



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 406: TRANSPORTATION ENGINEERING

DATE:

TIME:

INSTRUCTIONS

- *This paper comprises five questions*
- *Answer question number one and any other two questions*
- *All the optional questions carry equal marks*
- *Candidates to have relevant design manuals*

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define the term model. (3 marks)
- b) State **two** main categories of a model (6 marks)
- c) Using a neat sketch, highlight any **five** links between transportation and society goals (7 marks)
- d) Clearly explain the main **ten** problems encountered in data collection for transportation studies in developing countries like Kenya. (10 marks)
- e) Describe **two** characteristics that a study area should fulfill in origin-destination studies? (4 marks)

QUESTION TWO (20 MARKS)

- a) A gravity model was calibrated with the results as shown in table 1

Table 1

Impedance (travel time, min), w	4	6	8	11	15
Friction factor, F	0.035	0.029	0.025	0.021	0.019

Calculate the parameters A and C given that the relationship between the impedances (w) and friction factor (F) is given by the equation

$$F_{ij} = \frac{A}{W_{ij}^C} \quad (8 \text{ marks})$$

- 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:

- i. Screen line
- ii. Cordon line
- iii. Desire lines

(12 marks)

QUESTION THREE (20 MARKS)

- a) i) Clearly distinguish between revealed preferences (RP) survey and stated preferences (SP) survey with regard to data collection for transportation studies. (4 marks)
- ii) Explain the stages in an SP- data collection process. (5 marks)
- b) Data gathering for transport studies is one of the most expensive stages of the study process. Discuss the most typical constraints in the transport studies that need to be considered beforehand and to be clearly addressed. (5 marks)
- c) The spot speed at a particular location on highway is known to be normally distributed with a mean of 80 K.P.H and a standard deviation of 15 K.P.H. What is the probability that if a sample of 100 vehicles are tested the mean speed observed will exceed 75 K.P.H (6 marks)

QUESTION FOUR (20MKS)

- a) Define the following terms with respect to traffic survey
- Population of interest
 - Sampling unit (4 marks)
- b) Having identified the desired survey population and selected a sampling unit it is necessary to obtain a sampling frame from which to draw the sample. Outline **five** deficiencies that these sampling frames suffer from. (10 marks)
- c) Explain **three** sampling methods that are commonly used in road-side interview (RSI) method (6 marks)

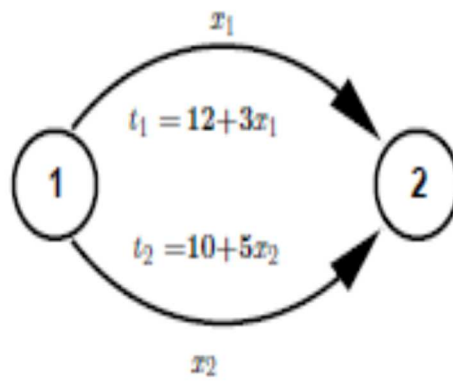
QUESTION FIVE (20 MARKS)

- a) Briefly explain the following:
- trip generation models
 - trip distribution models
 - trip assignment models
 - modal split (modal choice) models. (8 marks)
- b) The trip rate (y) and the corresponding household sizes (x) from a sample are shown in table 2 below. Using regression method, compute the trip rate if the average household size is 3.25. (6 marks)

Table 2

	House hold size (x)			
	1	2	3	4
Trips per day (y)	1	3	4	5
	3	4	5	8
	3	5	7	8

- c) i) Calculate the system travel time and link flow by doing user equilibrium assignment for the network in figure 1 below. (3 marks)
- ii) Verify that the flows are at user equilibrium. (**Note, sum of flows x_1 and x_2 equals 12**) (3 marks)



z	$\Phi(z)$	z	$\Phi(z)$	z	$\Phi(z)$
1.40	0.9192	1.90	0.9713	2.40	0.99180
.41	.9207	.91	.9719	.41	.99202
.42	.9222	.92	.9726	.42	.99224
.43	.9236	.93	.9732	.43	.99245
.44	.9251	.94	.9738	.44	.99266
1.45	0.9265	1.95	0.9744	2.45	0.99286
.46	.9279	.96	.9750	.46	.99305
.47	.9292	.97	.9756	.47	.99324
.48	.9306	.98	.9761	.48	.99343
.49	.9319	.99	.9767	.49	.99361
1.50	0.9332	2.00	0.97725	2.50	0.99379
.51	.9345	.01	.97778	.51	.99396
.52	.9357	.02	.97831	.52	.99413
.53	.9370	.03	.97882	.53	.99430
.54	.9382	.04	.97932	.54	.99446
2.55	0.99461	2.75	0.99702	2.95	0.99841
.56	0.99477	.76	.99711	.96	.99846
.57	.99492	.77	.99720	.97	.99851
.58	.99506	.78	.99728	.98	.99856
.59	.99520	.79	.99736	.99	.99861
2.60	0.99534	2.80	0.99744	3.00	0.99865
.61	.99547	.81	.99752	.10	.99903
.62	.99560	.82	.99760	.20	.99931
.63	.99573	.83	.99767	.30	.99952
.64	.99585	.84	.99774	.40	.99966
2.65	0.99598	2.85	0.99781	3.50	0.99977
.66	.99609	.86	.99788	.60	.99984
.67	.99621	.87	.99795	.70	.99989
.68	.99632	.88	.99801	.80	.99993
.69	.99643	.89	.99807	.90	.99995
2.70	0.99653	2.90	0.99813	4.00	0.99997
.71	.99664	.91	.99819		
.72	.99674	.92	.99825		
.73	.99683	.93	.99831		
.74	.99693	.94	.99836		

Fig. 1