



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL AND
ELECTRONIC ENGINEERING

**EEE 2520: TELETRAFFIC ENGINEERING:
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018**

**TIME: 2 Hours
DATE: Sep 2018**

INSTRUCTIONS TO CANDIDATES

You have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE QUESTIONS; Question one is compulsory. In addition attempt any other TWO questions

Do not write on the question paper

QUESTION ONE (Compulsory 30 marks)

- a) Define the following terms with respect to traffic flow.
- Queueing
 - Availability
 - Grade of service **[3 marks]**
- b) Consider a telephone traffic carried by a 6 channel link in the telephone network. Use a pure loss system model. New calls arrive according to a poisson process at the rate of 3 calls per minute and call holding times are independently and identically distributed with mean 2 minutes. Compute:
- Offered traffic
 - Carried traffic
 - Lost traffic **[5marks]**

- c) During the busy hour 1400 calls were offered to a group of trunks and 14 calls were lost. The average call duration was 3 min. Determine:
- i. Traffic offered
 - ii. Traffic carried
 - iii. GOS
 - iv. Total duration of period of congestion **[4 marks]**
- d) State the four factors that determine the average grade of service of a network. **[2 marks]**
- e) A PBX has 4 operators and receives 300 calls during the busy hour. The average holding time is 36sec. Assume that calls arrivals are Poissonian and service time is negative exponential distribution. Determine:
- i. The percentage of calls on calls on queue
 - ii. Average delay
 - iii. Percentage of call delays for more than 45 sec **[6marks]**
- f) The maximum calls per hour in a mobile cell equals 4000 and the average call holding time is 160 seconds. If the GOS is 2%, determine;
- i. Offered load
 - ii. Number of service channels required to handle the load **[4marks]**
- g) When dimensioning a route we need to determine the number of trunks or circuits that serve the route, several formulae are available among them are Binomial and Poisson, state them and assumptions and assumptions made in their use. **[6 marks]**

QUESTION TWO

- a) Distinguish between a tandem and transit switch **[2 marks]**
- b) With the aid of diagrams distinguish between a full availability switch and a limited availability switch **[4 marks]**
- c) A three stage non-blocking crosspoint switching network has 50 inputs and 50 outputs. Determine the:
- i. Minimum number of cross points required to implement this network
 - ii. Number of cross points required for a single stage 50x50 cross point switch
 - iii. Percentage saving in cross points achieved by using three stage network **[5 marks]**
- d) If the traffic offered is 0.9 TU determine :
- (i) The lost traffic
 - (ii) The grade of service provided by five switches arranged in full availability. **[4 marks]**
- e) With the aid of an appropriate diagram, explain the operation of space-division switching technology. **[5 marks]**

QUESTION THREE

- a) Briefly explain the following terms as used in public telecommunication networks
- (i) Subscribers
 - (ii) Local loop **[2 marks]**

- b) State **TWO** advantages and disadvantages of the LANS and WANS. **[4 marks]**
- c) If 1000 subscribers originate 60 Erlangs of traffic in the busy hour of a telephone exchange with an average holding time of 2.4 minutes:
- Calculate the busy hour calling rate per subscriber
 - If these subscribers lose 20 calls in the busy hour, calculate the grade of service **[4marks]**
- d) Network topology determines factors that affect a network enumerate these factors **[4 marks]**
- e) Consider the processor of a packet router in a packet switched data network. Traffic consists of data packets to be processed. Assume a pure waiting system model with a single server. New packets arrive according to Poisson process at the rate 2000 packets/second and packet processing times are mean 0.4ms. Determine the:
- Traffic load
 - Probability that a packet will wait longer than 2ms. **[4 marks]**
- f) Explain briefly the lost calls held (LCH) and the lost calls cleared(LCC) concept **[2marks]**

QUESTION FOUR

- a) Using a well labeled diagram, briefly describe the tree topology of a computer network. **[5 marks]**
- b) Explain with the aid of a sketch the difference between Pure Aloha and Slotted Aloha protocols **[4 marks]**
- c) The traffic offered to a full availability group of six trunks is 3 Erlangs. The average call holding time is 3 minutes. Determine:
- The average number of calls offered during hour
 - Grade of service (Assuming sequential testing)
 - The probability of no calls being offered during any specified 3 minute period (Assume Poisson distribution for the incidence of calls) **[6 marks]**
- d) Explain any three reasons why packet switching is preferred over circuit switching in data communication. **[3 marks]**
- e) In packet switching, differentiate between datagram approach and virtual circuit approach. **[2 marks]**

QUESTION FIVE

- a) State the **Erlang B** probability distribution formula **[2 marks]**
- b) Explain what the probability in (a) signifies and explain under which circumstances it would be unrealistic to use the probability distribution **[5 marks]**
- c) Define the mean of the offered traffic and its relationship with the average arrival rate and the average holding time of the system **[4 marks]**
- d) Two Erlangs are presented to five channels of a communication system. If the average message duration is 2 minutes calculate the average number of message handled per hour **[4 marks]**

- e) Determine the probability of the channels in (d):
- i. Being Idle
 - ii. Having three channels being occupied and
 - iii. The proportion of lost traffic

[5 marks]