M.E. ARCHITECTURE, FIRST YEAR SECOND SEMESTER EXAM 2019
LAND USE & TRAFFIC SYSTEM

Time: 3 Hours **Full Marks: 100**

Answer any five questions. All questions carry equal marks.

1. Define Land Use and Traffic system. **(4+6+4+6)**
How do you define urban forms? Describe different types of urban forms with examples. What are the different types of urban structures? Briefly describe the theories and models of urban structure.

2. Define accessibility, personal accessibility and accessibility of a place. **(6+5+9)**
Explain Hansen's accessibility model.
A small four zone city has the following characteristics:

Table: 1

Zone	Total existing population	Holding capacity (acres)
1	3000	100
2	2000	200
3	5000	300
4	4000	400
Total	14000	1000

Table: 2

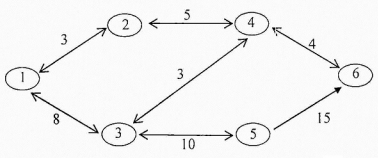
From i \ To j	1	2	3	4
1	2	4	6	8
2	4	3	5	7
3	6	5	4	6
4	8	7	6	5

The travel times (in minutes) from one zone to other are given Table 2.
An exponent of 2 can be assumed based on work done with other cities of the same size. If the population of this city is expected to rise to 20000 persons in 20 years, how will the population be distributed by zone? Assume that the total employment in each zone is proportional to the total existing population in that zone.

3. Briefly describe different techniques used for estimation of trip generation. **(6+14)**
a) 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	55	50	45	40	35	30	25
k	10	20	25	35	42	45	64

Or,
b) For the given network, find the shortest routes between every two nodes. The distances (in km) are given on the arcs. Arc (5, 6) is directional, so that no traffic is allowed from node 6 to node 5. All the other arcs allow traffic in both directions.



4. 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 3; **(6+14)**

Table: 3

	North	South	East	West
Design hour flow (q) in PCUs/hour	700	550	850	950
Saturation flows(s) in PCUs/hour	2400	2000	2800	3000

Calculate the optimum cycle time and green times for the minimum overall delay. The inter green 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.

5. What are the different techniques used for estimation of trip distribution of an area? **(4+16)**

The target year productions and relative attractiveness of the four-zone city have been estimated as per Table 4:

Table: 4

Zone	Productions	Attractiveness
1	1600	0
2	1000	4
3	2500	2
4	0	5

Table: 5

From i \ To j	1	2	3	4
1	5	10	15	20
2	10	5	10	15
3	15	10	5	10
4	20	15	10	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 inter zonal impedances W_{ij} will be as per Table 5. Explain the outcome of the estimation in light of land use planning.

6. One transport company carries truckload of coal from 3 mines to four thermal power stations. 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 6. Determine the minimum cost of transportation for supplying the required demand of the four sugar factories.

(10+10)

Table: 6

	D_1	D_2	D_3	D_4	Supply
O_1	20	16	24	13	10
O_2	25	17	14	23	14
O_3	30	18	12	35	20
Demand	6	10	13	15	44

After solving the given transportation problem for the basic feasible solution using any one of the three methods, check the basic feasible solution whether the solution obtained is optimum or not.

7. Write short notes on (any Two): **(10+10)**
   a. Relationships between Flow - Density, Speed - Density and Speed - Flow
   b. Rotary, c. Modal split

8. (a) Why do you need to use cost benefit analysis technique for arriving any investment decision? **(5+5+10)**

(b) Briefly describe the costs and benefits of the transport projects.

(c) A single lane road 50 km long is to be widened to two lanes at a cost of Rs. 25 lakhs per km, including all improvements. The cost of operation of vehicles on the single lane road is Rs. 4.00 per vehicle km, whereas it is Rs. 3.00 per vehicle km on the improved facility. The average traffic may be assumed 3000 vehicles per day over a design period of 20 years. The interest rate is 12 percent per annum. The cost of maintenance is Rs. 10,000 per km on the existing road and Rs. 15,000 per km on the improved road. Is the investment in the improvement scheme worthwhile?

9. A study area is partitioned into 4 zones, which contains potential for housing and service employment as shown in Table 7. Parameters relating to economic base concept are also specified in this table. For a future planning horizon, the amount of basic employment of 500 jobs has been determined and its spatial distribution allocates to zone 1 and zone 2. Given these data in Table 7, the problem is to find the equilibrium location of residents and employments. **(20)**

Table: 7

Variable Name	Notation	Zonal Values			
		1	2	3	4
Basic Employment	E_d^b	250	300	0	0
Housing opportunities	H_o	450	0	600	900
Service floor space (in 1000 sq m)	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:

From \ To	1	2	3	4
1	2	4	6	8
2	4	3	4	5
3	6	4	4	6
4	8	5	6	5

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

$$T_{do} = E_d \cdot \frac{H_o / t_{do}}{\sum_o H_o / t_{do}}$$

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:

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

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