1	C	R							

Internal Assessment Test IV – February 2022

Sub: Urban Transport Planning				Code: 17CV751/18CV745
Date: 04/02/2022	Duration: 90 mins	Max Marks: 50	Sem: VII	Branch (sections): CIVIL (A and B)

Answer any Five Questions

		Marks	OBE CO	OBE RBT
1.	Explain the inventory of land-use and economic activities in urban transportation planning. **Land use inventory:** • Accurate inventory of land-use is essential in transportation planning as travel characteristics are closely related to land use patterns. • The zones are classified into various land-use activities such as residential, commercial, industrial,institutional, recreational and open space. • It is the responsibility of Town and country planning authorities to classify zones into various land use • categories. Aerial photographs, and satellite imagery are used for land use classification. Inventory of economic activities: The following inventory of data on economic activities are collected • Population of survey area and various zones	[10]	CO2	L2

		• Age, sex and composition of family • Employment statistics • Housing statistics • Income • Vehicle ownership Some of the data pertaining to economic activities will be already available from periodic census. Careful analysis of census data will reveal the gap that needed to be filled by home-interview survey or some other means. • The limitations of census data should be clearly recognized before they are put into use. • The population data helps in estimating future trips making behiour. • Population maps indicating the density, institutional population, school enrolment and sociological • factors will facilitate better understanding of the travel pattern.			
2.	2	What is sampling and explain how is expansion factor applied in home-interview survey? Data collection is the first step in transportation planning. It involves collection of data on all factors that will influence travel pattern, existing transport facilities and inventory various landuse and economic activities. It is practically impossible to collect full data pertaining to study area. Hence sampling is done. Sampling is a technique which is used to get information about a population by studying the characteristics of samples drawn from the population. For example, in home interview survey, population is the set of all dwelling units in a study area and sample is the set of dwelling units where interviews are conducted. The accuracy of the information obtained from sampling increases as the size of the sample increases. There are different types of samples such as random samples, sequential sample, systematic samples, stratified samples. Commonly used is random samples. In this method, sampling is done in such a way that each member of population has the same chance of being chosen. Expansion factor is used in order to derive the travel characteristics of entire population from the data derived from sampling. For home interview surveys, the expansion factor is calculated as follows $$\text{Expansion factor} = A - \frac{\frac{A}{B}\left(C + \left(\frac{C}{B}\right)D\right)}{B - C - D}$$	[10]	CO1	L2

		Where A= Total number of addresses in the original list B= Total number of addresses selected as original sample C= Number of sample addresses that are ineligible D= number of sample addresses where no response is obtained.			
3.	3	Explain Multiple linear regression analysis and its two types The most common technique employed in establishing trip generation is multiple linear regression which fits mathematical relationships between dependent and independent variable. In the case of trip generation equation, the dependent variable is the number of trips and the independent variable are the various measurable factors that influence trip generation like land use and socio-economic characteristics. The general form of the equation can be expressed in the following form: Yp=a1X1+a1X2+a3X3+…….anXn+U • Yp= number of trips for specified purpose p • X1, X2, X3,……., Xn=independent variables relating to for example, land-use, socio economic factors etc. • a1, a2, a3,……, an= Coefficients of the respective independent variables X1, X2, X3,……., Xn, obtained by linear regression analysis • • U= Distribution term, which is a constant and representing that portion of the value of Yp not explained by the independent variables. Multiple linear regression analysis of two types: 1. Aggregated, or zonal least-square regression, where each traffic zone is treated as one observation. 2. Disaggregated, or Household least-square regression, where each household is treated as an observation. 3. **Zonal Regression Method (Aggregated Analysis)** In the case of zonal regression, the study area is divided into a number of zones. Each traffic zone is treated as one observation. The aggregated analysis which is most widely used is based on the assumption that contiguous households exhibit a certain amount of similarity in travel characteristics. The dependent variable is some measure of the zonal trip ends and the independent variables are typically the number of households, number of workers, number of cars, total incomes etc. Alternatively, the variables are expressed as mean values for the zones. This assumption allows the data in a zone to be grouped and the mean values of the independent variable used in further calculation. Sufficiently large survey data is needed to get reliable results. **Household least squares regression analysis (Disaggregated Analysis):** The logical extension to the arguments favouring a reduction in zone size is to develop data base that makes no reference to zone boundaries. One consideration is to treat this at household level. The dominating Influence of the head of household implies that the trip making activity of the household members can only be accurately predicted through a knowledge of total household characteristics. It would appear, then, that the household can reasonably be considered as a behavioural trip-making unit and therefore, treated as the basis for the trip end estimating procedure. In the household regression analysis, each household is considered as a separate input data, so that the wide observed variation in household characteristics and household trip making behaviour is incorporated into the models. The attempt, here, is to explain the total variation between households, as against the variation between zones, explained by zonal models.	[10]	CO2	L2
4.		Define modal spilt and explain in brief the factors affecting modal split. Modal split is the process of separating person-trips by the mode of	[10]	CO2	L1

