



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4503 : TRAFFIC ENGINEERING II

END OF SEMESTER EXAMINATION

SERIES: AUG 2024

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY) (30 Marks)

- a) i) State the objectives of road hierarchy (3 marks)
 - ii) Outline how road hierarchy reduces overall impact of traffic (4 marks)
- b) Mention **FOUR** major aims of traffic assignment procedures (4 marks)
- c) Explain what is meant by;
 - i. Stochastic user equilibrium
 - ii. All-or-Nothing assignment (4 marks)
- d) Distinguish between the following in graph theory:
 - i) Forest and sub forest
 - ii) Tree and subtree
 - iii) Spanning and minimum spanning (6 marks)
- e) Outline a Capacity restraint assignment (4 marks)
- f) i) Explain what is meant by the term 'minimum path' (2 marks)



ii) How is this minimum path selected?

(3 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

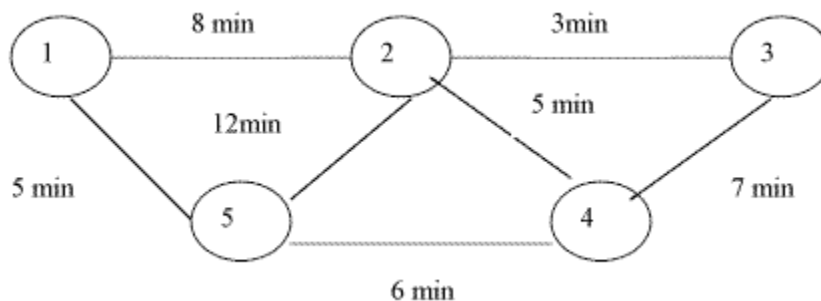
QUESTION TWO (20 Marks)

- a) Outline the **FOUR** levels of road hierarchy for network planning and development (4 marks)
- b) Assign the vehicle trips shown in the following O-D trip table to the network, using the all-or-nothing assignment technique. To summarize your results, list all of the links in the network and their corresponding traffic volume after loading. (16 marks)

Origin-Destination Trip Table:

From/to	Trips between Zones				
	1	2	3	4	5
1	-	100	100	200	150
2	400	-	200	100	500
3	200	100	-	100	150
4	250	150	300	-	400
5	200	100	50	350	-

Highway Network



QUESTION THREE (20 Marks)

- a) Outline **SEVEN** ways in which road hierarchy principles can assist planning agencies (7 marks)

- b) Briefly describe the following methods of traffic assignment
- i) incremental assignment
 - ii) Stochastic traffic assignment (4 marks)
- c) An observer counts 360veh/hr at a specific highway location. Assuming that the arrivals of vehicles at this highway location is poison distributed, estimate the probabilities of having 0, 1, 2, 3, and 4 or more vehicles arriving over a 20 second time interval. How is poison process useful in traffic modelling? (7 marks)
- d) Define vehicle Routing (2 marks)

QUESTION FOUR (20 Marks)

- a) Outline the following road types;
- i. Freeway
 - ii. Expressway
 - iii. Arterial road
 - iv. Collector street (8 marks)
- b) Outline the Limitations of Poisson Models (4 marks)
- c) Vehicles arrivals at a national park main gate are assumed Poisson distributed with an average arrival rate of 1 vehicle every 5 minutes. What is the probability of the following?
- i) Exactly two vehicles arrive in a 15 minutes interval
 - ii) Less than 2 vehicles arrive in a 15 minutes interval
 - iii) More two vehicles arrive in a 15 minutes interval (8 marks)

QUESTION FIVE (20 Marks)

- a) Describe the 'shockwave analysis' method used in traffic flow studies and mention key components (6 marks)

- b) A 3-lane expressway (one direction) is carrying a total volume of 5020 vehicles per hour when an incident occurs resulting in the closure of two lanes. If it takes 100 minutes to clear the obstruction, assuming the capacity of the highway is 2040 vehicles hour per lane, and assuming also that deterministic conditions exist determine the following
- i. The maximum queue length that will be formed
 - ii. The total delay
 - iii. The number of vehicles that will be affected by the incident
 - iv. The average individual delay (10 marks)
- c) Discuss the System optimum assignment (4 marks)