BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water Resources, and Coastal Engineering, Term Final (Spring) Examination 2025: Oct - Nov 2025

Student Group: 72< Earned Credit Hours ≤ 108

Subject: EWCE 351, Transportation Engineering

Time: 3.00 hours **Full Marks: 240**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** and **abbreviations** used have their usual meanings.

SECTION-A

Question 1 (Compulsory)

a. State the functions and desirable characteristics of pavement. Explain why the flexible pavements generally built in layers with better materials on top. **10**

b. Indicate the locations where rigid pavement is warranted. Differentiate between flexible and rigid pavement in terms of economy, environmental impact and recycling potential. Explain which type of pavement is more useful in submerged condition. **10**

c. Briefly discuss the effects of environment and speed on pavement design. List down the failure criteria of flexible and rigid pavement. **10**

d. Explain equivalent axle load factor (EALF). Determine the EALF of 45,000-lb single axle load. If the EALF of 46- Kip Tridem axle is 0.868, determine the EALF of 70,000-lb tridem axles. **10**

Question 2

a. List down different physical and regulatory measures with appropriate examples which are commonly used in traffic engineering practices. **10**

b. Indicate the general requirements of traffic control devices. Briefly discuss different types of Mandatory signs. **10**

c. Specify which geometric elements of a highway are influenced by the static and kinematic characteristics of vehicles. **7**

d. Design a two-phase signal for an isolated cross-junction using the following data: **13**
Amber time = 3 sec
Red-Amber time = 2 sec
Inter-green for: N-S = 9 sec; and E-W = 6 sec
Lost time for: N-S = 3 sec; and E-W = 2 sec

	North	South	East	West
Arrival Flow (PCU/hr)	540	660	900	790
Saturation Flow (PCU/hr)	2200	2300	2810	3000

Assume no turning traffic or parked vehicle.

Question 3

a. Recall the four-step travel demand modeling process: **10**

A. Trip generation
B. Trip distribution
C. Mode choice
D. Traffic assignment

Each step involved a variety of modeling methods. For each of the following methods, write the letters of the step in the four-step model for which the method is used (1 mark each).

All-or-nothing, Cross-classification, Destination choice, Gravity, Growth factor, Linear regression, Multinomial logit, nested logit, User equilibrium, Fratar/Furness.

b. MIST is planning to build a new building to house the growing transportation research program. You open the ITE Trip Generation Manual to the page for land use 760 "Research and Development Center" to find the two methods for calculating trip generation. One method has an average weekday trip generation rate of 8.11 trips per 1000 ft^2 gross floor area. The other method has the following equation: **10**

$ln(T) = 0.82\ ln(x) + 3.14$, where x is in units of 1000 ft^2 gross floor area. Estimate the number of trips that will be generated by MIST's new building on an average weekday.

c. Dhaka North City Corporation is planning school bus routes and wants to know how many students they will need to pick up from a particular neighborhood in the future, based on the forecasted number of households (HH) shown below. They use the following cross-classification trip generation model. **10**

Number of households					
		Household size			
		1–2	*3*	*4+*	*Total*
Income	*Lower*	20	30	50	100
	Higher	30	30	40	100
	Total	50	60	90	200

HBSch trip productions per HH				
		Household size		
		1–2	*3*	*4+*
Income	*Lower*	0.1	1.7	3.5
	Higher	0.1	1.4	3.1

Given this information, estimate the number of home based school trips predicted to be generated by this neighborhood in the future. Show your work.

d. For the following abbreviations, write out the words the abbreviation stands for, and describe what each is. **5×2=10**

(i) TIA
(II) TTA

Question 4

a. Dhaka North City Corporation has developed a gravity model for trip distribution, using the friction factors (FF) shown below. They are applying this model using the following information about forecasted trip productions, trip attractions, and travel times. **15**

Travel time	*FF*
1–15 minutes	0.76
16–30 minutes	1.04
31+ minutes	1.33

Trips		*Attraction*		*Production*
		1	*2*	*total*
Production	*1*	??		155
	2	??		70
Attraction	*total*	95	130	225