travel. It is usually expressed
as a fraction, ratio or percentage of the total number of trips. In general, modal split refers to the
trips made by private car or public transport (road or rail). An understanding of modal split is very
important in transportation studies.
FACTORS AFFECTING MODAL SPLIT (MODAL SPLIT ANALYSIS)
Factors influencing mode choice of urban travelers:
1. Characteristics of the trip.
2. Household characteristics.
3. Zonal characteristics.
4. Network characteristics.
1.**Characteristics of trip**
i**) Trip purpose**: the choice of mode is guided to a certain extent by the trip purpose. To give an example, home based school trips have a high rate of usage of public transport.
On the other hand, home based shopping journeys can have a higher rate of private car usage, for the simple reason that it is more convenient to shop when travelling in a personalized transport.
ii)Trip length: the length can govern an individual's choice of a particular mode. A measure of the trip length is also possible by the travel time and the cost of travelling.
2. **Household characteristics**
i**) Income**: the income of a person is a direct determinant of the expenses he is prepared to incur on a journey. Higher income groups are able to purchase and maintain private cars,
and thus private car trips are more frequent as the income increase.
ii) Car ownership: car ownership is determined by the income and for this reason both income and car ownership are inter-related in their effect on modal choice. In general, families which own a car prefer private car trips, and in contrast families without carpatronize public transport in the absence of any other alternative.

iii) Family size and composition: the number of persons in the family, the number of school-going children, the number of wage earns,the number of unemployed, the age-sex structure of the family, and some other factors connected with the socio- economic status of the family profoundly influence the modal choice. Some of these factors are responsible
for certain captive trips in public transport, such as those due to old age pensioners, school
children, crippled and infirm persons and those who do not wish to drive.
3. Zonal characteristics
i) Residential density
ii) Concentration of workers
iii) Distance from CBD
The use of public transport increases as the residential density increases. This is because of thefact that areas with higher residential density are inhabited by persons with lower income, lower levels of car ownership. It is also found that higher density areas are served well by public transport system and such areas are oriented towards a better use of public transport system.

	4. Network characteristics **i) Accessibility Ratio** It is a measure of the relative accessibility of that zone to all other zones by means of mass transit network and highway network. **ii) Travel Time Ratio (TTR)** The ratio of the travel time by public transport and travel time by private car gives a measure of the attractiveness or otherwise of public transport system. **iii) Travel Cost Ratio (TCR)** The ratio of cost of travel by public transport and cost of travel by car is one of the most important factors influencing modal choice. The importance of travel cost is related to the economic status. People with high incomes are unmindful of cost and prefer most expensive modes. **iv) Service Ratio (SR)** The relative travel service was characterized by the ratio of the travel excess travel times by public transport and car. The excess travel time was defined as the time spent outside the vehicle during a trip.			
5.	Explain minimum path tree with Moore's algorithm	[10]	CO1	L2
6.	What do you understand by capacity restraint technique and explain the methods based on this principle. Capacity restraint assignment techniques This is the process in which the travel resistance of a link is increased according to a relation between the practical capacity of the link and the volume assigned to the link. This model has been developed to overcome the inherent weakness of all-or-nothing assignment model which takes no account of the capacity of the system between a pair of zones. This method clearly restrains the number of vehicles that can use in any particular corridor. The whole system, if assigned with volumes which are beyond the capacity of the network, then it redistributes the traffic to realistic alternative paths. Steps: • Here the procedure is similar to all-or-nothing assignment as far as the initial data input are concerned. The additional data fed is the capacity of each link. The best paths are determined in the same way as in all-or-nothing assignment by building the minimum path trees. • Traffic is then assigned to the minimum paths, either fully or in stages. • As the assigned volume on each link approaches the capacity of the link, a new set of travel time on the link is calculated. • This results in a new network with a different minimum path tree, differing significantly from the earlier minimum path tree. As a consequence, assigning the inter-zonal volumes to the new tree produces a new volume on each link. • This iterative process is repeated until a satisfactory balance between volume and speed is achieved. Some of the capacity restraint methods are: **a) Smock Method:** In this method all-or-nothing assignment is first worked out. In an iterative procedure, the link travel times are modified according to the following function.. Smock model is used to compute link travel timeas:	[10]	CO1	L2

$$T_A = T_0 e^{\left(\frac{V}{C} - 1\right)} \quad (27)$$

Where, $T_A \leq 5T_0$
T_A = adjusted travel time which is used to determine the minimum paths or routes.
T_0 = Original travel time
e = exponential base
V = assigned volume
C = computed link capacity

In the second iteration, the adjusted travel time (TA) is used to determine the minimum paths. The resulting link volumes are averaged and these are again used to calculate the adjusted travel time for next iteration.

b) **Bureau of Public Roads (BPR) Method**:
The formula used to update the link travel time is:

$$T_N = T_0\left[1 + 0.15\left(\frac{Assigned\ \ Volume}{\text{Pr}\,actical\ \ capacity}\right)^4\right]$$

$$T_N = T_0\left[1 + 0.15\left(\frac{V}{C}\right)^4\right] \quad (26)$$

Where, T_0 = free flow time or base travel time at zero volume
T_0 = 0.87 * travel time at practical capacity
V = assigned volume
C = practical capacity

Signature of CI Signature of CCI Signature of HOD

Internal Assessment Test IV – February 2022

Dept. Of Civil Engineering

1	C	R							

Signature of CI Signature of CCI Signature of HOD