TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY EXAMINATIONS FOR DEGREE IN
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 2520: TELETRAFFIC ENGINEERING

END OF SEMESTER EXAMINATIONS
SERIES: APRIL 2014
TIME: 2 HOURS

INSTRUCTIONS:

– This paper has **FIVE** questions
– Answer question **ONE** and any other **TWO** questions.
This paper consists of Four printed pages

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QUESTION 1 (Compulsory)

a)   Define the following terms with respect to traffic studies:
   i. Busy hour
   ii. Availability
   iii. Blocking
   iv. Traffic   **(4 marks)**

b)   State FOUR factors that determine the average grade of service of a network.   **(4 marks)**

c)   With the aid of a well labelled diagram, explain the main components of public switched telephone network (PSTN).   **(4 marks)**

d) If 1000 subscribers originate 60 Erlangs of traffic in the busy hour of a telephone switch with an average holding time of 2.4 minutes
   i. Determine the busy hmr calling rate per subscriber.
   ii. If these subscribers lose 30 calls in the busy hour, calculate the grade of service. **(4 marks)**

e) Based on the Erlang β formula and given a BH requirement for a grade of service of 0.001 and BH traffic intensity of 25 Erlangs on a certain traffic relation, determine:
   i. The number of trunks required
   ii. Perform the same exercise but use poisson tables to determine the number of trunks required.
   (4 marks)

f) Define the term signaling as applied to the PSTN network. **(2 marks)**

g) A traffic load if one Erlang is offered to a full availability group of three channels. The average call duration is two minutes:
   i. Determine the average number of calls per hour
   ii. Determine the probability that no calls are offered during a specified period of TWO minutes.
   iii. Determine the properties of lost traffic
   iv. Determine the average number of calls lost per hour. **(8 marks)**

QUESTION 2

a) Explain briefly the following terms as used in public telecommunication networks:
   i. End office
   ii. Subscriber
   iii. Tandem switch
   iv. Queueing

b) Define the term network topology and name FOUR factors that affect a network. (4 marks)

c) Give TWO advantages and TWO disadvantages of
   i. A local area Network (LAN)
   ii. Wide Area Network (WAN)

d) The traffic offered to a full availability group of six trunks is 3 Erlangs. The average call holding time is 3 minutes. Determine
   i. The average number of calls offered during one hour.
   ii. The traffic carried by the first trunk
   iii. Grade of service (Assume sequential testing)
   iv. The probability of no calls being offered during any specified 3 minute period (Assume Poisson distribution for the incidence of calls. **(8 marks)**

QUESTION 3

a) Using a well labelled diagram, briefly describe the tree topology of a computer network. **(5 marks)**

b) Explain **TWO** advantages which the tree topology has over the star topology. **(2 marks)**

c) In computer, briefly describe the functions of the protocols at the sending and receiving computers.
(4 marks)

d) Give and explain **THREE** reasons why packet switching is preferred over circuit switching in data communication. **(3 marks)**

e) In packet switching, differentiate between datagram and virtual circuit approach. **(2 marks)**

f) 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 rate 2000 packets/second and packet processing times are mean 0.4 ms. Determine the:
i. Traffic load
ii. Probability that a packet has to wait longer than 2ms. **(4 marks)**

QUESTION 4

a) Explain how understand by circuit switching network. **(2 marks)**

b) In circuit switching, generally for communication to occur, **THREE** steps are involved, state and explain these steps with the aid of a diagram. **(4 marks)**

c) The traffic offered to **FIVE** switches arranged in full availability is 0.9TV. determine the:
i. Lost traffic
ii. Grade of service provided by **FIVE** switches arranged in full availability. **(4 marks)**

d) With the aid of a diagram explain the operation of space division switching. **(5 marks)**

e) A three stage non-blocking crosspoint switching network has 50 input and 50outputs.
i. Calculate the minimum of crosspoints required to implement this network.
ii. Determine many crosspoints would be required for a single stage 50 x 50 crosspoint switch.
iii. Determine percentage saving in crosspoints can be achieved by using a three stage network.
(5 marks)

QUESTION 5

a) i) State the Erlang β probability distribution formulae. **(2 marks)**
ii) Explain what the probability signifies and explain under what **FOUR** circumstances it would be unrealistic to use the probability distribution.
iii) Define the mean of the offered traffic and its relationship with the average arrival rate and the average holding time of the system. **(2 marks)**

b) A traffic load of TWO Earlangs is offered to a full availability group of five channels. The average call duration is three minutes. Determine:
   i. The average number of calls offered per hour
   ii. The probability that no calls are offered during a specified five minute period
   iii. The grade of service
   iv. How much traffic is carried by each network if the channels are always tested sequentially in the same order?