



TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
**UNIVERSITY EXAMINATION FOR:**  
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4514 : TRAFFIC ENGINEERING III

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**

- a) Figure 1 below is a graph showing the relationship between arrivals and departures of numbers of vehicles against specific times. Determine;

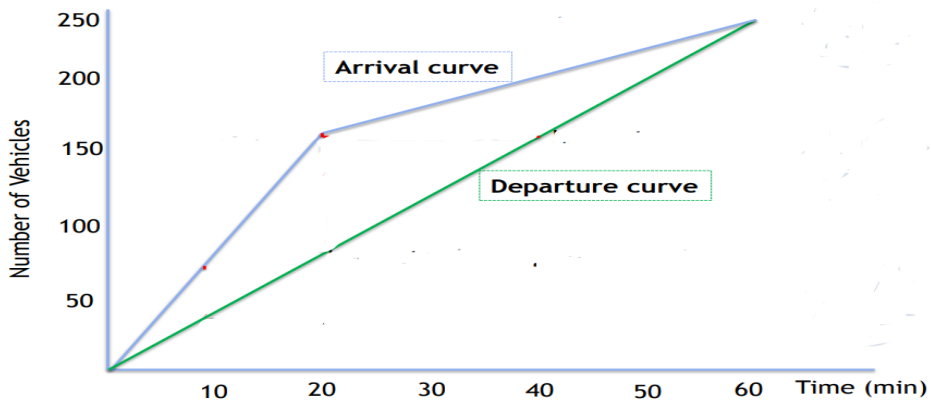


Figure 1

- i. The longest vehicle queue
  - ii. When the queue will dissipate
  - iii. The total time delay by all vehicles
  - iv. The average delay per vehicle
  - v. The average queue length (20 marks)
- b) Delay is a common measure of operational quality. Explain the following ways of quantifying delay.
- i. Approach delay
  - ii. Travel time delay
  - iii. Time in queue delay
  - iv. Control delay
  - v. Stopped time delay (10 marks)

## QUESTION TWO

- a) What is queuing in traffic science? (2 marks)
- b) Differentiate between traffic flow, traffic speed and traffic density. (6 marks)
- c) The speed of seven vehicles were measured at midpoint of a 0.5-mile (0.8kms) section of roadway. The speeds respectively were recorded as 44, 43, 44, 53, 47, 59 and 49 mi/h. Assuming the vehicles were travelling at a constant speed all through the section, compute;
  - i. Time mean speed
  - ii. Space mean speed (6 Marks)
- d) Vehicle time headways and spacings were measured at a point along a highway from a single lane over an hour. The average values were calculated as 3.5s/veh

for headway and 250ft/veh for spacing. Compute the average speed of the traffic.  
**(6 marks)**

### QUESTION THREE

- a) Differentiate uniform delay, random delay and overflow delay **(12 marks)**
- b) Describe the characteristics of a HCM 2000 delay model. **(8 marks)**

### QUESTION FOUR

- a) In a traffic analysis done on Mombasa-Malindi highway, 270veh/h were counted at Nyali bridge. Assuming that the vehicle arrival at this point was poisson distributed, estimate the probabilities of having the following number of vehicles over a 30 second period;
- i. 0 vehicles
  - ii. 5 vehicles
  - iii. Over 5 vehicles **(6 marks)**
- b) Considering a uniform traffic delay model at an intersection, the approach flow rate is 1000vph, saturation flow rate 2800 vph, cycle length 90s and an effective green ratio of 0.44 for the approach. Find the average delay per vehicle under these conditions.  
**(6 marks)**
- c) Outline some limitations in the poisson models in traffic analysis **(8 marks)**

### QUESTION FIVE

- a) Describe the poisson model as applied in traffic flow analysis **(5 marks)**
- b) A section of a highway is known to have a free flow of 70mi/h and capacity of 2500veh/h. In a given hour, 3155 vehicles were counted at a specific point along this highway section. If the linear speed density relationship in the normal speed density model applies, what would be the best estimate for the speed of the 3155 vehicles? **(5 marks)**
- c) An intersection has an approach flow rate of 1400 vph, a saturation flow rate of 2750 vph, a cycle length of 110s, and the effective green ratio for the approach is

0.55. Assuming progression adjustment factor of 1.25 and delay due to pre-existing queue 12 sec/veh, determine the control delay sec per vehicle expected.  
**(10 marks)**