



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

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: MARCH 2025
TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

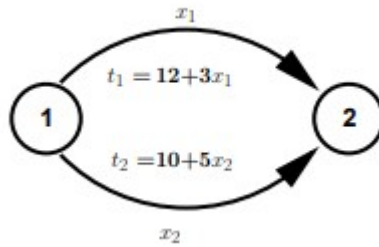
This paper consists of five questions.

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

Do not write on the question paper.

QUESTION ONE (COMPULSORY) 30 Marks

- a) Explain the **FOUR** major aims of traffic assignment procedures (4 marks)
- b) Briefly explain **TWO** important assumptions usually made in developing theories of route choice. (2 marks)
- c) Outline the steps in the Nearest neighbor procedure (NNP) for routing service vehicles solving the travelling salesman problem (4 marks)
- d) What are the **THREE** assumptions in User Equilibrium (UE) traffic assignment model? (3 marks)
- e) Calculate the system travel time and link flows by doing user equilibrium assignment for the network in the given figure below. Verify that the flows are at user equilibrium. (11 marks)



f) Explain the following terms used in graph theory

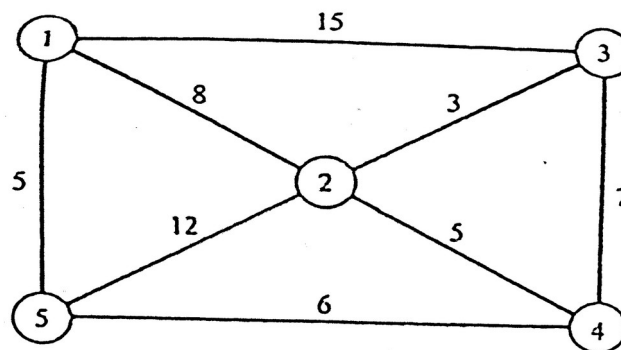
(6 marks)

- i. Adjacent edges.
- ii. simple path.
- iii. A simple graph
- iv. empty graph
- v. A null graph
- vi. A trivial graph

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (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

QUESTION THREE (20 Marks)

Two routes connect a city and a sub-urban. During the peak-hour morning commute, a total of 4500 vehicles travel from the suburban to the city. Route 1 has a 96km per hour speed limit and is 9.6km in length. Route 2 is 4.8km in length with a 72kph speed limit. Studies show that the total travel time on route 1 increases 2 minutes for every additional 500 vehicles added. Minutes of travel time on route 2 increases with the square of the number of vehicles expressed in thousands of vehicles per hour.

Determine user equilibrium travel time. (15 marks)

b) 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 (5 marks)

QUESTION FOUR (20 Marks)



- b) List **FIVE** Factors which have commonly been used to predict trip productions (person trip production) (5 marks)
- c) With the help of a diagram, derive the conservation or continuity equation expressing the law of conservation of a traffic stream. (15 marks)

QUESTION FIVE (20 Marks)

- a) Give **TWO** situations on a highway that lead to a bottleneck condition (2 marks)
- b) Differentiate between the following types of shockwaves.
- i. Backward forming shockwaves
 - ii. Backward recovering shockwaves (4 marks)
- c) The southbound approach of the signalized intersection carries a flow of 1000 veh/h/ln at a velocity of 50 mi/h. the duration of the red signal indication for this approach is 15sec. if the saturation flow is 2000veh/h/ln with a density of 75 veh/ln, the jam density is 150veh/mi. determine the following:
- a) The length of the queue at the end of the red phase
 - b) The maximum queue length
 - c) The time it takes for the queue to dissipate after the end of the red phase (14 marks)