THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2411: TRAFFIC ENGINEERING II

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) With the aid of suitable diagram, clearly explain the concept of stationary and non stationary traffic flow. **(6 marks)**

b) The following traffic flow data was collected in the field by an engineer from the Mombasa City Council.

Time	Number of Vehicles
6.00 – 6.15	120
6.15 – 6.30	180
6.30 – 6.45	150
6.45 – 7.00	160

(i) Compute the Peale Hour Factor (PHF) using the given information.
(ii) What is the significance of PHF in traffic engineering design? **(6 marks)**

c) Explain the concept of Hierarchy structure of highway networks and state the principle factors to be considered in designating streets into appropriate systems. **(4 marks)**

d) Explain the concept of shock-waves using clearly drawn and labeled diagrams. **(5 marks)**

e) Distinguish the following traffic flow regimes using sketches and state mathematically when they do occur free flow, congested flow and capacity flow. **(9 marks)**

Question Two

a) State the law of conservation of vehicles with respect to traffic flow in a network. **(2 marks)**

b) A school zone with speed limit of 32km/hour highway in the city of Kisumu. Stream measurement at various sections upstream, middle of the school zone and just downstream of the school zone, respectively are as follows:

Approaching zone: qA = 1000veh/hr, U_A = 64km/hr
Middle zone: qB = 1100veh/hr, U_B = 32km/hr
Downstream zone: qC = 1200veh/hr, U_C = 48km/hr

Sketch the q-k-u curves and indicate critical value. Calculate the density and direction of the shockwaves created by this 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 15minutes during morning and evening periods. **(18 marks)**

Question Three

a) Digo Road and Kilindini Road are two highways serving the city of Mombasa CBD with a traffic demand of 6000 vehicles during the peak hour. The service functions for the two routes are:

$$tDigo = 4 + 5(X_1 / C_1)$$

$$tKilindini = 3 + 7(X_2 / C_2)$$

When the t's are travel times in minutes, x's are the peak hours traffic volumes expressed in thousands of vehicles per hour. Initially, the capacitites of Digo Road (route 1) and Kilindini Road (route 2) are 4400 veh/hr and 5200 veh/hr respectively. If reconstruction activities on Kilindini Road cuts its capacity to 2200 veh/hr, how many additional vehicle-hours will be added in the corridor if the user equilibrium conditions hold? **(20 marks)**

Question Four

a) Traffic flow can be divided into two primary types of interrupted and uninterrupted flow. Briefly describe each type and state where they do occur in practice. **(6 marks)**

b) Explain the term "connectivity" as used in transportation networks. **(4 marks)**

c) A student riding his bicycle from campus on a one-way street takes 50 minutes to get home, in which 10 minutes was taken talking to the driver of a stalled vehicle. He counted 42 vehicles while rode his bicycle and 35 vehicles while he stopped. What are the travel time and flow of the vehicle stream? **(10 marks)**

Question Five

a) Explain the "All-or-Nothing" method used to assign traffic in given networks. **(5 marks)**

b) Two possible routes from an origin O destination D are shown in figure 5 below. The Northern route has a shorter distance but less capacity. The link performance function that govern the North and Sourth routes are:

$$T_N = 16\left[1 + 0.76\left(\frac{5000 - V}{2400}\right)^5\right]$$

$$T_S = 20\left[1 + 0.76\left(\frac{V}{3200}\right)^5\right]$$

Figure Q5: Network Routes

Figure 1

5000 cars leave the origin O at the speeds indicated in the figure. How many of the 5000 vehicles will use the Northern route and how many will use the Southern route such that the travel times on the South and North routes will be equal. **(15 marks)**