



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

FIFTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 510: LOGISTICS AND SYSTEM ANALYSIS IN TRANSPORTATION

DATE:

TIME:

INSTRUCTIONS

*This paper comprises of FIVE questions. Answer **THREE** questions*

*Question one is **compulsory** and carry 30 marks*

*Answer any other **TWO** questions*

QUESTION ONE (COMPULSORY) (30 MARKS)

- List any **Five** economic characteristics of highway transportation technology. (5 marks)
- Discuss how all or nothing method of vehicle distribution can be used as a way of optimization and evaluation of road transportation. (5 marks)
- Discuss transportation inventory and production cost interrelationships (5 marks)
- Discuss the categories in which vehicle can be classified. (4 marks)
- Table I below shows guide values used as conversion factors applicable to different vehicle types and different types of terrain.

Vehicle type	Level terrain	Rolling terrain	Mountainous terrain
Passenger car	1.0 pcu	1.5 pcu	1.5 pcu
Light Goods Vehicle (LGV)	1.0 pcu	1.5 pcu	3.0 pcu
Medium Goods Vehicle (MGV)	2.5 pcu	5.0 pcu	10.0 pcu
Heavy Goods Vehicle (HGV)	3.5 pcu	8.0 pcu	20.0 pcu
Buses	2.0 pcu	4.0 pcu	6.0 pcu
Motor cycle scoops	1.0 pcu	1.0 pcu	1.5 pcu
Pedal cycles	0.5 pcu	0.5 pcu	N/A

- i) Discuss the difference in vehicle types listed in column one. (7 marks)
- ii) Calculate the pcu/hr for an hourly traffic vol. of 250 pedal cycles, 62 buses, 375 Motor cycle scoops, 60 LGV and 100 HGV in a level terrain (2 marks)
- iii) Calculate the pcu/hr for an hourly traffic vol. of 900 passenger cars, 65 LGV, 60 MGV, 81 HGV and 32 buses in a Rolling terrain (2 marks)

QUESTION TWO (20 MARKS)

- a) State **three** general requirements in a computerized integrated road management system. (3 marks)
- b) Present a modal split model for two competing modes of transport with respect to percentage modal split and transport cost or time ratio. (7 marks)
- c) Describe the various components of future traffic and present a graphical variation of the components with respect to traffic volume overtime. (10 marks)

QUESTION THREE (20 MARKS)

- a) Name and briefly explain the two basic methods of vehicle forecasting. (4 marks)
- b) Name the methods of conducting O & D surveys and describe any two. (8 marks)
- c) Use the NPV criteria of project evaluation to establish the viability of a road project that would result in the costs and benefits in table 2c, after various periods from the base year, for different activities, assuming a discounted rate of 7.5%. (8 marks)

Table 2c: Costs and benefits of a road project

Activity	Time after base year (yrs)	Costs (Million Ksh)	Benefits (Million Ksh)
Survey and Design	11	256	-
Construction and supervision	5	5600	-
Maintenance	7	230	-
Vehicle operations and savings	4	-	3500
Time savings	9	-	260
Accident Savings	6	-	2900
Total		6,086	6,660

QUESTION FOUR (20 MARKS)

- a) Discuss the following
- i. Road Maintenance Cost saving benefit (3 marks)
 - ii. Accident savings benefit (3 marks)
 - iii. Net present value and how it is applied in road project evaluation (4 marks)
- b) Using a detailed BQ approach to price road construction works, discuss what consists a detailed cost estimate. (10 marks)

QUESTION FIVE (20MKS)

Table 4a: Trip matrix for transportation Zone

		Traffic to zone (pcu/hr)			
		A	B	C	D
Traffic from	A	0	24	186	193
Zone	B	34	0	260	178
(PCU)	C	111	283	0	213
	D	169	193	114	0

Use the trip matrix in table 4a, of traffic distribution at base year of forecast period, for various zones, to estimate in four interactions, using frater model, the traffic volume between various zones at its end of the forecast period. Zones A, B, C and D have traffic growth factors of 1.11, 1.22, 1.09 and 1.17 respectively.