List & Methods. – (1M) Explain Home Interview Survey – Purpose – 1M Method of data collection – 3M. Sampling – 1M (5M) Registration number survey Purpose – 1M Method of data collection – 3M (4M)	10M

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Internal Assessment Test – I / II / III

Sub: **Sub Code:** **Sem/Sec:**
Date: **Time:** **Max marks:**
Duration: 1 hr mins **Staff:**

Scheme and Solution

Question Number	Solution	Marks
(B)	Inventories required to collect information related to travel facilities – Purpose (1M) • Inventory of streets • Traffic Volume • Travel time studies • Public transport buses • Rail transport facilities • Parking inventory • Accident data. } 1M each.	8M
(C)	Definition of Study area & Zone – 1M – Coding for dividing area into zone – 1M – Factors considered. – 10 factors – 5M –	7M
4. (A)	Sampling – Definition & Purpose – 1M Methods – Simple Random sampling Systematic sampling Stratified sampling Cluster sampling Quota sampling Purpose sampling } Method to take samples. with examples (1.5 each meth)	10M
(B)	Stages involved in transport planning • Survey & Analysis of existing condition • Forecast & analysis of future condition & plan synthesis • Evaluation • Program adoption & implementation • Continuing study 2M each	10M

Question Number	Solution	Marks
(c)	External Cordon line - Definition (1M) Factor considered - 4 factors - 4M	5M
1 (c)	System approach to transport planning Flowchart - 5M Definition & Explanation - 2M	7M.

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DEPARTMENT OF CIVIL ENGINEERING

INTERNAL ASSESSMENT PAPER (5th Sem)

Internal Test: 2	Internal Quiz: 2	Academic Year: ODD / 2021-22	
Subject : Urban Transport Planning	Sub-Code: 18CV745	Sem: V[illegible]A&B'	
Date: 28/12/2021	Time: 2:00pm – 3:45pm	Dur: 1:45 min	
Internal Test max marks: **50**	Internal Quiz max marks: **10**		
Staff-Incharge: Nisarga P			

I. Quiz (Answer all multiple-choice question in first sheet of your answer book)

Q. No	Multiple choice question	BT level	CO Mapped
1	Trips having neither end at the home of person making the trip are known as____ a) Interzonal trip b) Home based trip c) Intrazonal trip d) Non home-based trip	L1	CO2
2	The method used for travel demand models are given below, match the suitable methods. A. Gravity Model i. Modal spit B. Lowry derivative model ii. Trip distribution method C. Category Analysis iii. Trip generation method D. Logit model iv. Land use model a) A-ii, B-iv, C-iii, D-iv b) A-iii, B-ii, C-i, D-iv c) A-i, B-iv, C-iii, D-ii d) A-ii, B-iv, C-iii, D-i	L1	CO2
3	With respect to Multiple Linear regression analysis, following assumption is true. a) All the variables are dependent b) All the variables are linear c) All the variables are normally distributed d) All the variables are discrete	L1	CO2
4	Trip categories are represented by a) Graphical form b) Desired line c) Multi-dimensional matrix d) All the above	L1	CO2
5	The better is the linear relationship between the variables when R is ___ a) Closer to 1 b) Closer to 0 c) Closer to -1 d) None of the above	L1	CO2
6	Growth factor value is calculated as: a) $E = \frac{ti}{Ti}$ b) $E = \frac{Ti}{ti}$ c) $E = ti \times \frac{Ti}{ti}$ d) $E = ti + \frac{Ti}{ti}$	L1	CO2
7	As per gravity model trip interchange between zones Statement A: directly proportional to relative attraction b/w zones Statement B: inversely proportional to special separation	L1	CO2

	a) Statement A and B are true b) Statement A is true and B is false c) Statement A is false and B is true d) Statement A and B are false		
8	0.65, 0.56, 0.67, 0.76 are the R-square values of four trip generation models X, Y, Z and W respectively. Which model is best? a) X b) Y c) Z d) W	L1	CO2
9	In the growth factor method, future estimated trip will be zero if the present trip generation rate is zero a) True b) False	L1	CO2
10	The category analysis for trip generation considers _____ as the fundamental analysis unit. a) Land-use b) Household c) Accessibility d) None of the above	L1	CO2

II. Internal Test (Answer any two full questions choosing one from each part) (Each full question carries 25 marks)

<table>
<tr><th>Main Ques</th><th>Sub Ques</th><th>Full Question</th><th>Marks</th><th>BT Levels</th><th>CO Outcome</th></tr>
<tr><td colspan="6">Part A</td></tr>
<tr><td rowspan="3">1.</td><td>A)</td><td>State the important criteria for the evaluation of regression equation with relative assumption made in analysis of trip generation and discuss the limitations of multiple linear regression analysis and the suitability.</td><td>10</td><td>L2</td><td>CO2</td></tr>
<tr><td>B)</td><td>The following table gives trip distribution between four zones 1, 2,3 and 4. Estimate the future interzonal trip between the four zones. (upto two iteration) using average growth factor method and draw the conclusion based on result.
<table>
<tr><td>O/D</td><td>1</td><td>2</td><td>3</td><td>4</td><td>Future Trips</td></tr>
<tr><td>1</td><td>10</td><td>20</td><td>15</td><td>18</td><td>140</td></tr>
<tr><td>2</td><td>21</td><td>16</td><td>17</td><td>14</td><td>150</td></tr>
<tr><td>3</td><td>30</td><td>21</td><td>25</td><td>27</td><td>200</td></tr>
<tr><td>4</td><td>10</td><td>9</td><td>16</td><td>13</td><td>100</td></tr>
<tr><td>Future Trips</td><td>150</td><td>120</td><td>180</td><td>160</td><td></td></tr>
</table></td><td>8</td><td>L2</td><td>CO2</td></tr>
<tr><td>C)</td><td>Explain the various factors governing the trip generation</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">2.</td><td rowspan="2">A)</td><td rowspan="2">The distribution of present trips among zone 1,2 and 3 are given in O-D matrix below. The future trips generated in zone 1,2 and 3 are expected to be 360, 1260 and 3120 respectively. Distribute the future trips among various zone using i) Uniform factor Method ii) Average growth factor method and draw the conclusion based on result.
<table>
<tr><td>O/D</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>1</td><td>60</td><td>100</td><td>200</td></tr>
<tr><td>2</td><td>100</td><td>20</td><td>300</td></tr>
<tr><td>3</td><td>200</td><td>300</td><td>20</td></tr>
</table></td><td rowspan="2">10</td><td rowspan="2">L2</td><td rowspan="2">CO2</td></tr>
</table>

	B)	The following information was obtained from a transportation survey of a town: Traffic zone number / Population in the zone (in thousand) / Total trip generated (in hundreds) 1 / 26 / 12 2 / 28 / 11 3 / 31 / 17 4 / 33 / 15 5 / 22 / 12 6 / 30 / 15 7 / 20 / 9 8 / 25 / 13 Develop a linear regression model for estimating the trips generated from a zone. If the population in a particular zone increases to 40,000 predict the expected trip generation from that zone.	10	L2	CO2
	C)	Explain category analysis and mention the assumptions made.	5	L1	CO2
		Part B			
3.	A)	Determine the future trip distribution by Furness method from the following data (upto two iteration) O/D / 1 / 2 / 3 / 4 / Future Trips 1 / - / 50 / 60 / 30 / 280 2 / 40 / - / 70 / 20 / 390 3 / 20 / 60 / - / 40 / 300 4 / 50 / 70 / 30 / - / 220 Future Trips / 200 / 500 / 340 / 150 /	10	L2	CO2
	B)	A self-contained town consists of four residential areas A, B, C and D and two industrial areas X & Y. The trips from home-work generated by each residential area are as follows A / B / C / D 1000 / 2250 / 1750 / 3200 There are 3700 jobs in industrial estate X and 4500 in industrial estate Y. It is known that attraction between zones in inversely proportional to the square of the journey times between zones. Calculate and tabulate the inter zonal trips for journey from home to work. The journey time in minutes from home to work are as follow Zone / X / Y A / 15 / 20 B / 15 / 10 C / 10 / 10 D / 15 / 20	15	L2	CO2
		OR			
4.	A)	Discuss the methods to distribute the interzonal trips based on growth factor.	10	L2	CO2
	B)	The total trips produced in and attracted to the three zones A, B, and C of a survey area in the design year are tabulated below	8	L2	CO2

Zone	Trip Produced	Trip Attracted
A	2000	3500
B	3500	4800
C	4800	2000

It is known that the trips between two zones are inversely proportional to the second power of the travel time between zones, which is equally 25 min. If the trip interchange between zones B and C is 300. Calculate the trip interchange between zones A-B, A-C, B-A and C-B

	C)	Explain Opportunity model of trip distribution.	7	L2	CO2

Comments:

Signature of Faculty ***Scrutinizer*** ***HOD***

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BGS Health & Education City, Kengeri, Bangalore.

