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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Final Examination**Course No.: CEE 4853****Course Title: Public Transportation System****Summer Semester: 2021-2022****Full Marks: 150****Time: 3.0 hours**

There are 6 (Six) Questions. Answer All questions. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume values as necessary. The examination is open book and students are allowed to bring lecture notes (all compiled into **two** books).

1. Write a short note on the public transportation system in Dhaka city. The note should cover but not be limited to these topics: modal distribution along with their role, business model, service quality, design and operation, equity and environment, future challenges, etc. (15)
CO1
PO6
2. You are to infer the number of boarding on a route based on the load of a coach. For that, you have surveyed the route and collected 15 paired data for boarding and corresponding loading data. Generate those 15 paired data and calculate the conversion factor along with the coefficient of variation of the conversion factor. Also, how many samples will you collect during the monitoring phase at a 90% confidence level? Assume tolerance of inferred data to be $\pm 10\%$ and show the calculation of sample size. (15)
CO2
PO2
3. Imagine you are responsible to run bus service which is currently operating only on a single route having terminals at A and B. Your service starts from both end at 5:30 AM and runs till 1:30 PM. The depot is located near one of the terminals and it takes the bus 15 min. to travel from the depot to the nearest terminal. Other relevant information will be as follows: (30)
CO2
PO2

	AM Peak Period 9:00 – 10:30	Base Period Other times
Headways	15 min.	25 min
Scheduled trip time (A to B; B to A)	40 min; 35 min	25 min; 15 min
Min. layover time	3 min	5 min

Plan the vehicle blocks along with timetable and time-space network representation.

4. As a public transport planner you are given the responsibility to assess four services serving the same route: express bus service, premium bus service, standard bus service, and light rail transit, using AHP. You will be evaluating the services based on these criteria: travel time, comfort and reliability. Generate hypothetical data, show all calculation steps and rank the services from the best to the worst. Then, introduce their cost of travel into the model and suggest how your selection may get impacted by cost. (30)
CO3
PO3
5. Imagine that you are in year 2040 and Dhaka city has an extensive BRT network. Construct these cost models: traditional model, variable cost model and peak and off-peak period models. The service will run for 7 days a week considering Saturdays and Sundays as the weekends. (30)
CO2
PO2

The total cost assigned for this service is 150 million USD. Following data are given to complete the calculation:

Basis	F/V	Cost Assigned (%)	Operating Stat. *	Unit Costs
Rev. Veh. Hr.	V	45	2 million	35.0
	F	3		
Rev. Veh. Km.	V	30	20 million	3.0
	F	2		
Peak Veh.	F	20	800	US\$ 45,000
Total				

* Annual

Bus operating by day of week and corresponding hours per day:

	Weekday			Friday	Saturday
	Peak	Base	Evening		
#Buses Operating	800	450	200	250	500
Hours/day	6	6	4.5	12	14

6. Utility functions for Drive Alone (D), Car Pool (C) and Transit (T) are given as follows:

$$V_{qD} = -0.34 - 0.051TT_D - 0.094TC_D/INC_q$$

$$V_{qC} = -0.051TT_C - 0.094TC_C/INC_q$$

$$V_{qT} = -0.051TT_T - 0.094TC_T/INC_q$$

Here, V = utility, TT = travel time in hour, TC = travel cost in USD, and, INC = income of a traveler in 1000 USD.

The mode-specific travel time and cost are as follows:

Mode	Time (Hr)	Cost (US\$)
Drive Alone	0.54	3.4
Car Pool	0.71	2.21
Transit	1.4	0.74

- What mode does a traveler with an income of \$14,000 choose? (in probability)
- What mode does a traveler with an income of \$51,000 choose? (in probability)
- What can you do to encourage high-income people to use transit?
- If you think that gender will have an impact on mode choice, then how can you redevelop the utility functions? What will be the sign of the parameter representing gender?

(30)
CO2
PO2