

May - 2015

Total Pages—7

(Set-1)

**M.Tech-2nd (TE)**

**Urban Transportation System Planning**

Full Marks : 70

Time : 3 hours

Attempt **Q. No. 1** and any **five** questions from the rest

*The figures in the right-hand margin indicate marks*

1. Attempt *all* of the following questions :  $2 \times 10$

- (a) What do you understand by model ?
- (b) What are the sets of basic information a trip should contain ?
- (c) Show under what condition the solution of a user-equilibrium traffic assignment tends to the solution of a system optimal traffic assignment ?
- (d) In a transportation demand-supply interaction, why the demand is called a derived one ?

( Turn Over )

- (e) Give instances, when and how the link-performance function becomes a multivariate function of flow level.
- (f) What are the parameters of household characteristics likely to influence trip production of a zone?
- (g) What do you understand by generalised cost of travel?
- (h) What do you understand by basic-employment in Lowry's land-Use model?
- (i) What do you understand by value of travel time?
- (j) Draw a flow-chart of Lowry Land use model.
2. (a) In a travel survey conducted among 20 passengers travelling between two cities A and B, it was observed that 6 chose bus and 14 chose car. Suppose, that travel cost for bus and car remained same for all 20 passengers and they were 47 and 38 units

respectively. Lets assume the deterministic utility function of mode choice models as under

$$V_{\text{Mode}} = \alpha \cdot \text{TravelCost}_{\text{Mode}}$$

Calculate the travel demand by bus and car, if total passenger demand is 100 and travel cost between cities A and B by bus and car are 35 and 25 units respectively?

- (b) Draw the flow diagram of four-step travel demand model. 3
3. (a) Explain the demand-supply interaction with reference to urban transport system. 7
- (b) Draw and explain the transit network representation. 3
4. (a) Explain a model of trip-end type model split model. Under what circumstances, the trip-end type model is developed? 4 + 2
- (b) What are the basic properties of a trip-distribution model? 4



5. (a) Explain, how the various levels of decision of a trip-maker for making a trip are mapped in a four-step travel demand modelling. 4
- (b) Describe with an example, how various alternatives of a transportation project are evaluated? 6
6. (a) Show how the two different types of constraint are incorporated in a doubly-constrained Gravity Model of trip-distribution. 6
- (b) The Table 1 shows the trip production rate of various household sizes of a particular zone. Table 2 shows the forecasted number of households of various household sizes of the same zone. Forecast the trip production in that zone. 4

Table 1

Household Size	Auto Ownership		
	0	1	2+
1	2.1	2.4	2.4
2	2.4	2.8	3.4
3+	2.7	3.1	3.9

Table 2

Household Size	Auto Ownership		
	0	1	2+
1	25	125	3
2	32	175	254
3+	10	89	512

7. (a) Determine the trip distribution through one-iteration using the following model : 7

$$T_{i-j} = P_i \left[ \frac{A_j F_{ij} K_{ij}}{\sum_{j=1}^n A_j F_{ij} K_{ij}} \right]$$

Where,

$T_{i-j}$  = Number of trips from zone  $i$  to zone  $j$

$P_i$  = Total number of trips produced in zone  $i$

$A_j$  = Total number of trips attracted to zone  $j$

$F_{ij}$  = Friction factor (which is generally an inverse function of travel time)

$K_{ij}$  = Socio-economic adjustment factor for interchange  $ij$ , say = 1 for all zones.

Table 3. Trip Production and Attraction for a Three-Zone Study Area

Zone	1	2	3
Trip Production	140	330	280
Trip Attraction	300	270	180

Table 4. Travel Time between Zones

Zone	1	2	3
1	5	2	3
2	2	6	6
3	3	6	5

Table 5. Travel Time vs Friction factor

Travel Time (min.)	Friction Factor $F^t$
1	82
2	52
3	50
4	41
5	39
6	26
7	20
8	13

- (b) What are the input vector considered in Lowry Model and what are calculated inside of the Lowry model? 3
8. (a) Mathematically describe the user-equilibrium and system-optimal traffic assignment. 3 + 3
- (b) Discuss the merit and demerit of growth factor and synthetic trip distribution model. 4