Department of Civil Engineering

Internal Assessment Test – I / II / III

Sub: Urban Transport Planning **Sub Code:** 18CV745 **Sem/Sec:** 5 A+B

Date: 28/12/2021 **Time:** 2:00pm - 3:45pm **Max marks:** 50

Duration: 1 hr 45 mins **Staff:** Nisargap

Scheme and Solution

Question Number	Solution	Marks
	PART-I (Quiz) - 1M each	
1	d) non home-based trip	
2.	a) A-ii, B-iv, C-iii, D-iv	
3.	c) All the variables are normally distributed	
4.	c) Multi-dimensional matrix	
5.	a) Closer to 1	10M
6.	b) $E = \frac{T_i}{t_i}$	
7.	a) Statement A and B are true	
8.	d) W	
9.	a) True.	
10.	b) Household.	
	II - Internal test	
1.A)	Assumptions - 3M General form of MLRA - 4M Limitations - 3M	10M
B)	Future trip distribution: $T_{i-j} = t_{i-j}\left[\frac{E_i + E_j}{2}\right]$ - 1M <Average Factor Method> Calculations: - 4M Trip distribution matrix	

O\D	1	2	3	4	E_i
1	22	39	37	41	1
2	45	31	42	32	1
3	59	36	56	55	0.97
4	21	17	37	28	0.97
E_j	1	0.97	1	1	

- 3M

8M

Question Number	Solution	Marks
C)	Factors governing trip generation 7 factors (1 × 7) or	7M
2 A)	Uniform Growth factor method	

O \ D	1	2	3	4
1	60	100	200	350
2	100	20		
3				
4				

O \ D	1	2	3
1	218	365	729
2	365	73	1094
3	729	1094	73

4M

Average growth factor method

2 iteriation. - 3 × 2

6M

I iteriation

O \ D	1	2	3	E_2
1	60	200	700	0.375
2	200	60	1350	0.783
3	700	1350	120	1.438
E_3	0.375	0.783	1.438	

II iteriation

O \ D	1	2	3	E_1
1	23	116	631	0.46
2	116	47	150	0.76
3	631	1494	172	1.35
E_1				

B) Linear regression equation $Y = b_0 + b_1 x_1$ - 1M

$$b_1 = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

$= 0.469$ - 2M

$$b_0 = \left(\frac{\Sigma y - b_1 \Sigma x}{n}\right)$$

$= 0.396$ - 2M

$$r = b_1 \left[\frac{n\Sigma x^2 - (\Sigma x)^2}{n\Sigma y^2 - (\Sigma y)^2}\right] = 0.82 - 2M$$

$$\boxed{Y = 0.396 + 0.469 x_1} - 1M$$

Tabulations - 3M.

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Internal Assessment Test – I / II / III

Sub: **Sub Code:** **Sem/Sec:**
Date: **Time:** **Max marks:**
Duration: 1 hr mins **Staff:**

Scheme and Solution

Question Number	Solution	Marks
(c)	Category Analysis. - purpose Assumptions - 5 assumptions	5M
	PART-B	
3. A)	Furness method. I iteration	10M

O\D	1	2	3	4	Ei
1	22	40	35	40	1.02
2	45	32	40	31	1.01
3	61	39	55	56	0.94
4	21	18	36	28	0.97
Ej	1	0.93	1.08	1.03	

– 5M

II iteration

O\D	1	2	3	4	Ei
1	22	39	37	41	1
2	45	31	42	32	1
3	59	36	56	55	0.97
4	21	17	37	28	0.97
Ej	1.02	0.97	1	1	

– 5M

B) Gravity model

$$T_{i-j} = P_i \times \frac{\frac{A_j}{(d_{ij})^n}}{\frac{A_j}{(d_{ij})^n} + \cdots \frac{A_n}{(d_{ij})^n}}$$

I iteration.

Calculation:

O\D	X	Y
A	582	399
	594	406
B	601	1649
	602	1648
C	790	960
	1900	1300
D	1862	1277
Ci	3836	4284
	3866	
Aj	3700	4500

Question Number	Solution	Marks
	Adjusted attraction factor. A_x = ~~3790~~ 3523 A_y = ~~4926~~ 4694 II iteration Calculations; O/D | X | Y A | 571 | 427 B | 563 | 1685 C | 753 | 997 D | 1827 | 1366 3714 4485 Adjusted attraction factor. A_x = 3557 3510. A_y = 4752. 4710 (or)	
4 A)	Methods of trip distribution using Growth factor. a) Uniform G.F b) Average G.F c) Fratar method d) Furness method 2.5 each	10M
B)	$T_{ij} = \frac{K P_i A_j}{t^n}$ – 1M ; $K = \frac{1}{25}$ – 2M $T_{A-B} = 800$ $T_{B-A} = 900$ $T_{C-B} = 1600$ } 1×5M $T_{A-C} = 800$ $T_{C-A} = 900$	8M
C)	Opportunity model - importance – 1M Intervening opportunity model – 3M Competing opportunity model – 3M	7M

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DEPARTMENT OF CIVIL ENGINEERING

INTERNAL ASSESSMENT PAPER (5th Sem)

Internal Test: 3	Internal Quiz: 3	Academic Year: ODD / 2021-22
Subject : Urban Transport Planning	Sub-Code: 18CV745	Sem: VII 'A&B'
Date: 29/01/2022	Time: 11:00am –12:45pm	Dur: 1:45 min
Internal Test max marks: **50**	Internal Quiz max marks: **10**	
Staff-Incharge - Nisarga P		

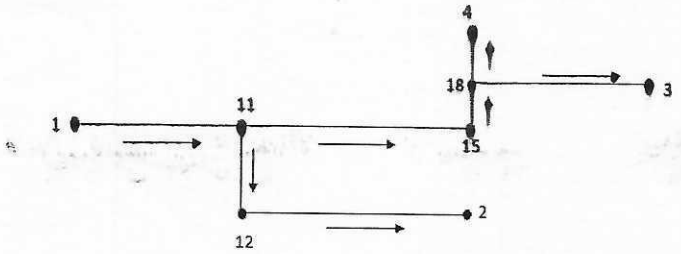
I. Quiz (Answer all multiple-choice question in first sheet of your answer book)

Q. No	Multiple choice question	BT level	CO Mapped
1	Which of the following model is not used for Modal Split analysis? a) Competing opportunity model b) Probit model c) Logit model d) None of the above	L1	CO3
2	Utilities of two transport modes are 1.0 each. Estimate the probability of one of the modes a) 0.45 b) 0.55 c) 0.5 d) 0.6	L1	CO3
3	The estimation of what proportion of total forecasted trips between two zones, shall use the available alternative routes is known as _____ a) Trip generation b) Modal split c) Route assignment d) Trip distribution	L1	CO3
4	The basic factor, that lead people to choose one route over the another is __ a) Travel time b) Travel cost c) Level of service d) All the above	L1	CO3
5	Route assignment is related to _____ a) Assigning existing trips to existing transport network b) Assigning future trips to existing transport network c) Assigning future trips to future transport network d) All of the above	L1	CO3
6	_____ method is used to estimate the proportion of person or vehicles likely to reroute to a new or improved facility. a) Capacity restraint b) Multiple Route Assignment c) Detroit d) Diversion curve	L1	CO3
7	Minimum path tree defines a) Route of travel which has least travel time b) Route of travel with less traffic volume c) Both a &b d) None of the above	L1	CO3
8	In capacity restraint assignment V/C ratio is maintained by a) Reducing number of vehicles assigned b) Altering the link travel time c) Choosing alternate route d) None of the above	L1	CO3

9	In Lowry's Land-use-Transport model the basic employment is _____ allocated to the city planning process a) Endogenously b) Exogenously c) Both A & B d) None of the above	L1	CO3
10	Distribution and retail are examples for a) Service employment b) Basic employment c) Community employment d) None of these	L1	CO3

II. Internal Test (Answer any two full questions choosing one from each part) (Each full question carries 25 marks)

Main Ques	Sub Ques	Full Question	Marks	BT Levels	CO Outcome
		Part A			
1.	A)	Define modal split and explain in brief the factors affecting modal split.	10	L2	CO3
	B)	With the flow diagram explain Pre-distribution modal split.	10	L2	CO3
	C)	To overcome congestion on the urban street network, a motorway is proposed. The travel time from one zone centroid to another via the proposed motorway is estimated to be 10min whereas the time for same travel via existing street is 18 min. the flow between the two-zone centroid is 1000veh/hour. Assign the flow between the new motorway and existing street.	5	L2	CO3
		OR			
2.	A)	State traffic assignment? Explain its general principles.	10	L2	CO3
	B)	The calibrated utility function for travel in a medium city by automobile, bus and metro is given by $U = a - 0.02X_1 - 0.005X_2$; X_1 = Cost of travel (Rs), X_2 = Travel time (min) Calculate modal split for given values. Mode / a / X_1 / X_2 Automobile / -0.3 / 120 / 30 Bus / -0.35 / 20 / 45 Metro / -0.40 / 60 / 35 If parking fee of 10/- per trip is imposed on automobile, what would be the split to the other two modes?	10	L2	CO3
	C)	Discuss the important considerations for selecting land-use model.	5	L1	CO3
		Part B			
3.	A)	Explain the following a) All-or-nothing assignment b) Capacity Restraint Technique	10	L2	CO3

	B)	Example: Figure below shows the minimum path tree connecting zone centroid 1 with zone centroid 2, 3, & 4. The traffic volume from zone centroid 1 to zone centroid 2, 3, & 4 are given. From zone centroid — To zone centroid — Traffic volume (Vehicles/hour) 1 — 2 — 1900 1 — 3 — 2800 1 — 4 — 4200  It is required to assign the flow from zone centroid 1 to zone centroid 2, 3, & 4	10	L2	CO3
	C)	Explain the application of traffic assignment techniques.	5	L2	CO3
		OR			
4.	A)	Write a flow chart of fundamental structure of Lowry derivative model and explain the principal components of model.	10	L2	CO3
	B)	Explain in detail, various diversion curves used in trip assignment technique.	10	L2	CO3
	C)	Draw the flow diagram for modal split carried out between trip generation and trip distribution.	5	L1	CO3

Comments: Accepted.

