TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4514 : TRAFFIC ENGINEERING III

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

a) What is queuing in traffic science? **(2 marks)**

b) Differentiate between traffic flow, traffic speed and traffic density. **(6 marks)**

c) Describe the poisons model as applied in traffic flow analysis **(5 marks)**

d) 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)**

e) 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)**

f) A section of a highway is known to have a free flow of 7mi/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)**

QUESTION TWO

a) 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)**

b) An intersection has an approach flow rate of 1400 vph, a saturation flow rate of 2750 vphg, 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)**

QUESTION THREE

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

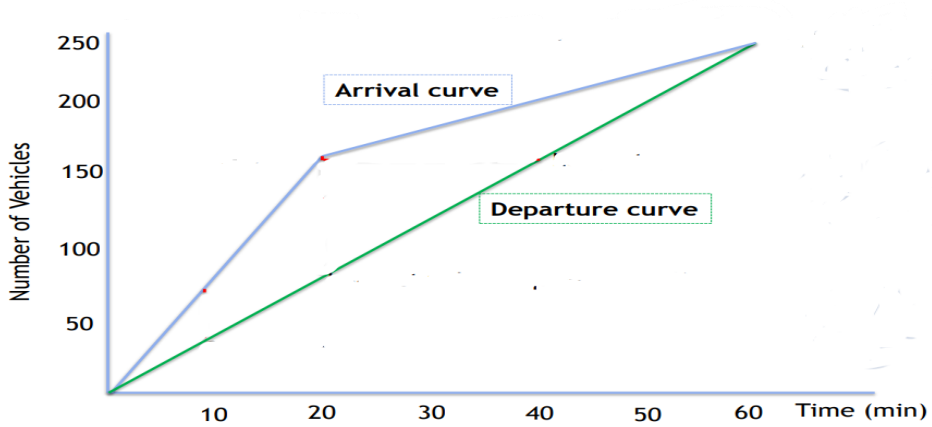

Figure 1

i. The longest vehicle queue
ii. When the queue will dissipate
iii. The total time delat by all vehicles
iv. The average delay per vehicle
v. The average queue length (20 marks)

QUESTION FOUR

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

QUESTION FIVE

a) In a traffic analysis done on Mombasa-Malindi highway, 270vehh/h were counted at Nyali bridge. Assuming that the vehicle arrival at this poit 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 ration of 0.44 for the approach. Find the average delay per vehicleunder these conditions.
   (6 marks)
c) Outline some limitations in the poisons method of traffic analysis **(8 marks)**