



**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 2520: TRAFFIC ENGINEERING III

**END OF SEMESTER EXAMINATION**

**SERIES: DECEMBER 2012**

**TIME: 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 (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

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**Question One (Compulsory)**

- a) (i) In reference to queueing 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 queueing analysis method. **(6 marks)**
- (ii) With reference to a signalized road intersection, describe a deterministic queueing analysis method. Use sketches where possible. **(6 marks)**

- c) Planes land on a runway (one runway) in a given airport. In this airport, there are 30 arrivals per hour whose arrival times are poisson distributed. The landing time is 90 seconds and is deterministic in nature. If the fuel cost is given as ksh. 5000/= per hour, calculate:
- (i) Average length of queue
  - (ii) Average waiting time
  - (iii) Expected number of planes in the system
  - (iv) Fuel cost per hour as a result of delay
- (8 marks)**

### Question Two

- a) With the aid of sketches where necessary, explain the **TWO** aspects of a queue service system. **(9 marks)**
- b) Customers arrive at a ticket counter in a local theater at a rate of 240 persons per hour at 5.30 pm. 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/I queue. **(6 marks)**
- c) Briefly describe ‘saturation and under-saturation’ in queueing systems. **(5 marks)**

### Question Three

- a) Describe the following factors that characterizes 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)**
- b) Describe the ‘shockwave analysis’ method used in traffic flow studies. **(5 ½ marks)**
- c) Briefly explain the following ‘human behavior’ encountered in queues.
- (i) Balking
  - (ii) Reneging
  - (iii) Jockeying
- (4 ½ marks)**

### Question Four

- a) (i) Name and describe the **TWO** main categories in which queue discipline is divided into: **(6 marks)**
- (ii) In relation to queue configuration, briefly describe queueing process. **(4 marks)**
- b) (i) Briefly explain the queueing theory and its evolution. **(5 marks)**
- (ii) Explain why queues form and give clear examples of how queueing problem can be addressed in places where they occur. **(5 marks)**

### Question Five

- a) With the aid of a sketch, briefly describe the 'poisson distribution' and its relevance in queueing analysis. **(4 marks)**
- b) Briefly explain the 'littles' law as used in queueing analysis. **(3 marks)**
- c) A movie theater ticket booth has a mean arrival rate of 3 persons per minute. Using the information given below, calculate the characteristic of the system applying 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 queue ( $W_q$ )
  - (iv) Percentage idle time ( $I$ )
- (13 marks)**