Signature of Faculty *Scrutinizer* *HOD*

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Department of Civil Engineering

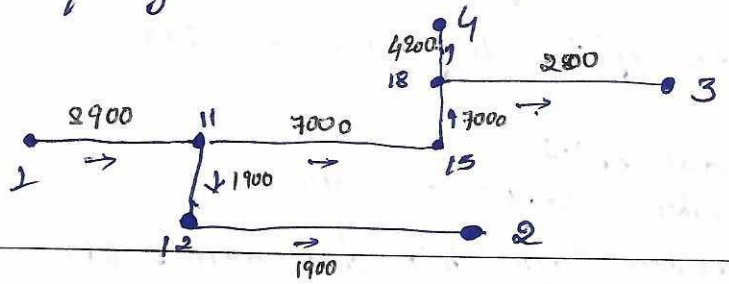
SCHEMES & SOLUTIONS

Internal Test: 3	Internal Quiz: 3	Academic Year: EVEN / 2020-21	
Sub: Urban Transport Planning	Sub-Code: 18CV745	Sem: VII	
Date:	Time: 1:00pm - 2:45pm	Dur: 1:45 min.	
Internal Test max marks: 50	Internal Quiz max marks: 10		
Staff-Incharge: Nisarga. P			

Comments:

Signature of Faculty: **Signature of Scrutinizer:** **Signature of HOD:**

Q. No.		Marks Alloted
	I Quiz.	
1.	a) Competing opportunity model.	
2.	a) Trip assignment.	
3.	c) 0.5	
4.	a) Travel time.	
5.	d) All the above.	
6.	d) Diversion Curve.	
7.	a) Route of travel which has least travel time	
8.	b) Altering link travel time	
9.	b) Exogeneously	
10.	b) Basic employment.	
	II Internal test	
1.A	Definition modal split - 2M Factors affecting modal split - 4 factors - 8M	
B.	Pre distribution modal split. a) At trip generation stage - 3M b) After trip generation before trip distribution - 6M	

Q. No.		Marks Alloted
e)	$P = \frac{100}{1+t_p^6}$; $T_R = 0.56$ — 1M $P = 96.5\%$ — 2M Traffic diverted to new motorway = 35 veh/hr — 1M	5
2. A)	Definition of traffic assignment — 2M Applica General Principle — Moor's Algorithm for minimum path tree — 8M with example	10
B)	$U_a = -2.85$; $P_a = 9.5\%$ $U_B = -2.975$; $P_b = 62.40\%$ $U_m = -1.755$; $P_m = 28.03\%$ — 5M After imposing parking fee of 10/- $V_a = -3.05$ $P_a = 7.96\%$ $V_B = -0.975$ $P_b = 63.506\%$ $V_m = -1.775$ $P_m = 28.52\%$ — 5M	10
c)	Consideration for selecting land use model. 5 factors	5M
3. A)	a) All or nothing assignment b) Capacity Restraint technique } Explain principle — 5M each	10 M
B)		10M

Q. No.		Marks Alloted
c)	Applications of traffic assignment - 5 - applications	5M
4. A)	Fundamental structure of Lowry derivative model Flow chart - 4M Components - Basic employment Servic employment Household structure - 6M	10M
B)	Diversion curves a) Simple diversion curves b) Diversion curves for expressways c) Bureau of Public roads d) California diversion curves } Explain the importance & general form of graph.	10M.
c)	Flow diagram for Post distribution / trip interchange	5M

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DEPARTMENT OF CIVIL ENGINEERING

URBAN TRANSPORT PLANNING (18CV745)

ASSIGNMENT-1

<table>
<tr><th>Q No</th><th>Question</th><th>CO mapped</th></tr>
<tr><td>1</td><td>Explain the 4-Stage transport planning model?</td><td>CO1</td></tr>
<tr><td>2</td><td>What are the impacts of transportation on environment?</td><td>CO1</td></tr>
<tr><td>3</td><td>Explain the various sources of noise generated from road vehicles causing pollution.</td><td>CO1</td></tr>
<tr><td>4</td><td>Explain the various stages involved in urban transport planning.</td><td>CO1</td></tr>
<tr><td>5</td><td>Describe how the study area is divided into Zones and mention the factors to be considered while dividing area into zones.</td><td>CO1</td></tr>
<tr><td>6</td><td>List the various methods available for data collection. Explain a) Home Interview Survey b) Registration Number Survey</td><td>CO1</td></tr>
<tr><td>7</td><td>Define sampling and explain the methods available for sampling.</td><td>CO1</td></tr>
<tr><td>8</td><td>State the important criteria for the evaluation of regression equation with relative assumption made in analysis of trip generation and discuss the limitations of multiple linear regression analysis and the suitability</td><td>CO2</td></tr>
<tr><td>9</td><td>The following information was obtained from a transportation survey of a town:
<table>
<tr><th>Traffic zone number</th><th>Population in the zone (in thousand)</th><th>Total trip generated (in hundreds)</th></tr>
<tr><td>1</td><td>26</td><td>12</td></tr>
<tr><td>2</td><td>28</td><td>11</td></tr>
<tr><td>3</td><td>31</td><td>17</td></tr>
<tr><td>4</td><td>33</td><td>15</td></tr>
<tr><td>5</td><td>22</td><td>12</td></tr>
<tr><td>6</td><td>30</td><td>15</td></tr>
<tr><td>7</td><td>20</td><td>9</td></tr>
<tr><td>8</td><td>25</td><td>13</td></tr>
</table>
Develop a linear regression model for estimating the trips generated from a zone. If the population in a particular zone increases to 40,000 predict the expected trip generation from that zone.</td><td>CO2</td></tr>
<tr><td>10</td><td>Explain the various factors governing the trip generation.</td><td>CO2</td></tr>
</table>

Faculty In-charge
NISARGA P

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DEPARTMENT OF CIVIL ENGINEERING

URBAN TRANSPORT PLANNING (18CV745)

ASSIGNMENT-2

<table>
<tr><th>Q No</th><th>Question</th><th>CO mapped</th></tr>
<tr><td>1</td><td>The distribution of present trips among zone 1,2 and 3 are given in O-D matrix below. The future trips generated in zone 1,2 and 3 are expected to be 360, 1260 and 3120 respectively. Distribute the future trips among various zone using
i) Uniform factor Method
ii) Average growth factor method and draw the conclusion based on result.
<table>
<tr><td>O/D</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>1</td><td>60</td><td>100</td><td>200</td></tr>
<tr><td>2</td><td>100</td><td>20</td><td>300</td></tr>
<tr><td>3</td><td>200</td><td>300</td><td>20</td></tr>
</table></td><td>CO2</td></tr>
<tr><td>2</td><td>The following table gives trip distribution between four zones 1, 2,3 and 4. Estimate the future interzonal trip between the four zones. (upto two iteration)
<table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>Future Trips</td></tr>
<tr><td>1</td><td>10</td><td>20</td><td>15</td><td>18</td><td>140</td></tr>
<tr><td>2</td><td>21</td><td>16</td><td>17</td><td>14</td><td>150</td></tr>
<tr><td>3</td><td>30</td><td>21</td><td>25</td><td>27</td><td>200</td></tr>
<tr><td>4</td><td>10</td><td>9</td><td>16</td><td>13</td><td>100</td></tr>
<tr><td>Future Trips</td><td>150</td><td>120</td><td>180</td><td>160</td><td></td></tr>
</table></td><td>CO2</td></tr>
<tr><td>3</td><td>The total trips produced in and attracted to the three zones A, B, and C of a survey area in the design year are tabulated below
<table>
<tr><td>Zone</td><td>Trip Produced</td><td>Trip Attracted</td></tr>
<tr><td>A</td><td>2000</td><td>3500</td></tr>
<tr><td>B</td><td>3500</td><td>4800</td></tr>
<tr><td>C</td><td>4800</td><td>2000</td></tr>
</table>
It is known that the trips between two zones are inversely proportional to the second power of the travel time between zones, which is equally 25 min. If the trip interchange between zones B and C is 300. Calculate the trip interchange between zones A-B, A-C, B-A and C-B</td><td>CO2</td></tr>
</table>

<table>
<tr><td>4</td><td>The calibrated utility function for travel in a medium city by automobile, bus and metro is given by U= a – 0.002X_1 -0.005X_2 ; X_1 = Cost of travel(Rs) , X_2 = Travel time (min)

Calculate modal split for given values

<table><tr><td>Mode</td><td>a</td><td>X_1</td><td>X_2</td></tr><tr><td>Automobile</td><td>-0.3</td><td>120</td><td>30</td></tr><tr><td>Bus</td><td>-0.35</td><td>20</td><td>45</td></tr><tr><td>Metro</td><td>-0.40</td><td>60</td><td>35</td></tr></table>
Is a parking fee of 10/- per trip is imposed on automobile, what would be the split to the other two modes?</td><td>CO3</td></tr>
<tr><td>5</td><td>State traffic assignment and its applications? Explain its general principle.</td><td>CO3</td></tr>
<tr><td>6</td><td>Explain the concept of Lowry derivative model with a flow diagram.</td><td>CO3</td></tr>
</table>

Faculty In-charge
NISARGA P

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INTERNAL ASSESSMENT BOOK

Student Name : Bhoomika A.E

Semester & Section : 7th & A Section USN : 1JB18CV009

Subject: Urban Transport planning Subject Code: 18CV745 Branch: civil

Name of Faculty in charge : Nisarga . P.

Q No.	Internal Assessment Test - I Date : 19/11/21 Max. Marks : 50 PART - A				Q No.	Internal Assessment Test - II Date : 28/12/21 Max. Marks : 50 PART - A				Q No.	Internal Assessment Test - III Date : 31/1/2022 Max. Marks : 50 M PART - A			
	A	B	C	Total		A	B	C	Total		A	B	C	Total
1	3	7	6	16	1					1				
2					2	10	10	5	25	2	6	10	5	21
	PART - B					PART - B					PART - B			
3					3	9	15		24	3				
4	8	1	5	14	4					4	10	10	5	25
I Test IA Marks Total				30	II Test IA Marks Total				49	III Test IA Marks Total				46
Quiz 1/Assignment etc.,				07	Quiz 2/Assignment etc.,				09	Quiz 3/Assignment etc.,				05
Student Signature : Bhoo					Student Signature : Bhoo					Student Signature : Bhoo				
Signature of Invigilator					Signature of Invigilator G. Asha					Signature of Invigilator				
Signature of Faculty in charge					Signature of Faculty in charge					Signature of Faculty in charge				

Avg. IA Marks for 50 (A) : 42 Assignment /Quiz etc., for 10 (B) : 10 Total IA Marks for 40 (A+B): 35

30 - (25)

HOD

Principal

Department of civil engineering

Dept. Vision:

To produce high quality civil engineering graduates to suit the ever dynamic infrastructure industry.

