TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2403: TRAFFIC ENGINEERING I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 18 May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attempt question ONE (Compulsory) and any other TWO questions.

QUESTION 1

a) Describe the following terms used in traffic engineering

(i)	Traffic	(2marks)
(ii)	Spacing	(2marks)
(iii)	Headway	(2marks)
(iv)	Clearance	(2marks)
(v)	Gap	(2marks)
(vi)	Flow rate	(2marks)
(vii)	Volume	(2marks)
(viii)	Density	(2marks)

b) A timer is begun at a time 0.0 seconds for 25 seconds and the time at which the front end of vehicles pass the observation point ,say A-A' are noted as follows:

Vehicle	Time of Passing (sec)
4	3
5	5.2
6	8.2
7	12.1
8	15.5
9	18.2

i. What are the individual headways? (3marks)
ii. What is the average headway? (1mark)

c) Four vehicles, 18, 20,21 and 22ft long ,are distributed over a length of a freeway lane 500ft long.What is the lane occupancy? (1 mark)

d) (i) Three vehicles are traversing a 1-mile segment of a highway at the following speeds: 50mph, 40mph and 35.3mph.
Calculate the space mean speed and the time mean speed. (2marks)

e) Describe ''level of service'' A-F as applied in traffic analysis (7marks)

SECTION B *(Answer any TWO questions from this section. Each question carries 20 marks)*

QUESTION 2

(a) Differentiate between 'uninterrupted' and interrupted flows as used in traffic studies (5marks)

(b) Briefly explain TWO types of traffic signals (5marks)

(c) Outline FOUR requirements for traffic control devices (4marks)

(d) Explain the following
(i) Induced traffic (1mark)
(ii) Generated traffic (1mark)
(iii) Mixed traffic (1mark)

(e) What is ITS and what are two of its disadvantages? (3marks)

QUESTION 3

(a) (i) State Greenshield's Model (2marks)

(ii) Given the relationship between speed and density from empirical data as ; U=54.5-0.24k.
Estimate q_{max}, u_o, k_j (8marks)

(b) (i) Derive Greenberg's model and show that C is the speed at maximum flow. (10marks)

(ii)The speed density relationship of traffic on a section of a freeway lane was estimated to be :v_x=18.2ln(220/k) (6marks)

a. What is the maximum flow,speed ,and density at this flow? (3marks)
b. What is the jam density? (1mark)

QUESTION FOUR

a. Define the following:
   i. Deterministic queuing models (2marks)
   ii. Stochastic queuing models (2marks)
b. List FIVE advantages of one-way street system (5marks)

c. Explain the relevance of The Manual on Uniform Traffic Control Device(MUTCD) (1marks)

d. An airport has a single runway;airplanes have been found to arrive at the rate of 15 per hour.It is estimated that each landing takes three minutes.Assuming a poisson process for the arrivals and an exponential distribution for landing times use an M/M/1 model to determine the following performance measures:
   (i) Runway utilization
   (ii) Expected number of planes waiting to land
   (iii) Expected waiting time
   (iv) Probability that waiting will be more than 5minutes,10minutes and the probability that there will be no waiting. (10marks)

QUESTION FIVE

(a) Explain the following as used in traffic engineering
   (i) Annual average daily traffic(AADT) (2marks)
   (ii) Annual average weekly traffic(AAWT) (2marks)
   (iii) Average daily traffic (2marks)
   (iv) Design years (2marks)
(b) State FIVE objectives of traffic engineering (5marks)
(c) Using hypothetical(fundamental) diagrams clearly describe the connection between mean speed,density and flow. (7marks)