NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Faculty of Computing and Informatics

Department of Computer Science

QUALIFICATION: BACHELOR OF COMPUTER SCIENCE HONOURS	
QUALIFICATION CODE: 08BCHC	**LEVEL: 8**
COURSE: MOBILE NETWORKS AND ARCHITECTURES	**COURSE CODE: MNA810S**
DATE: JULY 2023	**SESSION: 1**
DURATION: 3 HOURS	**MARKS: 100**

SECOND OPPORTUNITY/ SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER(S)	**PROF DHARM SINGH JAT**
MODERATOR:	**DR LINOH MAGAGULA**

THIS QUESTION PAPER CONSISTS OF FOUR PAGES
(Excluding this front page)

INSTRUCTIONS

1. Write clearly and neatly.
2. Write all your answers in the answer booklet provided.
3. Number the answers clearly.
4. This paper consists of two sections; Section A and B.
5. Answer ALL questions in section A.
6. Answer any 3 questions in section B.
7. Begin each section on a new page.
8. Marks/scores per question are given in [ ].
9. Do not use or bring into the examination venue books, programmable calculators, mobile devices and other material that may provide you with unfair advantage. Should you be in possession of one right now, draw the attention of the examination officer or invigilator.
10. NUST's examination rules and regulations apply.

SECTION A
[40Marks]

SECTION A ***[40Marks]***
*This section contains **TWO** questions.*
*Attempt **ALL** questions.*

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*Attempt **ALL** questions.*

Q1 Choose the correct answer for each of the following multiple-choice questions.
[20 marks, 2 marks for each]

(i). What is an access point (AP) in a wireless LAN?

A. device that allows wireless devices to connect to a wired network
B. wireless devices itself
C. both (A) and (B)
D. none of the mentioned.

(ii). What is the Normalised repeat distance when a cluster size in a cellular topology is 13:

A. 6.5
B. 13.0
C. 3.6
D. 2.0

(iii). The shape of the cellular region for maximum radio coverage is

A. circular
B. square
C. oval
D. hexagon.

(iv). Which of the following is a component of a 3G network architecture?

A. User Equipment (UE)
B. Radio Access Network (RAN)
C. Core Network
D. All of the options

(v). 3G W-CDMA is also known as

A. UMTS
B. DECT
C. DCS-1800
D. ETACS

(vi). IMSI stands for?

A. Internet Mobile Subscriber Identity
B. International Mobile Subscriber Identity
C. International Mobile Subscriber Identification
D. International Mobility Subscriber Identity

(vii). A wireless network uses ___ waves to transmit signals.

A. Mechanical
B. Radio
C. Sound
D. Water

(viii). Which multiple access technique is used by IEEE 802.11 standard for wireless LAN?

A. CDMA
B. CSMA/CA
C. ALOHA
D. None of the mentioned.

(ix). What causes fading of the received radio signals in a mobile communication environment?

A. Direct propagation
B. Multipath Propagation
C. Bi-path Propagation
D. None of the above

(x). Which of the following is part of a BSS (Base Station Subsystem) in a GSM network?

A. BTS - Base Transceiver Station
B. BSC - Base Station Controller
C. BTS and BSC
D. None

Q2 (i). Write two functions of the Mobility Management (MM) protocol in UMTS. [4]

(ii). Write two functions of the eNB in E-UTRAN systems. [4]

(iii). What is the difference between LTE FDD and LTE TDD? [4]

(iv). Why is Temporary Mobile Subscriber Identity (TMSI) required when we have an international mobile subscriber identity (IMSI)? [4]

(v). Explain how CSMA/CA solves the Hidden and exposed terminals problems. [4]

SECTION B ***[60Marks]***

This section contains ***FOUR*** *questions*

Attempt any ***THREE*** *questions.*

Q3 a) A TDMA/FDD-based GSM cellular system has a band of 25 MHz for the forward link, divided into radio channels of 200 kHz each. Suppose eight speech channels (time slots) are supported on a single radio channel. Calculate the maximum number of simultaneous subscribers that can be accommodated in the GSM system. [8]

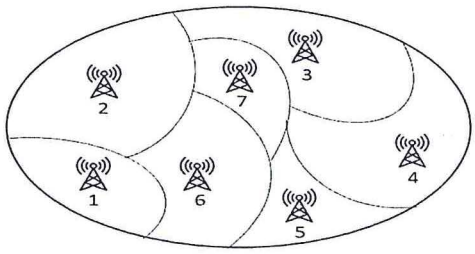
b) The GSM System uses a frame structure where each frame consists of eight-time slots and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find:

a. Time duration of a bit [3]
b. Time duration of a slot [3]
c. Time duration of a frame [3]
d. How long must a user occupy a single slot and wait between two simultaneous transmissions? [3]

Q4 a) Consider a cellular system in which the total available voice channels to handle the traffic are 960. The area of each cell is 6 $km^{2,}$ and the total coverage area of the system is 2000 km^2. Calculate:

(a) The system capacity in terms of total number of channels if the cluster size N is 4 [4]
(b) The system capacity in terms of total number of channels if the cluster size is 7. [4]
(c) How many times would a cluster of size 4 have to be replicated to cover the entire cellular area? Does decreasing N increase the system capacity? Explain. [4]

b) Consider two scenarios: 1. A simple high-power transmitter that can support 100 voice channels covering a given service area. 2. Let the service area be divided into seven smaller area cells, as shown in figure below, each supported by a lower power transmitter. The available spectrum of 100 voice channels is divided into four groups of 25 channels each. The cells (1,7), (2,4), (3,5) and 6 are assigned distinct four channel groups. Show that the total number of channels that can be supported by the second scenario is enhanced to 175 to cover the same service area as the first scenario. [8]



Q5 a) If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of duplex channels available per cell if the system uses:

(i). four-cell reuse [3]
(ii). seven-cell reuse, and [3]
(iii). 12-cell reuse. [4]

b) A total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the three systems. [3] [3] [4]

(i). four-cell reuse
(ii). seven-cell reuse, and
(iii). 12-cell reuse.

Q6 a) With the help of an appropriate diagram, explain the basic steps of Mobile originated call (MOC). [8]

b) With the help of an appropriate diagram discuss how Encryption is achieved in a GSM network. [6]

c) What is the difference between LTE FDD and LTE TDD? [6]

GO***OD LUCK!***