Dept. Mission:

To establish as a state of art learning center to meet the demands of future through conducive learning programme.
→To develop as a recognized consultancy and research center to cater the needs of the industry & society.

About Anti - Ragging

SJBIT has zero tolerance policy for ragging. The Institute views ragging, is an uncivilized, and inhuman practice. We do not subscribe to the view that one could wait till something happens in order to initiate stringent action. Any rigorous action in such cases may damage a young career. So we repose faith in averting such eventualities. For this, the Institute has proactive policy.

Punishments for Ragging

1. Cancellation of admission.
2. Suspension from attending classes.
3. Withholding/withdrawing scholarship/fellowship and other benefits.
4. Debarring from appearing in any test/examination or other evaluation process.
5. Withholding results.
6. Debarring from representing the University in any regional, national or international meet, tournament, youth festival etc.
7. Suspensions/expulsion from the hostel.
8. Rustication from the college and University for period varying from 1 to 4 years.
9. Expulsion from the college and consequent debarring from admission to any other college.
10. Rigorous imprisonment of three years and/or a fine of upto Rs.25,000.
11. Collective punishment: When the persons committing or abetting the crime or ragging are not identified, the institution has resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

1] c] both a & b

2] d] survey & analysis of existing condition.

3] b] Bus rapid Transport system

4] c] both a & b

5] a] Gravity model

6] b] External cordon line.

7] a] sector 5 zone 6 & subzone 8

8] c] 1 in 8 households

9] c] external to internal

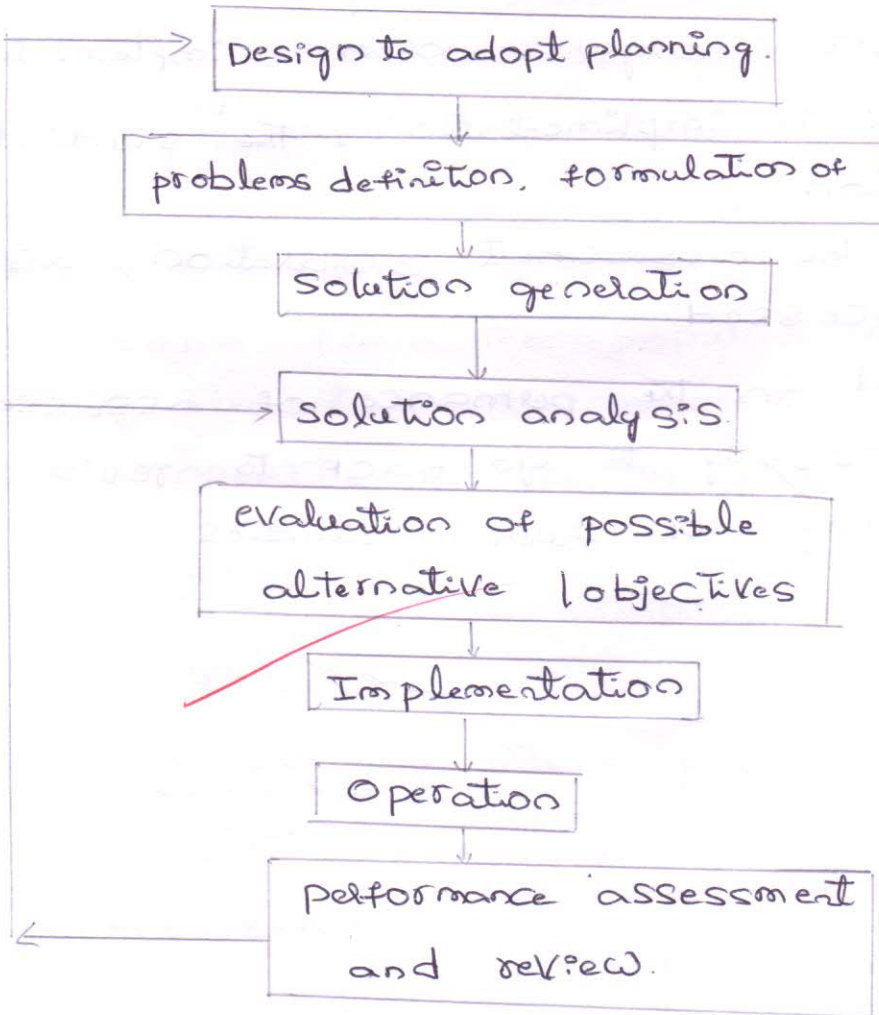
10] b] Intra linked.

7

part - A

1 c] System approach to transport planning.

The 'System' refers to complex whole (or) organized whole, which consist of sets of connected thing (or) parts, whose components and interaction (some) are vital to the operation of system



⇒ Design to adopt planning is a first step in system approach to transport planning. it is tool for achieving desirable goadl and objective.

⇒ After objective & goals defined, the solution are generated due to consideration of problems, constraints, potential and forecasting. The so generated after the analysis.

⇒ The best amongst choosen is implementation.

⇒ After the implimentation, The it studied in operation.

⇒ After the assessment operation, assessme is processed.

⇒ based on the permance of assessment, n it necessary to go back to revise the planning for further studies.

4A] Sampling :-

Sampling is a technique, select individual elements of the population, statical interference between of item & element characteristics of the whole population.

There are 2 methods.

→ probability sampling

→ Non probability sampling.

a] probability sampling:

⇒ It is a sampling in which the surveyor can sets a selection of few criteria and choosen the sample from the population.

Every element of the population have an equal opportunities to be part of an selected sample.

a] → simple random sampling

→ systematic sampling

→ stratified sampling

→ cluster sampling

a] Simple random sampling :-

It is type of sampling in which the surveyor can choosed the element from the whole population, every element have a chance to be selected by entirely on random.

⇒ This is sampling the surveyor can use the random number generator or other technique which is based on the entirely on chance (random)

b] Systematic sampling :-

It is also ~~simpli~~ similar to simple random sampling but easier to conduct.

In this also every element is selected instead of random no generator, use the systematic regular interval.

c] stratisfied sampling :-

In this sampling, the surveyor can choose ~~the~~ population is divided into subgroups,

The ~~good~~ surveyor can choose the elements on the basis of relattant characteristics of age, vehicle ownership, income -- etc.

Then calculate how many individual are sampled from each subgroup.

d] cluster sampling :-

In this sampling, the population is divided into subgroups.

The surveyor can choose the element on the bases same characteristic. Instead of sampling individual from each of subgroup., ~~or~~ select randomly an subgroup.

This Sampling is for large and dispersed population but more risk of error in data.

B] Non - probability sampling :

In this Sampling, the surveyor can sets a few criteria and choosen the same element from the whole population.

⇒ every element of population have difficulties in equal opportunities to be part of a selected sample (element).

Further divided into

→ convinience sampling
→ Quota sampling
→ Snowball sampling
→ purposive sampling.

Convinience Sampling :-

In this Sampling, The elements more accels to the surveyor, but there is no tell It can't produce generalized a result.

Example

Quota Sampling :

In this sampling, the surveyor can a choose element to given study area.

Snow ball Sampling

The large population is hard to accel. Then snow ball Sampling is used to recruit the participant via other participants.

4c) External cordon line :-

It is a imaginary line ~~representing~~ representing the boundary of study area is called external cordon line.

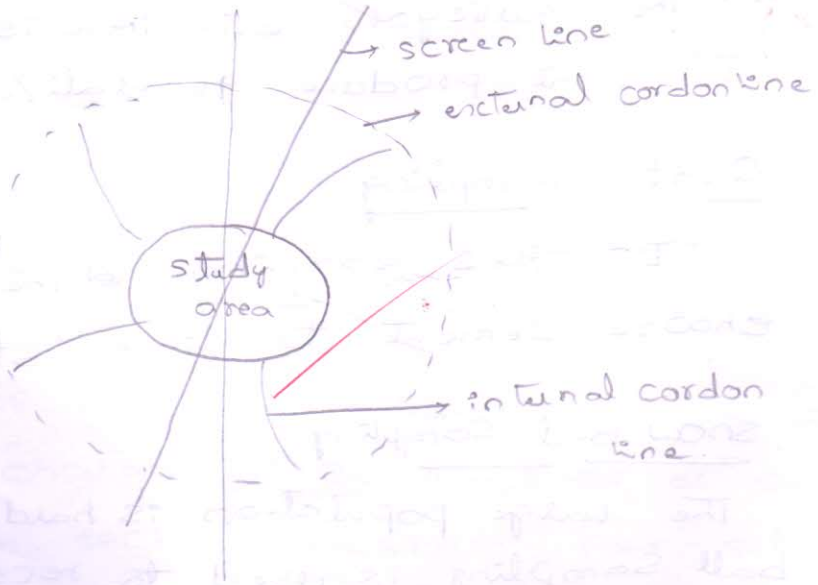
Factors :-

⇒ External cordon line should circumscribe of all area already studied and developed during the ~~study~~ period of study.

⇒ External cordon line should be continous and uniform in its course so that it movements cross only once.

⇒ All the area oriented towards the city center.

⇒ External cordon line compatible with previous study area and of studied for future.



1 g) Merit & demerits Demerits of MTS.

Mass transit system It refers to scheduled intra city service of fixed route in a vehicle shared mode.

Merits

→ Reduction in congestion
→ Save time
→ cost effective
→ Environmental impact
→ social impact.

Reduction in congestion :

The mass trasit system, the main idea behind this system is reduce the number of vehicles on the road by providing larger facilities which carrie large no of population is possible conventional bus system.

Save time :-

⇒ Mass transit system save the time by means of it moves in high speed & stop only at the specific points.

⇒ Environmental impacts :

⇒ Mass transit system is environmentaly friendly compared to other mode of transportation and also reduces the air pollution.

⇒ cost effective :

The mass transit system is at low cost.

⇒ social impacts :

In mass transit system, irrespective of financial status, religion @, cast people are travelled. It increase the social integrity of the country.

Demerits

⇒ It is economically feasible in area which has large population.

