THE TECHICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2520: TRAFFIC ENGINEERING III

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: FEBRUARY 2013
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) (i) Briefly explain the queuing theory and its evaluation. **(5 marks)**

(ii) Explain why queues form and give four clear examples of how queuing problems can be addressed in various places where they occur. **(6 marks)**

b) Describe the following factors that characterize the input source of a queue.
(i) Size of calling population
(ii) Pattern of arrival at the system
(iii) Behavior of the arrivals **(10 marks)**

c) With the aid of sketches, where necessary explain the **TWO** aspects of queue service systems. **(9 marks)**

Question Two

a) (i) Name and describe the **TWO** main categories in which queue displine is divided into: **(6 marks)**

(ii) In relation to queue configuration, briefly describe queuing process. **(4 marks)**

b) Describe the 'shock wave' analysis method used in traffic flow studies. **(5 ½ marks)**

c) Briefly explain the following 'human behaviour' encountered in queues:
(i) Balking
(ii) Reneging
(iii) Jocking **(4 ½ marks)**

Question Three

a) (i) With reference to a signalized road intersection describe a deterministic queuing analysis method. Use sketches where possible. **(6 marks)**

(ii) With the aid of a flow chart briefly describe the stochastic queuing analysis method. **(6 marks)**

b) Planes land on a runway (one run way) in a given airport. In this airport there are 30 arrivals per hour whose arrival time are Poisson distributed. The landing time is 90seconds and is deterministic in nature. If the fuel cost is given as kshs. 5,000 per hour, calculate:
(i) Average length of queue
(ii) Average waiting time
(iii) Expected number of pierces in the system
(iv) Fuel cost per hour as a result of delay **(8 marks)**

Question Four

a) Briefly explain the 'Little Law' as used in queuing analysis. **(3 marks)**

b) A movie theatre ticket booth has a mean arrival rate of 3 persons per minute and a service rate of 4 persons per minute. Using the M/m/1 model, calculate the characteristics of the system by determining.
(i) Mean number of persons in the system (L)
(ii) Mean number of persons in the waiting line (Lq)
(iii) Mean time in the queuing system (w)
(iv) Mean time in the queue (wq)
(v) Percentage idle time (I) **(13 marks)**

c) With the aid of a sketch, briefly describe the 'Poisson distribution' and its relevance in queuing analysis. **(4 marks)**

Question Five

a) (i) In reference to queuing analysis, describe the 'diffusion approximations' **(5 marks)**

(ii) Briefly explain the importance of the diffusion approximations. **(5 marks)**

b) Customers arrive at the ticket counter in a local movie theatre at a rate of 240 persons per hour at 5.30pm. After 10 minutes the arrival rate declines to 60 persons per hour and continues at that rate 20 minutes. If the time required to serve each customer is 20 seconds describe the performance of the system. Draw the graph for the D/D/1 queue. **(6 marks)**

c) Briefly describe saturation and under saturation as used in queuing systems. **(4 marks)**