Ref. No.: Ex/PG/ARCH/T/1210A/2024

M.E. ARCHITECTURE FIRST YEAR SECOND SEMESTER EXAM 2024
LAND USE AND TRAFFIC SYSTEM

Time: 3 Hours | Full Marks: 100

Answer all questions

1. Describe the concept of Lowry model with the help of diagrams. (CO1:4+16=20)
A study area is partitioned into 4 zones, which contains potential for housing and service employment as shown in Table-1. Parameters relating to economic base concept are also specified in this table. For a future planning horizon, the amount of basic employment of 650 jobs has been determined and its spatial distribution allocates to zone 1 and zone 2. Given these data, the problem is to find the equilibrium location of residents and employments.

Table-1

Variable Name	Notation	Zonal Values			
		1	2	3	4
Basic Employment	E_d^b	**200**	**450**	**0**	**0**
Housing opportunities	H_o	**500**	**0**	**600**	**1000**
Service floor space (in 1000 sqm)	F_d	**0**	**2**	**0**	**1**
Persons per worker	μ	**3**	**3**	**3**	**3**
Service workers per person	ν	**0.2**	**0.2**	**0.2**	**0.2**

The following inter-zonal travel time in minutes are given:

To ⇨ / From ⇩	1	2	3	4
1	**2**	**8**	**6**	**7**
2	**8**	**3**	**4**	**7**
3	**6**	**4**	**3**	**4**
4	**7**	**7**	**4**	**3**

The residential locations are calculated from the following gravity model based on accessibility of workplaces to housing opportunities:

$T_{do} = E_d \cdot \dfrac{H_o / t_{do}}{\sum_o H_o / t_{do}}$. Residential work trip ends are summed and multiplied by μ to give population R_o. The locations of service employment are calculated from the following gravity model based on accessibility of residences to service opportunities:

$T_{od} = R_o \cdot \nu \cdot \dfrac{F_d / t_{do}^2}{\sum_d F_d / t_{do}^2}$.

Show one iteration to assign populations to the 4 zones using Lowry model.

2. What is Traffic management? (CO2: 4+4+12=20)
What are the advantages and disadvantages of using traffic signal in vehicular and pedestrian traffic?
A fixed time two-phase signal is to be provided at an intersection having a North-South and an East-West road where only straight-ahead traffic is permitted. The design hour flows from the various arms and the saturation flows for these arms are given in the following table:

	North	South	East	West
Design hour flow (q) in PCUs/hour	**950**	**600**	**800**	**1000**
Saturation flows(s) in PCUs/hour	**2400**	**2000**	**3000**	**3000**

Calculate the optimum cycle time and green times for the minimum overall delay. The intergreen time should be the minimum necessary for efficient operation. The time lost per phase due to starting delays can be assumed to be **2 seconds**. The value of the amber period is **2 seconds**. Sketch the timing diagram for each phase.

Or,

Define time mean speed and space mean speed. Establish the relationships between Flow - Density, Speed - Density and Speed - Flow.

A section of highway is known to have a free-flow speed of 55mi/h and a capacity of 3300 veh/h. In a given hour, 2100 vehicles were counted at a specified point along this highway section. Estimate the space-mean speed of these 2100 vehicles applying the linear speed-density relationship.

3. What are the different techniques used for estimation of trip distribution of an area.

The target year productions and relative attractiveness of the four-zone city have been estimated as follows: (CO3a:5+15=20)

Zone	Productions	Attractiveness
1	**2000**	**3**
2	**0**	**2**
3	**2600**	**2**
4	**0**	**5**

The calibration of the gravity model for this city estimated the parameter c to be **2.0** and all the socio-economic adjustment factors to be equal to **unity**. Apply the gravity model to estimate all target interchanges Q_{ij} and to estimate the total target-year attractions of each zone given that the target-year interzonal impedances W_{ij} will be as follows:

j ➡		2	3	4
i ⬇				
1	**5**	**10**	**15**	**20**
2	**10**	**5**	**10**	**15**
3	**15**	**10**	**5**	**10**
4	**20**	**15**	**10**	**5**

Explain the outcome of the estimation in light of land use planning.

Or,

Briefly describe different techniques used for estimation of trip generation.

Given the following measurements of traffic speed 'u' and concentration 'k'. Apply the method of least squares to find the best fitting straight-line $u = a + bk$.

u	50	45	40	30	25	40	35	30	50	45
k	14	25	35	45	64	30	35	40	20	30

4. Briefly describe the different Trip assignment procedures.

One transport company carries truckload of Sugarcane from 3 stores to four sugar factories. The supply in truckloads and the demand in the truckloads together with the unit transportation costs per truckload (in Rs.1000) on the different routes are summarized in the given table. (CO3b: 6+14=20)

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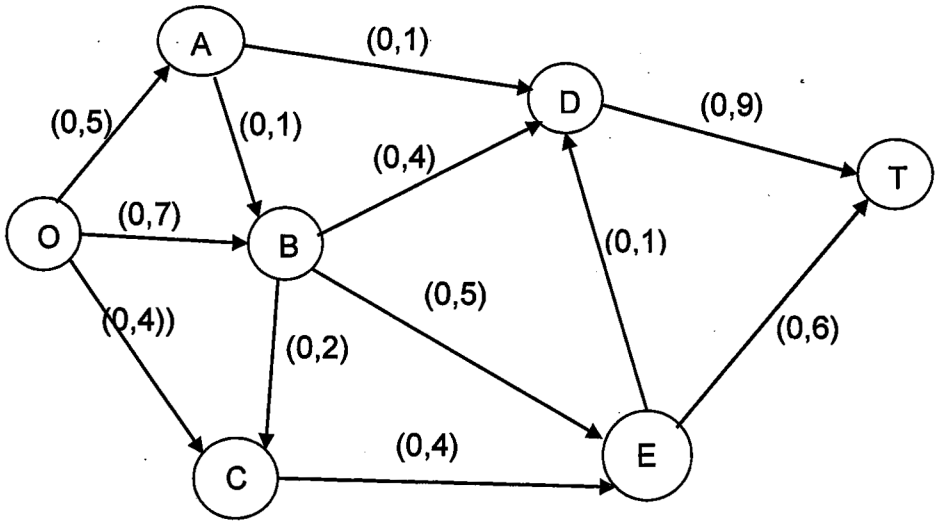
Husking Factories ➡	1	2	3	4	Supply
Paddy Stores ⬇					
1	**20**	**14**	**25**	**12**	**30**
2	**24**	**18**	**14**	**20**	**40**
3	**28**	**12**	**10**	**24**	**50**
Demand	**15**	**25**	**35**	**45**	**120**

Compare the given data with two different methods like **NorthWest Corner rule** and **Vogel's Approximation methods** and state which method is appropriate.

Or,

Briefly describe the different Trip assignment procedures.

Determine the maximal flow and the optimal flow in each arc for the network in the given figure.



5. What are the objectives of cost benefit analysis related to any transport project?
   Briefly describe the costs and benefits of the transport projects. (CO4: 4+4+12=20)
   A single lane road 30 km long is to be widened to two lanes at a cost of Rs. 40 lakhs per km, including all improvements. The cost of operation of vehicles on the single lane road is Rs. 5.00 per vehicle km, whereas it is Rs. 2.50 per vehicle km on the improved facility. The average traffic may be assumed 2500 vehicles per day over a design period of 20 years. The interest rate is 10 percent per annum. The cost of maintenance is Rs. 15,000 per km on the existing road and Rs. 10,000 per km on the improved road. Is the investment in the improvement scheme worthwhile?