⇒ It is not easy to ~~of~~ built up and operate

⇒ Flexibility in time, people need to wait for long time for buses and ~~electric~~ destination to reach ~~desired~~ destination in desired time is not possible.

⇒ robbery and crimical activities is more.

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1 A) Impacts of transportation on environment.

→ Energy consumption in transport

→ Air pollution.

→ Noise pollution.

→ €

a] Air pollution :-

Air pollution is the also one of the Pollution impacts on the environment in various forms.

Some of the pollutants impacts are.

CO_2 → changes the climate

CO → respiratory damage

leads .. etc.

b] energy consumption

energy consumption also impacts environment.

If the fuel is used in the transportation. the fuel is used for the Next generation.

⇒ Noise pollution also produces from the transpotation is also impact the environment

It produces the heavy sounds it effects on human being and birds.

⇒ damaging aesthetics of the city
⇒ oil spills in ocean
⇒ Loss of marine life
⇒ Loss of endangered species
⇒ Low quality food
⇒ Decrease in water table.

3

4 (b) stages involved in the urban transit planning

→ survey and analysis of existing condition
→ plan synthesis
→ evaluation
→ continuing study.

1] d] Non home based trip

2] a] Two-way moment

3] c] All the variables are normally distributed

4] c] multi dimensional matrix

5] b] closer to 1

6] b] $E = \frac{Ti}{ti}$

7] a] statement A & B are true

8] a] X

9] a] true

10] b] household

88

9] A) i) Uniform growth factor method

O/P	1	2	3	t_i	T_i
1	60	100	200	360	360
2	100	20	300	420	1260
3	200	300	20	520	3120
				1300	4740

Growth factor $G.F = \frac{T_i}{t_i} = E_i$

Formula.

$$T_{i-j} = t_{i-j} \times E$$

$$= \frac{4740}{1300}$$

$$= 3.646$$

O/P	1	2	3	t_i	T_i
1	218	365	729	1312	360
2	365	73	1094	1532	1260
3	729	1094	73	1896	3120
				4740	4740

$$E_i = \frac{t_2}{t_i}$$

$$= \frac{4740}{4740}$$

$$E_i = 1$$

ii] Average Growth factor method

O/D	1	2	3	b_i	P_i	$E_i = \frac{P_i}{b_i}$
1	60	100	200	360	360	1
2	100	20	300	420	1260	3
3	200	300	20	520	3120	6
a_j	360	420	520			
A_j	360	1260	3120			
$E_j = \frac{A_j}{a_j}$	1	3	6			

$$T_{i-j} = t_{i-j}\left[\frac{E_i + E_j}{2}\right]$$

$$T_{1-1} = 60\left[\frac{1+1}{2}\right] = 60$$

$$T_{1-2} = 100\left[\frac{1+3}{2}\right] = 200$$

$$T_{1-3} = 200\left[\frac{1+6}{2}\right] = 700$$

$$T_{2-1} = 100\left[\frac{3+1}{2}\right] = 200$$

$$T_{2-2} = 20\left[\frac{3+3}{2}\right] = 60$$

$$T_{3-3} = 300\left[\frac{3+6}{2}\right] = 1350$$

$$T_{3-1} = 200\left[\frac{6+1}{2}\right] = 700$$

$$T_{3-2} = 300\left[\frac{6+3}{2}\right] = 1350$$

$$T_{3-3} = 20\left[\frac{6+6}{2}\right] = 120$$

i \ j	1	2	3	t_i	P_i	E_i
1	60	200	700	960	360	0.37
2	200	60	1350	1610	1260	0.78
3	700	1350	120	2170	3120	1.44
a_j	960	1610	2170			
A_j	960	1260	3120			
E_j'	1	0.78	1.44			

II iteration

$$T_{i-j} = t_{i-j}\left[\frac{E_i + E_j}{2}\right]$$

$$T_{1-1} = 60\left[\frac{0.37+1}{2}\right] = 41$$

$$T_{1-2} = 200\left[\frac{0.37+0.78}{2}\right] = 115$$

$$T_{1-3} = 700\left[\frac{0.37+1.44}{2}\right] = 634$$

$$T_{2-1} = 200 \times \left[\frac{0.78+1}{2}\right] = 178$$

$$T_{2-2} = 700 \left[\frac{0.78+0.78}{2}\right] = 47$$

$$T_{2-3} = 1350 \left[\frac{0.78+1.44}{2}\right] = 1499$$

$$T_{3-1} = 700 \left[\frac{1.44+1}{2}\right] = 854$$

$$T_{3-2} = 1350 \left[\frac{1.44+0.78}{2}\right] = 1499$$

$$T_{3-2} = 190 \left[\frac{1.44+1.44}{2}\right] = 173$$

of	1	2	3	b_i	P_i	E_i
1	41	115	634	790	360	0.45
2	178	47	1499	1724	1260	0.73
3	854	1499	173	2526	3120	1.23
a_j	1073	1661	2306			
A_j	360	1260	3120			
E_j^2	0.33	0.75	1.35			

10

further iteration will continue until E_i & E_j reaches unity.

2 b)

zone	x	y	x^2	y^2	xy
1	26	12	676	144	312
2	28	11	784	121	308
3	31	17	961	289	527
4	33	15	1089	225	495
5	22	12	484	144	264
6	30	15	900	225	450
7	20	9	400	81	180
8	25	13	625	169	325
$n = 8$	$\Sigma x = 215$	$\Sigma y = 104$	$\Sigma x^2 = 5919$	$\Sigma y^2 = 1398$	$\Sigma xy = 2861$

Linear regression eqn of the form

$$y = b_0 + b_1 x_1$$

y = dependent variable

x_1 = independent variable

b_0 = regression constant

b_1 = regression co-efficient

$$b_0 = \frac{\Sigma y - b_1 \Sigma x}{n}$$

$$b_1 = \frac{n \Sigma xy - \Sigma x \Sigma y}{n(\Sigma x^2) - (\Sigma x)^2}$$

$$b_1 = \frac{8 \times 2861 - 215 \times 104}{8 \times (5919) - (215)^2}$$

$$\boxed{b_1 = 0.468}$$

$$b_0 = \frac{\Sigma y - b_1 \Sigma x}{n}$$

$$= \frac{104 - 0.468 \times 215}{8}$$

$$\boxed{b_0 = 0.423}$$

$\therefore y = b_0 + b_1 x_1 \quad (x_1 = 40)$

$x_1 = 4000$ ~~lbs~~

$y = 0.423 + 0.468 \times 40$

$\boxed{y = 19.143 \text{ hudreds}}$

$$r = b_1 \left[\frac{n(\Sigma x^2) - (\Sigma x)^2}{n(\Sigma y^2) - (\Sigma y)^2} \right]$$

$$= 0.468 \left[\frac{8 \times 5919 - (215)^2}{8 \times 1398 - (104)^2} \right]$$

$$\boxed{r = 1.43}$$

10

part - B

3 A]

O/D	1	2	3	4	bi	Pi	Ei
1	-	50	60	30	140	280	2
2	40	-	70	20	130	390	3
3	20	60	-	40	120	300	2.5
4	50	70	30	-	150	220	1.46
aj	110	180	160	90			
Aj	200	500	340	150			
Ej	1.81	2.78	2.12	1.66			

(column wise)

O/D	1	2	3	4	bi	Pi	Ei
1	-	139	127	50	316	280	0.88
2	72	-	148	33	253	390	1.54
3	36	167	-	66	269	300	1.11
4	91	195	64	-	350	220	0.62
aj	139	501	339	149			
Aj	200	500	340	150			
Ej	1.43	0.99	1	1			

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Row wise

	1	2	3	4	b_i^0	P_i^0	E_i
1	-	122	112	44	278	280	1
2	111	-	225	51	390	390	1
3	40	185	-	73	298	300	1
4	56	121	40	-	217	2200	1
a_j	207	428	380	168			
A_j	200	500	340	150			
E_j	0.96	1.16	0.89	0.89			

Further iteration continue until E_i & E_j equals 1

3B]

Pi

A 1000

B 2250

C 1750

D 3200

X 3700

Y 4500

n = 2

$$T_{i-j} = Pi \times \frac{\frac{Aj}{(d_{i-j})^n}}{\frac{Aj}{(d_{i-j})^n} + \dots + \frac{Ak}{(d_{i-j})^n}}$$

$$T_{A-X} = 1000 \times \frac{3700/15^2}{\frac{3700}{15^2} + \frac{4500}{20^2}} = 594$$

$$T_{A-Y} = 1000 \times \frac{4500/20^2}{\frac{3700}{15^2} + \frac{4500}{20^2}} = 406$$

$$T_{B-X} = 2250 \times \frac{3700/15^2}{\frac{3700}{15^2} + \frac{4500}{20^2}} = 602$$

$$T_{B-Y} = 2250 \times \frac{\frac{4500}{10^2}}{\frac{3700}{15^2} + \frac{4500}{10^2}} = 1648$$

$$T_{C-X} = 1750 \times \frac{\frac{3700}{10^2}}{\frac{3700}{10^2} + \frac{4500}{10^2}} = 790$$

$$T_{C-Y} = 1750 \times \frac{\frac{4500}{10^2}}{\frac{3700}{10^2} + \frac{4500}{10^2}} = 960$$

$$T_{D-X} = 3900 \times \frac{\frac{3700}{15^2}}{\frac{3700}{15^2} + \frac{4500}{20^2}} = 1900$$

$$T_{D-Y} = 3200 \times \frac{\frac{4500}{20^2}}{\frac{3700}{15^2} + \frac{4500}{20^2}} = 1300$$

