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: JANUARY 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) Differentiate between Time headway and Space headway (2 marks)

i. Time headway

ii. Space headway

b) Differentiate between the following types of speed (4 marks)

1. Running speed
2. Journey speed

c) State **FOUR** components of congestion costs in traffic management (2 marks)

d) State **FOUR** benefits of parking control and restraints in traffic management

(2 marks)

e) Using relevant equations, discuss the following Traffic flow parameters
   i. Density
   ii. Flow (4 marks)

f) Outline the following types of roads:
   i. Arterial urban roads
   ii. Collector urban roads
   iii. Local urban roads (6 marks)

g) Briefly outline the following traffic assignment types
   i. All-or-nothing assignment and list its one advantage and two disadvantages (5 marks)
   ii) Stochastic user-equilibrium assignment assignment and state the assumptions on which this method is based. (5 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 marks)

a) Differentiate between the following types of shockwaves. (4 marks)
   i. Backward forming shockwaves
   ii. Backward recovering shockwaves

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 average individual delay (12 marks)

c) Outline the following road types; (4 marks)
   i. Freeway
   ii. Expressway

QUESTION THREE (20 Marks)

a) Discuss **FOUR** common forms of vehicle movement control traffic management (4 Marks)

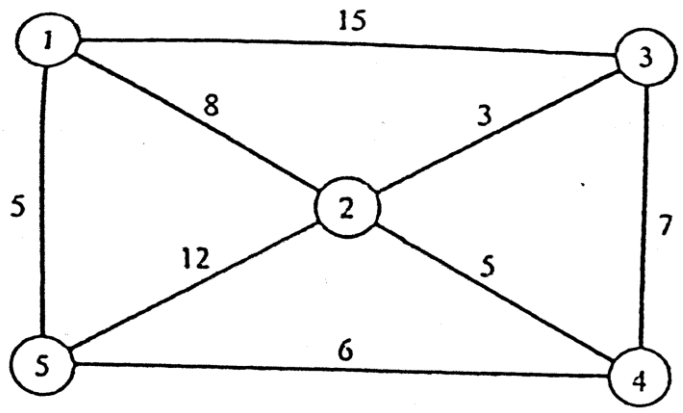
b) State the main purpose of hierarchy of highway networks and explain four main objectives of the hierarchy (6marks)

c) Four vehicles are traveling at constant speeds between sections X and Y (280 meters apart) with their positions and speeds observed at an instant in time. An observer at point X observes the four vehicles passing point X during a period of 15 seconds. The speeds of the vehicles are measured as 88, 80, 90, and 72 km/hr respectively. Calculate the;

i. flow,
ii. density,
iii. time mean speed, and
iv. space mean speed of the vehicles. (10 marks)

QUESTION FOUR (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 FIVE (20 Marks)

a) Using speed Vs flow of vehicles relationship given in fig 1 below, describe the flow conditions in zone SP, PBC and OC. (6 marks)

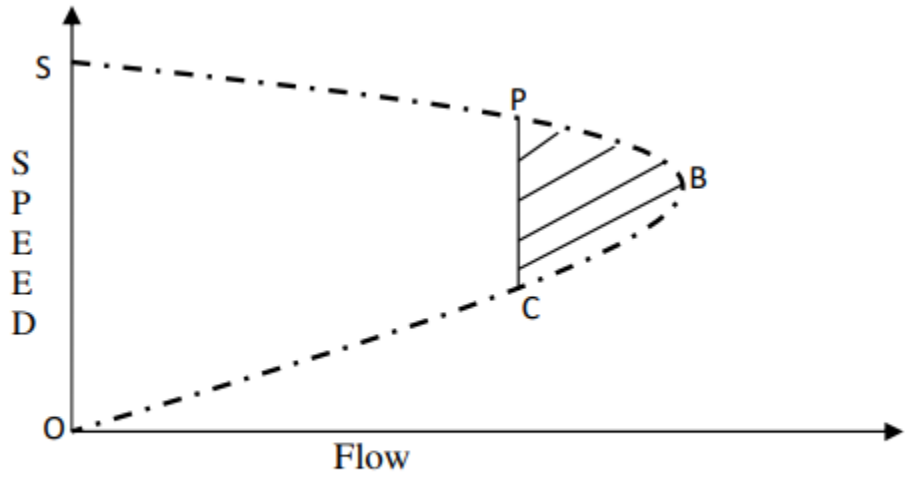


Fig 1

b) A movie theater ticket booth has a mean arrival rate of 3 persons/minute and the service rate is 4 persons/minute. Calculate the characteristics of this queuing system applying the M/M/1 model. (8 marks)

c) 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)