Travel times		*Attraction*	
		1	*2*
Prod.	*1*	5	18
	2	18	7

Given this information, estimate the number of trips predicted by the gravity model to be produced by each of zones 1 and 2 and attracted by zone 1 in the forecast year.

b. A resident of Mirpur DOHS is planning to attend a cricket match in Mirpur Stadium. He/She considers the following two modal options. **15**

Modal option 1 : Drive 10 minutes to a garage, pay Tk 10 to park, and walk 5 minutes to the stadium

Modal option 2: Walk 55 minutes to the stadium

Assume the following multinomial logit mode choice utility equations apply.

$V_{Drive} = (-0.25) \times IVTT + (-0.40) \times OVTT + (-1.60) \times CO$

$V_{Walk} = (-0.40) \times OVTT$

Whare, IVTT= in-vehicle travel time

OVTT= out-of-vehicle travel time

CO= Cost

Given these informations, find out the probability that she will choose to walk. Show your work.

c. There are two primary routes for 3000 vehicles to travel from ECB to Mirpur Cantonment, one via DOHS and one via Mirpur Ceramic Road, with the following travel time (TT) functions (Where Y is in units of 1000 vehicles): **10**

$$TT_{DOHS}(Y_1) = 22 + 5Y_1$$

$$TT_{Ceramics}(Y_2) = 20 + 5Y_2$$

Assuming user equilibrium, predict the number of vehicles (among 3000) to take DOHS road. Show your work.

SECTION-B

Question 5 (Compulsory)

a. Explain the importance and characteristics of maintaining functional hierarchy (functional classification) of highway in developing an efficient road network. **12**

b. What are the benefits of green transport? Describe different types of bike facilities. **10**

c. List the types of traffic you need to consider while designing a new highway/road. **08**

d. Tabulate the design standards (crest width, carriage-way width, width of paved shoulder, number of lanes) for different types of national, regional and feeder roads (type 1 to 6) according to Standards of the Roads and Highway Department of Bangladesh. **10**

Question 6

a. Write down the functions of shoulder. Explain why the colour and texture of shoulder should be different from through traffic lane. **10**

b. Explain the advantages of ITS (Intelligent Transport System) in traffic engineering. **08**

c. Show in a diagram the various cross- sectional elements of a two lane highway (include all possible element within the right of way). **08**

d. Define superelevation runoff and tangent runout. State the methods **14**

of attaining superelveation on ground. Explain any one method with the help of sketch.

Question 7

a. Explain the reasons of providing adequate sight distances in a highway. Write the impacts of (i) weather condition (dry and wet) (ii) grade (upward and downward) (iii) driver's eye height on stopping sight distance (SSD). **10**

b. State the design principles of "At Grade Intersection". Explain with the help of diagram the best possible alignment of an "At Grade Intersection". **10**

c. Describe different types of traffic islands (Classified based on their formation and function). **12**

d. Estimate the total passing sight distance of a two-lane highway for average passing speed of 62 mph. The initial maneuver time is 4.5 sec and average acceleration is 1.5 mph/sec. Consider the time of passing vehicle occupying right lane as 11.3 sec and clearance length as 300 ft. **08**

Question 8

a. Describe the probable causes of traffic accidents. Put forward your recommendations for the reduction of road traffic accident in Bangladesh both in the context of urban and rural environment. **15**

b. State the key locations where adequate street lighting is required. **05**

c. Illustrate the problems associated with "on street parking". **10**

d. Determine the minimum length of a crest vertical curve between a +0.5% grade and -1.0% grade for a road with 100 kmph design speed provided the vertical curve must ensure 190 m SSD. **10**
If the road segment is followed by +0.5% grade again, then determine the minimum length of the sag vertical curve when SSD must be 220 m. Round as the length to the next greatest 20m interval. Assume height of driver's eye = 1.1 m and height of object = 0.15 m.