Zone	X	Y	Total production
A	594	406	1000
B	602	1648	2250
C	790	960	1750
D	1900	1300	3200
Cj	3886	4314	8200
Aj	3700	4500	

$$A_{jm} = \frac{A_j}{C_{j(m-1)}} \times A_{j(m-1)}$$

$$= \frac{3700}{3886} \times 3700$$

$$= 3514 \cdot 3523$$

$$A_{jm} = \frac{4500}{3444 4314} \times 4500$$

$$= 6440.83$$

$$= 4694$$

II iteration

$A_x = 3523$, $A_y = 4694$

$$T_{A-x} = 1000 \times \frac{\frac{3523}{15^2}}{\frac{3523}{15^2} + \frac{4694}{20^2}} = 572$$

$$T_{A-y} = 1000 \times \frac{\frac{4694}{20^2}}{\frac{3523}{15^2} + \frac{4694}{20^2}} = 428$$

$$T_{B-x} = 2950 \times \frac{\frac{3523}{15^2}}{\frac{3523}{15^2} + \frac{4694}{10^2}} = 563$$

$$T_{B-Y} = 2250 \times \frac{\frac{4694}{10^2}}{\frac{3523}{15^2} + \frac{4694}{10^2}} = 1687$$

$$T_{C-X} = 1750 \times \frac{\frac{3523}{10^2}}{\frac{3523}{10^2} + \frac{4694}{10^2}} = 750$$

$$T_{C-Y} = 1750 \times \frac{\frac{4694}{10^2}}{\frac{3523}{10^2} + \frac{4694}{10^2}} = 1000$$

$$T_{D-X} = 3200 \times \frac{\frac{3523}{15^2}}{\frac{3523}{105^2} + \frac{4694}{20^2}} = 1829$$

$$T_{D-Y} = 3200 \times \frac{\frac{4694}{20^2}}{\frac{3523}{15^2} + \frac{4694}{20^2}} = 1371.$$

Zone	X	Y	total production
A	572	428	1000
B	563	1687	2250
C	750	1000	1750
D	1829	1371	3200
Cj	3714	4485	
Aj	3700	4500	

$$A_x = \frac{3700}{3714} \times 3523$$

$$\boxed{A_x = 3509}$$

$$A_y = \frac{4500}{4485} \times 4694$$

$$\boxed{A_y = 4709}$$

2] category analysis :-

Category analysis is the determining of avg value of dependent variables defines the categized independent variables is called category analysis.

Assumption

⇒ households are the fundamental unit of Trip generation process, make journey start & end in response with family

⇒ household with one set of characteristic generate different rate tips with other sets of household characteristics

⇒ 3 factors considered for category analysis

→ income

→ car ownership

→ household structure

→ above 3 factor, limiting no of ranges are established so as to describe the trip generation capacity by limiting no category.

Category

household

→ differe depend on Income, car ownership, household structure.

It is divided into

a] Income → 6 levels

- <₹500pa
- 500-1000pa
- 1000-1500pa
- 1500-2000 pa
- 2000-2500 pa
- > 2500 Pa

b] Car ownership - 3 class

- → 0 car class
- → 1 car
- → more than 1 car

c] household structure - 6 stucture.

- → No employed resident & one non employed adult
- → No employed resident & two non employed adult
- → One employed resident & one less employed adult
- → One employed resident & two more employed adult
- → 2(or) more employed resident & one(or) less employed adult
- → 2(or) more employed resident & two (or) more employed adult.

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1] b) ~~c~~ c) logit model ✓

2] c) 0.5 ✓

3] c) route assignment ✓

4] d) all the above ✓

5] d) all the above ✓

6] d] Diversion curve ✓

7] c) both a & b ✓

8] b) choosing alternate route ✓

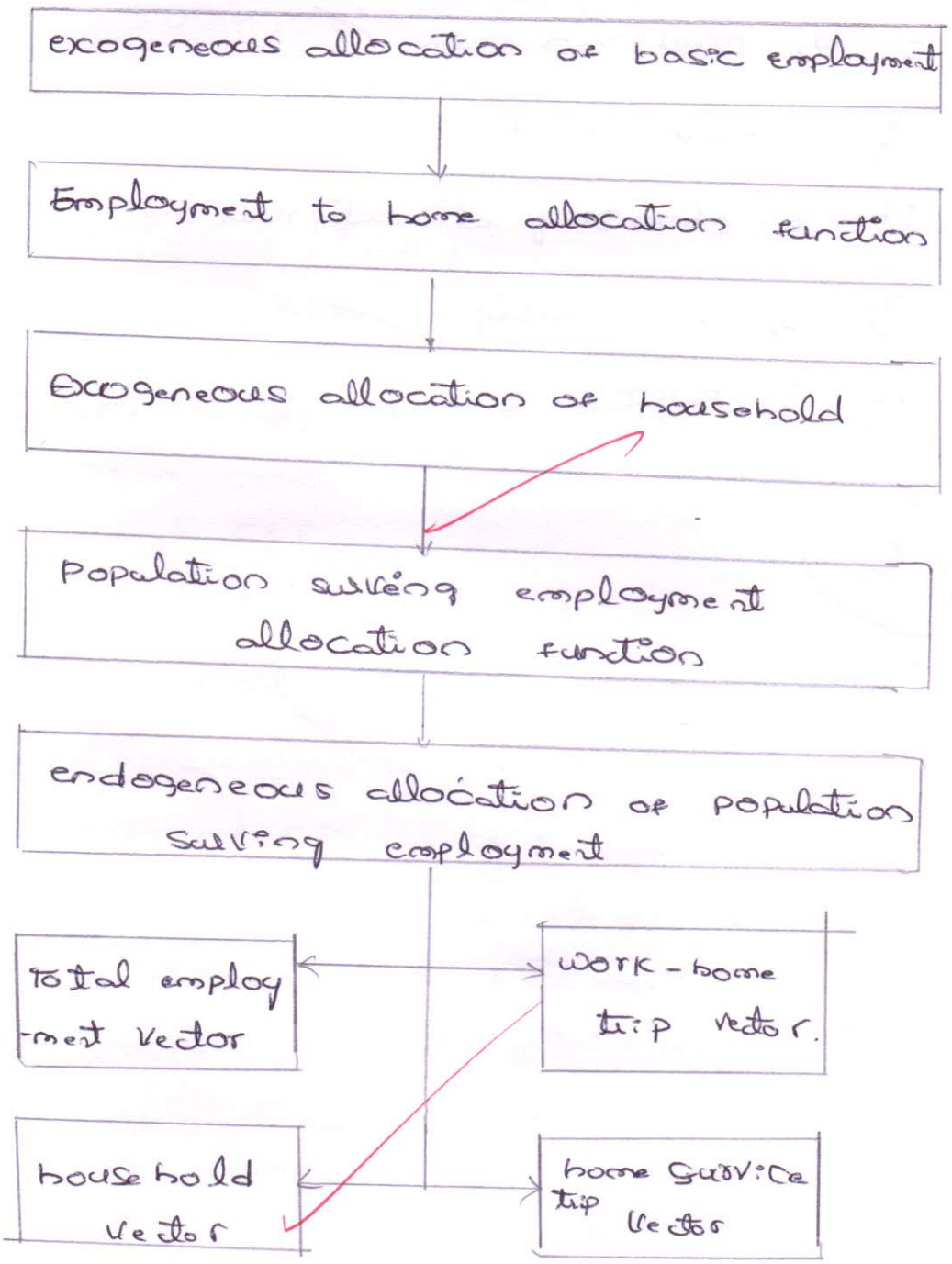
9] b) exogenously ✓

10] a) service Employment ✓

05

4A] Lowry derivative model :-

Lowry derivative model is simple structure, requires modest data, comprehensive and economical. A good response changes in the input variables.



3 principle

→ population

→ Employment

→ communication b/w population & employment

a) Basic employment

Basic employment is the ba employment industries who output & service are sold in market external to the region under study area.

The location for basic employment is with in the region is independent of the population of that zone.

ex: primary industries, trade, utility national finance institution.

b) Bas: service employment

The category of service the employment to the population of that region.

The location for service employment with in the region is dependent of the population of that zone.

ex: distribution & retail

Elementary & high school employment

e] house hold sector consist of residential population in the model. The spatial distribution for basic employment is allocated exogeneously. The spatial distribution for both basic employment & household calculated with in the model.

→ ~~For~~ rule for the both employment & household calculated within the structure.

Some of the important equation are

a] land use :-

$$A_j = A_j^U + A_j^B + A_j^R + A_j^H$$

b] Total employment :-

$$E_j = E_j^B \sum_{n=1}^{m} E_j^K$$

$$A_j^K = E_j^B \sum_{n=1}^{m} e^K E_j^K$$

c] For the population :-

$$N = f \sum_{n=1}^{m} E_j$$

Where,

A → Area of land

E → employment

N → population

H → household sector

U → unused usable sector

B → Basic sector

R → retail sector

K → class of establishment of retail sector

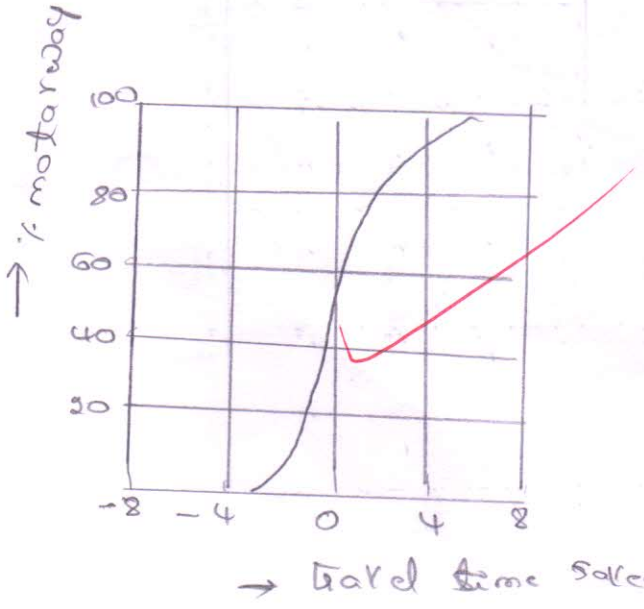
n → no of zones.

