B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER - 2019

Traffic Planning & Management

Time 3 hours | Full marks 100

Use separate answer-scripts for each part

Part I: (60 Marks: Attempt All Questions, each question carries 15 marks)

1. Define linear aggregate transportation demand function. How does it differ from Kraft model? The bus service from Esplanade (Kolkata) to Durgapur is currently served by regular buses and Volvo buses. 1000 passengers per day use the regular buses and 500 use Volvo service. Travel times (min) and fares (Rs.) are as follows:

	Travel time	Fare
Regular buses	4 hours	Rs. 170
Volvo buses	2 hours and 30 minutes	Rs. 320

The linear arc-time and arc-price elasticities of demand are as follows:

	Regular bus		Volvo	
	Time	Fare	Time	Fare
Regular bus	-0.03	-0.04	+0.02	+0.05
Volvo	+0.05	+0.02	-0.07	-0.20

If the fare of the Volvo were raised to Rs 330, what would be the effect on ridership? 3+3+9=15

2. A study area is partitioned into 4 zones with potential for housing and service employment as shown. 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, the problem is to find the equilibrium location of residents and employments following Ira Lowry.

Variable Name	Notation	Zonal Values			
		1	2	3	4
Basic Employment	E_d^b	150	350	0	0
Housing opportunities	H_o	700	0	800	1200
Service floor space (in 1000 sq m)	F_d	0	2.5	0	1.5
Persons per worker	μ	2.4	2.4	2.4	2.4
Service workers per person	ν	0.2	0.2	0.2	0.2

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:

$$T_{od} = R_o . v . \frac{F_d / t_{do}^2}{\Sigma_d F_d / t_{do}^2}.$$

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

To / From	1	2	3	4
1	2	9	6	7
2	9	3	4	7
3	6	4	3	4
4	7	7	4	3

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

3. A 5-zone city having travel-times (in minutes) as shown in the following table is likely to add 1000 people to its present population in next 5 years.
   a. If the distribution of this additional people is in proportion of a zone's accessibility to employment in various zones, and b=2, use Hansen's model in distributing the excess population in the different zones of the city.
   b. If the additional population is distributed on the basis of accessibility to employment, as well as, availability of vacant dwelling places in each zone (acres), distribute the added population afresh.

Zones	1	2	3	4	5	Future jobs	Empty land
1	1	3	8	5	12	150	51
2	3	1	6	2	9	30	21
3	8	6	1	4	7	200	42
4	5	2	4	1	7	100	19
5	12	9	7	7	1	25	72

4. Write critical notes on the 4 steps of 4-stage sequential transportation planning method in the following order:
   (a) Selecting study area
   (b) Trip generation
   (c) Trip distribution
   (d) Modal Split
   (e) Route assignment

5*3=15

Ref. No.: Ex/CE/T/424D/2019

B. E. CIVIL ENGINEERING 4TH YEAR 2ND SEMESTER EXAMINATION 2019

TRAFFIC PLANNING AND MANAGEMENT (ELECTIVE – III)

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

Part II **40 marks**

Use Separate Answer scripts for each Part

Answer ALL Questions

Answer brief & to the point. Assume standard value for any parameter, if required

1. Explain shockwave through a neatly drawn Flow-Density curve for a highway section. Assume speed-density as linear. If a bottleneck is created due to closure of half the number of lanes of the section, explain its impact on speed, density and shockwave of the traffic flow if original flow is i) less than bottleneck capacity and ii) more than bottleneck capacity 3+(2+3)

2. The mean free speed and jam density on a lane of a highway are observed as 60 KmpH and 200 pcu/Km. The average traffic flow on the lane is observed as 1000 pcu/Hr. A slow moving vehicle travelling at 12 KmpH enters the lane, forcing the vehicles behind to queue up and move in a platoon. Using the information, find -
   a. The speed of the stream under the average flow condition.
   b. The flow in the queued up platoon of vehicles
   c. The speed of the resultant shockwave.
   d. The length of the queue if the slow moving vehicles remain in the stream for 2Km 10

3. Explain the different parameters that influence a queuing model for highway traffic flow. 10

4. Deduce the simple queuing model $P_n = \rho^n(1-\rho)$ where all symbols carry usual meaning mentioning the assumptions for the solution. 8+4