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## TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT BUILDING AND CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR**  
BACHELOR OF SCIENCE IN CIVIL ENGINEERING  
ECV 4413: TRANSPORTATION ENGINEERING 1  
SPECIAL/SUPPLEMENTARY EXAMINATION

**SERIES: JULY 2025**

**TIME: 2 HRS**

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### **Instructions to Candidates**

1. Answer **Question One** and any other **Two questions** Only.
  2. All diagrams should be clearly drawn and labeled.
  3. Use of **programmable** calculators and **smart phones** is not allowed.
  4. Each question should be on a fresh page of the answer booklet.
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### **Question One (Compulsory)**

- a) What is “transportation engineering?” How is it linked to “traffic engineering”? (2 marks)
- b) i) Explain the main aims of sample design as part of data gathering process for transportation studies. Outline two difficulties that exist in achieving these aims. (2 marks)  
ii) Briefly explain the various elements that entail the sample design and which need to be clearly defined or determined for data collection process. (3 marks)
- c) Clearly distinguish the terms coverage and connectivity with respect to quantitative description of transportation network, stating clearly how each can be measured and the indices with respect to which they measured. (5 marks)

- d) Third year Civil Engineering students went to Thika Road Juja and collected the following traffic flow data:

<u>Time</u>	<u>Number of vehicles</u>
5.00 – 5.15pm	1000
5.15 – 5.30pm	1100
5.30 – 5.45pm	1200
5.45 – 6.00pm	900

Using the given data, compute the peak hourly factor (PHF). Explain the significance of PHF in traffic engineering design. How does the value of PHF generally vary? (5 ½ marks)

- e) Discuss the supply and demand sides and their components that the transport system constitutes. (5 marks)
- f) Data gathering for transport studies can be one of the most expensive stages of the study process. Discuss the most typical practical constraints in the transport studies that need to be considered beforehand and to be clearly addressed. (7 ½ marks)

### **Question two**

- a) Clearly explain the main SEVEN problems encountered in data collection for transportation studies in developing countries like Kenya. (7 marks)
- b) Briefly and with the aid of suitable diagrams explain the following terms as used in establishment of study areas for purposes of gathering data for transport studies:
- Screen line
  - Cordon line
  - Desirelines
- What characteristics should a study area fulfill ? (6 marks)
- c) Clearly distinguish between revealed preferences (RP) survey and stated preferences (SP) survey with regard to data collection for transportation studies. Explain the stages in an SP – data collection process. (7 marks)

**Question three**

a) What is transportation network? Explain the analysis problems of transportation network which are of particular interest in transportation engineering and planning. (3 marks)

a. The most commonly used method to obtain density in traffic streams is the use of presence type detectors which senses the presence of a vehicle within the study area.

In respect to this show that density is given by:-

$$K = \frac{O_c (V_l + D_l)}{V_l}$$

Where:  $V_l$  = Length of the vehicle

$O_c$  = Fraction of time detector is occupied

$D_l$  = Length of detector

$K$  = Density (17 marks)

**Question four**

a) With respect to zoning for transportation demand modeling, explain the term “zone centroid”. (2 marks)

b) Briefly explain the following: trip generation, models, trip distribution models, trip assignment models, and modal split (modal choice) models. (6 marks)

c) The following information connecting family size households (HH), trips and car ownership was collected for Nairobi City Council (shown in table Q4.1)

Table Q4.1: Households, family size and trips

Family size	Auto/car ownership					
	0		1		2 or more	
	HH	TRIPS	HH	TRIPS	HH	TRIPS
1	900	1100	2000	5000	120	200
2	1500	2000	2000	6000	700	1500
3	1300	1900	3000	1400	5000	20000
4 or more	800	1500	4000	18000	5000	26000

- i) Compute and tabulate the number of trips per household with respect to the family size and car ownership. Develop appropriate curves (of family size verses trips) representing all your results. (6 marks)
- ii) Forecasting the number of households in a typical zone of the study area gave the data in Table Q4.2.  
Table Q4.2. Forecast households per family size and car ownership.

Family size (HH)	Car ownership		
	0	1	2 or more
1	36	50	10
2	12	65	200
3	18	45	250
4 or more	10	25	410

- Determine the expected (forecast) number of trips produced by this zone. (3 marks)
- iii) Give the advantage of this trip generation modeling approach. (3 marks)

**Question Five**

- (a) Name and explain TWO basic attributes used to evaluate transportation systems. (4 marks)
- (b) Describe the FOUR elements that make up the physical plan of most transportation systems. (6 marks)
- (c) With the aid of sketches describe the following networks:-
- i. Circumferential
  - ii. Territorial (10 marks)