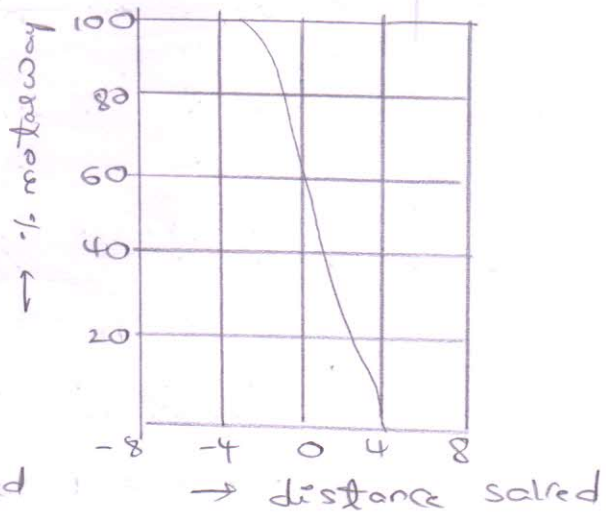
4③ Diversion curves

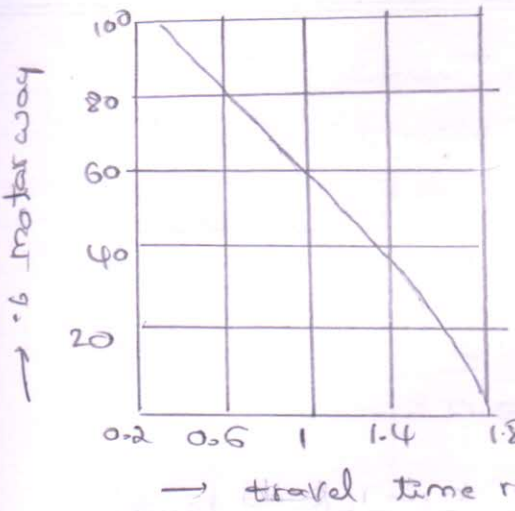
a] The most frequently used assignment technique is the diversion curve.

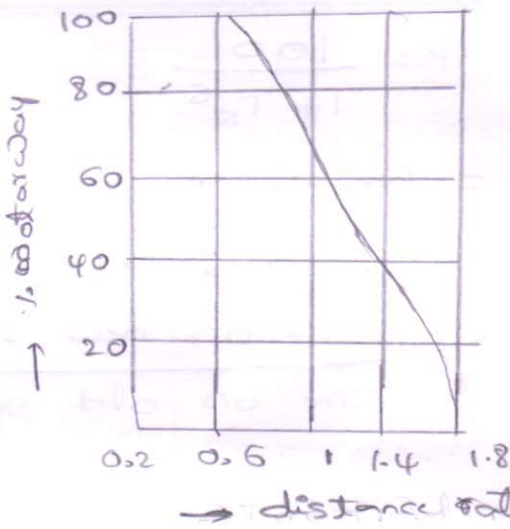
The diversion curve represent the empelical delived relationshipt to shown the traffic diverted on to new facility. once such new facility constructed, the data obtained from the pattern of road of usage in the past bail up the these curve.

→ Travel time saved
→ distance saved
→ Travel time ratio
→ Cost ratio
→ distance ratio
→ Travel time & distance saved.



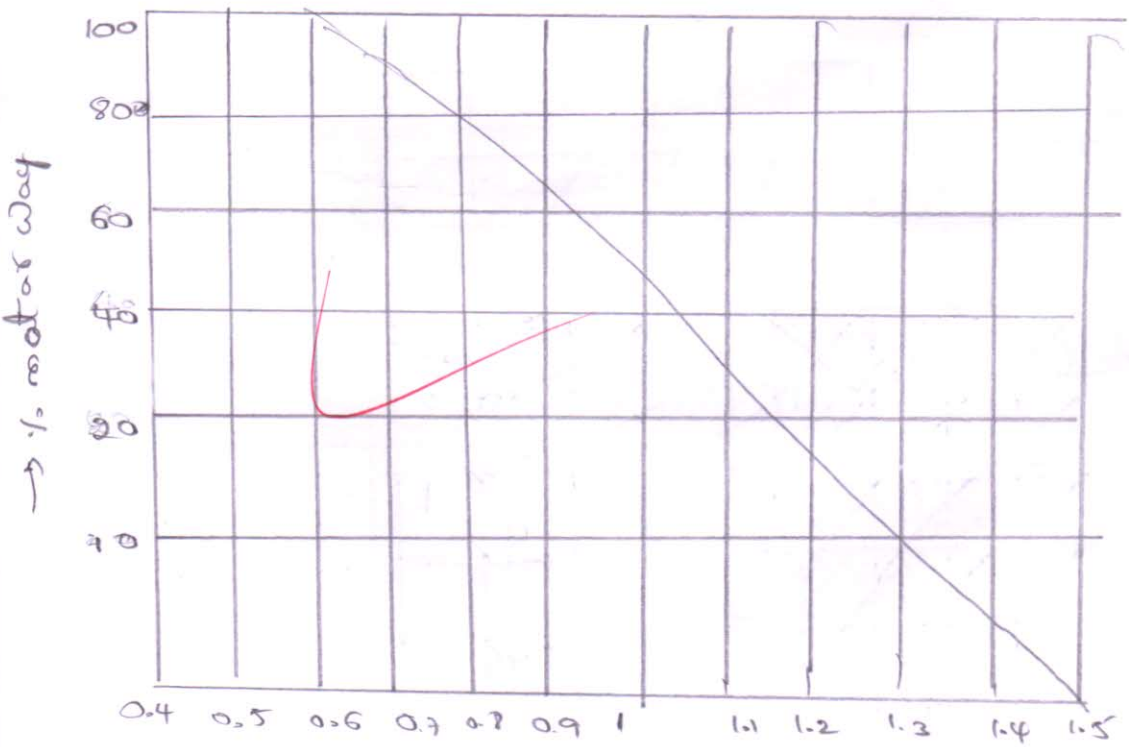






simple diversion curves for one variable.

b) A well know example for travel time ratio to determine the traffic diverted on to new expressway of Bureau of Public road transport



$$P = \frac{100}{1 + T_R^6}$$

P = Percentage motorway

TR = Travel time ratio

$$TR = \frac{\text{Time on new system}}{\text{Time on old system.}}$$

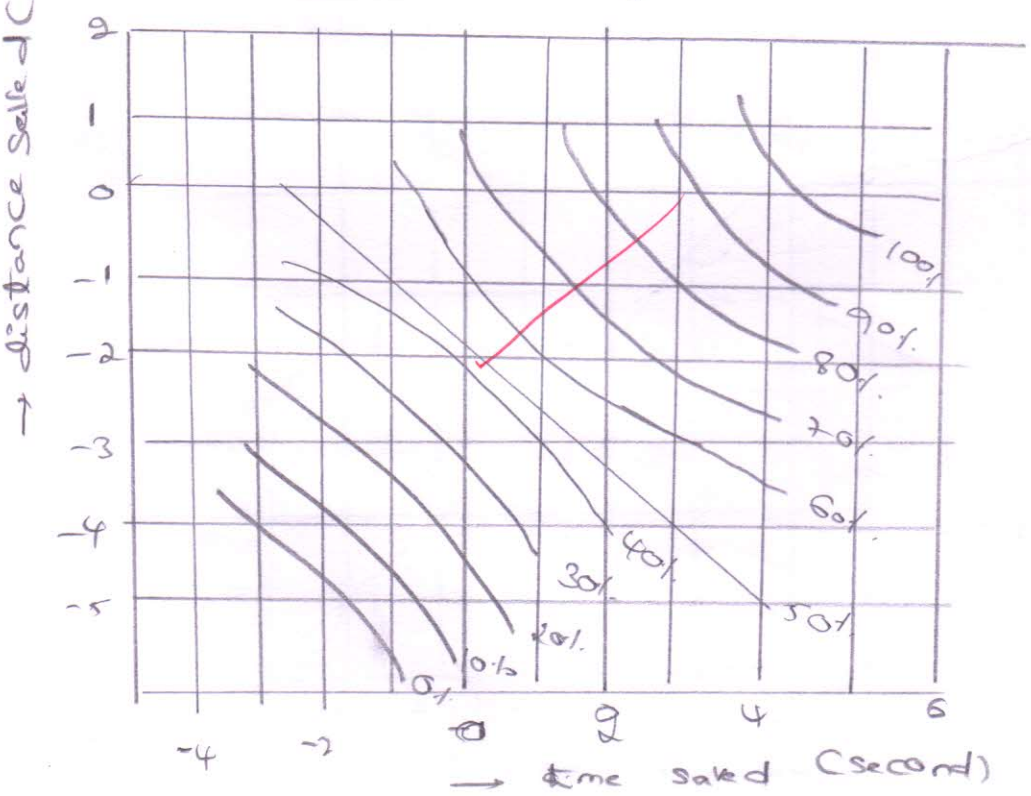
c] A well known example for two variable, travel time & distance saved using motor way is the California diversion curve

$$P = 50 + \frac{(d + 0.5t)}{[(d - 0.5t)^2 + 4.5]^{0.5}}$$

t → travel time saved (second)

d → distance saved (miles)

