



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of BUILDING & Civil engineering

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING

TCV 4312 : TRAFFIC ENGINEERING I

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) State any **FIVE** functions of a traffic engineer. (5 marks)
- b) Briefly define **TWO** main types of traffic Flow (4 Marks)
- c) Describe the following terms used in traffic engineering
 - (i) Spacing (2 marks)
 - (ii) Headway (2 marks)
 - (iii) Flow rate (2 marks)
 - (iv) Volume (2 marks)
- d) With the help of fundamental diagrams of traffic flow, show the relationship between density and speed. (3 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)



- a) The speed-density relationship of traffic on a section of a freeway lane was estimated $v_s = 18.2 \ln\left(\frac{220}{k}\right)$.
- (i) What is the maximum flow, speed and density at this flow
- (ii) What is the jam density? (10 marks)
- b) Inspection of a freeway data set reveals a free flow speed of 60 mph, a jam density of 180 vehicles per mile per lane, and an observed maximum flow of 2000 vehicles per hour. Determine the linear equation for velocity for these conditions, and determine the speed and density at maximum flow conditions. (10 marks)

QUESTION THREE (20 Marks)

- a) Give **THREE** Reasons for longitudinal delineation (3 marks)
- b) A student riding his bicycle from campus on one-way street takes 50 minutes to get home of which 10 minutes was taken talking to a driver of a stalled vehicle. He counted 42 vehicles while he rode his bicycle, and 35 vehicles while he stopped. What are the travel time and flow of the vehicle stream? (7 marks)
- c) The volume at a section of a two-lane highway is 1500 veh/h in each direction and the density is about 25 veh/km. A large dump truck loaded with soil from an adjacent construction site joins the traffic stream and travels at a speed of 10 km/h for a length of 2.5 km along the upgrade before turning off onto a dump site. Due to the relatively high flow in the opposite direction, it is impossible for any car to pass the truck. Vehicles just behind the truck therefore have to travel at the speed of the truck, which results in the formation of a platoon having a density of 100 veh/km and a flow of 1000 veh/h. Determine how many vehicles will be in the platoon by the time the truck leaves the highway. (10 marks)

QUESTION FOUR (20 Marks)

- a) Describe **TWO** methods of traffic volume measurements applied in Kenya. (4 marks)
- b) List **FIVE** uses of data collected during traffic studies. (5 marks)
- c) Explain any **FIVE** road pricing mechanism that must be satisfied in order to be workable and to come close to attaining its objectives (5 marks)
- d) Explain **THREE** methods of indirect methods of charging on roads (3 marks)
- e) If the spacing between vehicles is 500 feet what is the density? (3 marks)

QUESTION FIVE (20 Marks)

A school zone (20mph) of $\frac{1}{4}$ -mile length is located on a 40mph highway. Stream measurements at various sections upstream, middle of the school and just downstream of school zone, respectively are as follows:

Approaching zone: $q_A = 1000 \text{ veh/hr}$, $v_A = 40\text{mph}$

Middle of zone: $q_B = 1100 \text{ veh/hr}$, $v_B = 20\text{mph}$

Downstream of zone: $q_C = 1200 \text{ veh/hr}$, $v_C = 30\text{mph}$

Sketch the q-k-v curves and indicate critical values. Calculate the intensity and direction of the shockwaves created by the speed zone. What is the length of the platoon created by the speed zone and the time required to disperse it? (assume that the speed zone restriction operates for only 15min during morning and evening periods.