TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING
[Institutional Based Programmes]

ECE 2520: TRAFFIC ENGINEERING III

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
TIME ALLOWED: 2 HOURS

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

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

Question One (Compulsory)

a) Describe the 'shockwave analysis' method used in traffic flow studies. **(5 ½ marks)**

b) Briefly explain the following human behavior encountered in queues **(4 ½ marks)**
- **(i)** Reneging
- **(ii)** Jockeying
- **(iii)** Balking

c) Briefly describe the following factors that characterizes the input source of a queue:
- **(i)** Size of calling population
- **(ii)** Pattern on arrival at the system
- **(iii)** Behavior of the arrivals **(10 marks)**

d) (i) Name and briefly describe the **TWO** categories in which queue discipline is divided into: **(6 marks)**

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

Question Two

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) (i) With the aid of a flow chart briefly describe the stochastic queuing analysis method. **(5 marks)**

(ii) With reference to a signalized road intersection, describe a deterministic queuing analysis method. **(5 marks)**

Question Three

a) (i) Explain why queues form and give a good example of how a queuing problem can be addressed in places where they occur. **(5 marks)**

(ii) Briefly explain the queuing theory and its evolution. **(5 marks)**

b) (i) In relation to queue configuration briefly describe the queuing process. **(4 marks)**

(ii) Name and describe the TWO main categories in which queue dispine is divided into **(6 marks)**

Question Four

a) Briefly explain the 'littles' law as used in queuing analysis **(3 marks)**

b) With the aid of a sketch briefly describe the "poisson distribution and its relevance in queuing analysis. **(4 marks)**

c) A movie theatre ticket both has a mean arrival rate of 3 persons per minute and a service rate of 4 persons per minute. Using the information given below, calculate the characteristics of the system using a M/M/1 model by determining:

(i) Mean number of persons in the system (L)
(ii) Mean number of persons in the waiting line (L_q)
(iii) Mean time in the queuing system (W)
(iv) Mean time in the queue (W_q)
(v) Percentage idle time (I) **(13 marks)**

Question Five

a) Briefly describe "saturation and under saturation" in queuing systems. **(5 marks)**

b) With the aid of sketches, where necessary, explain the **TWO** aspects of a queue service system. **(9 marks)**

c) Customers arrive at a ticket counter in a local theater 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 for 20 minutes. If the time required to serve each customer is 20 seconds, describe the performance of the queue system. Draw the graph for the D/D/1 queue. **(6 marks)**