



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: APRIL 2025

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) Explain term Hierarchy as applied in Traffic Engineering (2 marks)
- b) Differentiate between the following types of shockwaves. (4 marks)
 - i. Backward forming shockwaves
 - ii. Backward recovering shockwaves
- c) i) Explain what is meant by the term 'minimum path' (2 marks)
ii) How is this minimum path selected? (3 marks)
- d) Define the following terms as used in traffic characteristics
 - i. Headway (2 marks)
 - ii. Time headway (2 marks)
 - iii. Space headway (2 marks)
- e) Differentiate between the following types of speed (4 marks)
 - i) Running speed
 - ii) Journey speed

- f) Briefly define the following terms used in network analysis giving on example for each
- i) Node
 - ii) Branches
 - iii) Sink
 - iv) source (6 marks)
- g) State **THREE** components of congestion costs in traffic management (3 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 marks)

- a) In road hierarchy, State **THREE** (6 marks)
- i. Functional characteristics
 - ii. Frictional characteristics
- b) i) State the objectives of road hierarchy (3 marks)
- ii) Outline how road hierarchy reduces overall impact of traffic (3 marks)
- c) State **FOUR** benefits of parking control and restraints in traffic management (2 marks)
- d) You are entering an arena to watch a basketball game. There is only one ticket line to purchase tickets. Each ticket purchase takes an average of 18 seconds. The average arrival rate is 3 persons/minute. Assuming M/M/1 queuing, find:
- i) Average length of the queue and
 - ii) Average waiting time in queue (6 marks)

QUESTION THREE (20 Marks)

- a) Outline the Limitations
- i) of Poisson Models
 - ii) Deterministic Queuing Modes (4 marks)

- b) Explain the **FOUR** major aims of traffic assignment procedures (4 marks)
- c) Define the following terms:
- i. Average Daily Traffic (ADT) (2marks)
 - ii. Average Weekday Traffic (AWT) (2marks)
 - iii. Average Annual Daily Traffic (AADT) (2marks)
- d) The maximum capacity of a 2-lane carriage way of a 4-lane dual carriage way is 2400 veh/hr. Due to pipeline operations, the width of a 2-lane way is reduced restricting the vehicle to 1200veh/her. When the flow upstream beyond the influence of the bottleneck is reasonably steady and free flowing at 1700 veh/hr, find.
- i. The mean speed of traffic in the bottleneck.
 - ii. The rate at which the queue of congested conditions outside bottleneck grows.

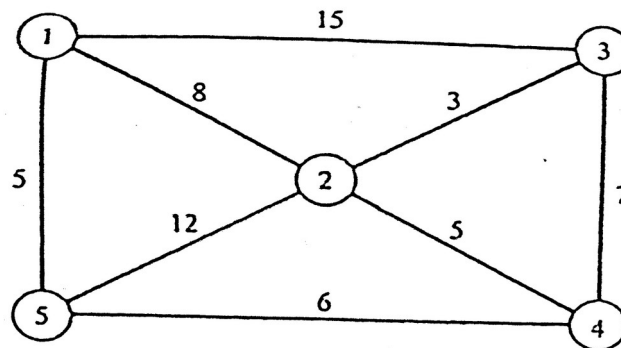
The mean space headway when the vehicles are stationary is 8m. The relationship between speed and concentration is linear (6 marks)

QUESTION FOUR (20 Marks)

- a) Give **THREE** situations on a highway that lead to a bottleneck condition (3 marks)
- b) Briefly describe the following methods of traffic assignment
- i. incremental assignment
 - ii. Capacity restraint (4 marks)
- c) An exit of a toll gate with a single booth, vehicles arrive at random at a rate of 20 vehicles per minute. The service has an average rate of 22 vehicles per minute. Assume M/D/1, estimate the following:
- i) Average length of queue formed at the toll gate
 - ii) Average waiting time of vehicles
 - iii) Average time vehicles spent in the system (9 marks)
- d) The following are spot speeds observed at Makupa course way: 70,75, 65,79 and 85 km/h. Determine the Time Mean Speed and Space Mean Speed. (4 marks)

QUESTION FIVE (20 Marks)

A highway network consisting of five nodes and eight links is shown in the figure below. The cost of transportation is also shown. A trip table showing the numbers of vehicles per hour wanting to go from one node to another is also provided. Assign the trips to the network using the all-or-nothing method. All the links are two-way. Find the total volume on each individual link and the total cost of all the trips.



Trip-Table

From \ To	1	2	3	4	5	
1	0	50	60	70	30	210
2	40	0	30	60	80	210
3	90	40	0	20	50	200
4	80	70	90	0	30	270
5	30	40	50	60	0	180
	240	200	230	210	190	1070