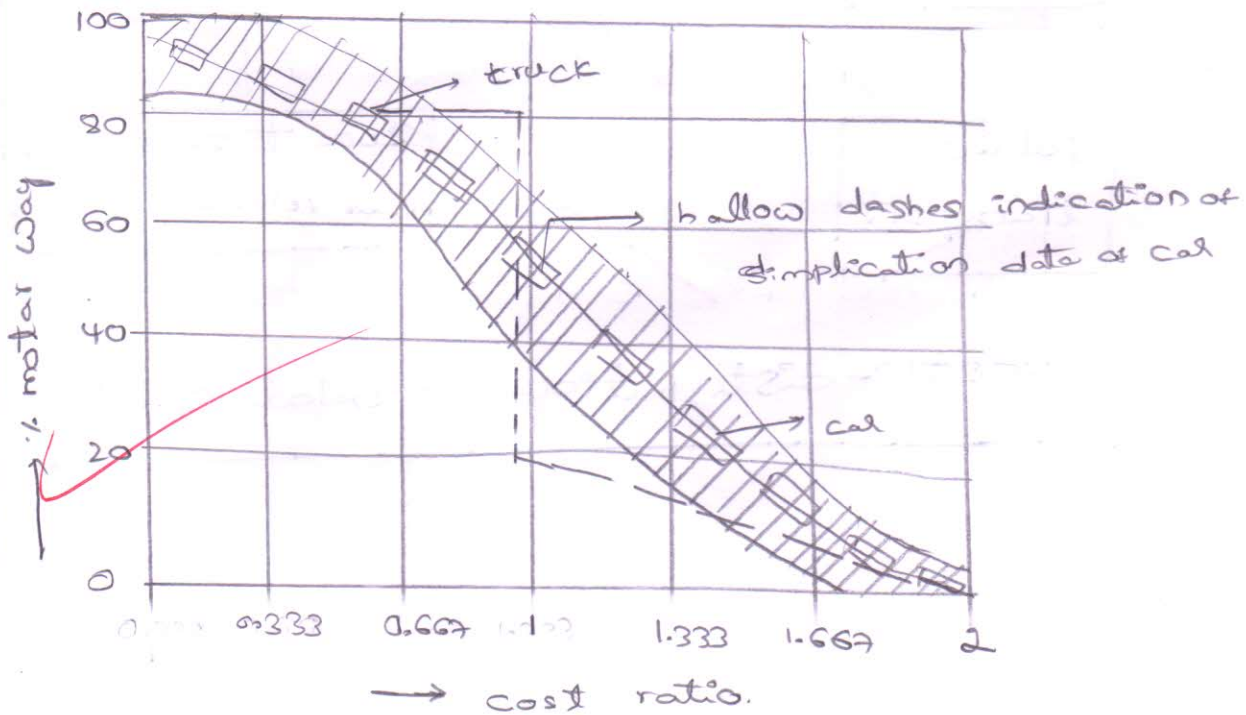
P → % motorway.



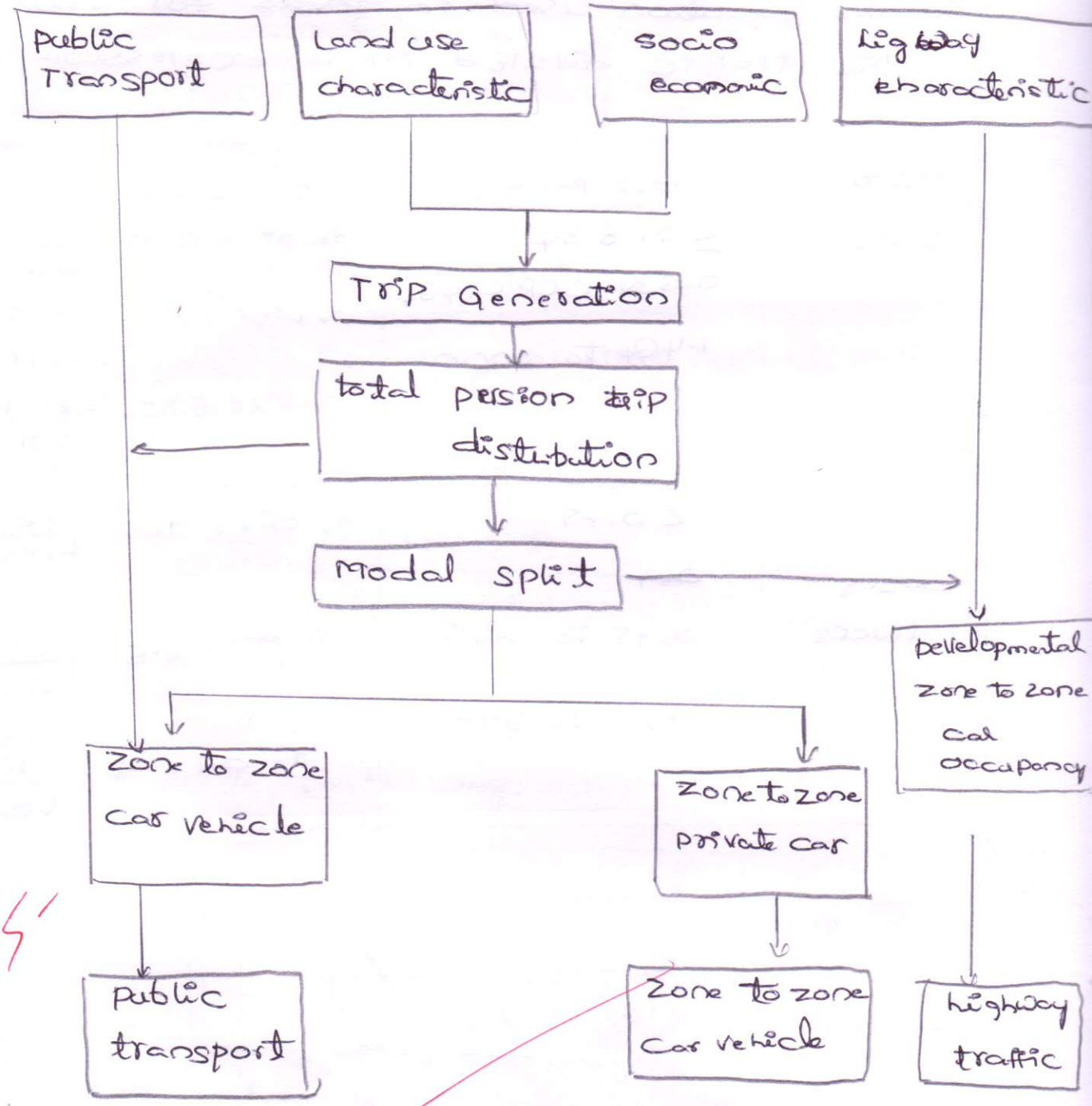
d) The equation used in India for estimating the traffic diverted on a expressway.

Item	cost ratio	equation
Cars	≤ 0.834	$\%\ Div = 98.75 - \frac{CR}{0.634} \times 8.125$
	$0.634 < CR < 1.464$	$\%\ Div = 90.635 - \frac{CR - 0.634}{0.831} \times 84.18$
	1.464 to 2000	$\%\ Div = 6.25 - \left[\frac{CR - 1.465}{5.31}\right] \times 5.25$
buses trucks	< 0.75	$\%\ div = 900 - \left[\frac{CR}{0.75}\right] \times 5$
	0.75 to 1.25	$\%\ div = 95 - \left(\frac{CR}{0.75}\right) \times 90$
	1.25 to 200	$\%\ div = 5 - \left[\frac{2CR}{0.75}\right] \times 5$

10



c)



post - distribution modal split

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1 A] **Modal split**

It is the process of separating the person trip by mode of travel.

Factors affecting the modal split

a) characteristic of trip
b) household characteristic
c) zonal characteristic
d) Network characteristic.

a) characteristic of trip

→ Trip purpose

→ ~~TP~~ Trip length

2] Important consideration

→ simplicity
→ modest data requirement
→ adoptability
→ operational & rapidity
→ computer cost
→ comprehensiveness.

a] simplicity :-

The model should have simple structure easy to comprehend & model generally consume less time & resource.

b] modest data requirement

The model make use of data routinely available with the planning department.

c] adoptability

→ The model have to adoptable for given any location.

d) operational & rapidity

→ The model should be operational & easy to capable of interpretation and should be able to rapid wide range of policy option.

e) computer cost

computer cost for the model should be cheap cost.

f) comprehensiveness

The model should be comprehensive and should be synthesis the relationship b/w activities housing & transport system adequately.

$U = a - 0.02X_1 - 0.005X_2$

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2 B] $U_a = -0.3 - 0.02(120) - 0.005(30) = -2.85$

$U_b = -0.35 - 0.02(20) - 0.005(45) = -0.975$ ~~-1.775~~

$U_m = -0.4 - 0.02(60) - 0.005(35) = -1.775$ ~~-2.75~~

mode	U	e^U	$Pt = \frac{e^U}{\sum_{i=1}^{n} e^U}$	% P
Automobile	-2.85	0.0578	0.0956	9.56
Bus	-0.975	0.3771	0.6241	62.41
Metro	-1.775	0.1694	0.2803	28.03

$$P_a = \frac{e^{U_a}}{e^{U_a} + e^{U_b} + e^{U_m}}$$

$U_a = -0.3 - 0.02(130) - 0.005(30) = -3.05$

10

Mode	U	e^U	Pt	% P
Automobile	-3.05	0.0473	0.0796	7.96
Bus	-0.975	0.3771	0.6074	60.74
metro	-1.775	0.1694	0.2728	27.28

Use due to increase of parking charges in automobiles = 9.56 - 7.96 = ~~1.95~~ 1.6%

2 A]

Traffic assignment

Traffic assignment is the one of the stages in the transport planning process; Separating the inter trip is allocated to different parts of the network forming to transport system is called Traffic assignment

principle

→ The assignment technique is based on the route selection.

→ The choice of mode of route selection is based on the number of criteria such as journey time, length, cost, convinience and safety -- etc.

→ As a first step, the highway network decided by systems of nodes & links

→ **Node** :-

Node is a zone or neither centroid of zone or intersection of 2 (or) more link

→ **Link**

Link is the section of highway network blw intersection of section.

For computer analysis network description is coded, key punched, and stored in the memory of computer.
Then the computer is made to selecting the minimum path b/w the zones and assigning predicted trips to these zones.

→ The minimum path is the route of travel which has least accumulation of distance, time (or) other parameter.

→ The nodes defines the link comprising of minimum path b/w any 2 zone centroid is called tree.

→ The tree is calculated by the computer from starting zone centroid and progressively selecting shortest path to terminal zone centroid.

→ The traffic accumulation of link may so happen. so individual link gets overloaded. In that case adjustment have to be made in accordance with the travel time flow relationship fed to the Computer.

Example 1,