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: JUNE 2023	SESSION: 1
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY 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]*

*This section contains **TWO** questions.*
*Attempt **ALL** questions.*

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

   (i).   At what frequencies do Wi-Fi radios make transmissions?

            A. 3.5 GHz or 7.2 GHz
            B. 2.4 GHz or 5.5 GHz
            C. 2.0 GHz or 6.5 GHz
            D. 3.0 GHz or 8.2 GHz

   (ii).   What is an Uplink in a Cellular network?

            A. Sending of data from Base Station to Mobile
            B. Sending of data from Mobile to the Base Station
            C. Sending of data from Base Station to Base Station
            D. None

   (iii). The area covered by one Transmitter in a GSM network is called _____?

            A. Licensed area
            B. Octagon
            C. Cell
            D. Yard

   (iv). A group of Cells is called _____ ?

            A. BSC
            B. BTS
            C. Cluster
            D. Atom

   (v).   Which of the following wireless standards has the highest maximum data
          rate?
            A. 802.11n
            B. 802.11b
            C. 802.11a
            D. 802.11g.

   (vi). In wireless distribution system
            A. multiple access points are inter-connected with each other.

B. there is no access point.

C. only one access point exists.

D. none of the mentioned.

(vii). 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

(viii). What is the interface between RNC and SGSN?

A. Lu

B. Lc

C. Lm

D. None

(ix). How many OFDM symbols are available in one Time slot in Normal CP and Extended CP in Time-domain in LTE E-UTRAN Frame Structure ?

A. Four OFDM symbols in Normal CP and three OFDM symbols in Extended CP

B. Five OFDM symbols in Normal CP and four OFDM symbols in Extended CP

C. Six OFDM symbols in Normal CP and six OFDM symbols in Extended CP

D. Seven OFDM symbols in Normal CP and six OFDM symbols in Extended CP

(x). If the frequency of a radio wave is 5.0 GHz, what is the wavelength of the wave (velocity of light=3×10^8m/s)?

A. 66 meters

B. 16.3 millimeters

C. 60 millimeters

D. None of the option

Q2 (i). Explain why the traditional IP addressing scheme cannot be used in a mobile network. [4]

(ii). Explain the hand-off mechanism in mobile communications. [4]

(iii). Explain two functions of the Physical layer in a wireless and mobile environment. [4]

(iv). Explain Time Division Multiplexing. [4]

(v). Explain Multi-path propagation. [4]

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SECTION B   [60Marks]
This section contains **FOUR** questions
Attempt any **THREE** questions.

Q3   A particular cellular system has the following characteristics: cluster size
=7, uniform cell size, user density=100 users/sq km, allocated frequency
spectrum = 900-949 MHz, bit rate required per user = 10 kbps uplink and
10 kbps downlink, and modulation code rate = 1 bps/Hz.

   a)   (i.) How much bandwidth is available per cell using FDD?   [5]
            (ii.) How many users per cell can be supported using FDMA?   [5]
            (iii.) What is the cell area?   [5]

   b)   If the available spectrum per cell is divided into 35 channels and TDMA is   [5]
         employed within each channel:
         What is the bandwidth and data rate per channel?

Q4 a)   With the help of an appropriate diagram, explain the basic steps of Mobile
         terminated call (MTC) i.e., needed to connect a calling station with a   [12]
         mobile user when the calling station is outside the GSM network.

    b)   Assume a spectrum of 480 kHz is allocated over a base frequency for
         communication between stations A and B.

            (i)   Divide the entire bandwidth into four subbands.   [4]

            (ii) Why do we divide the entire bandwidth into sub-bands?   [2]

            (iii) Should we allocate a guard band? Why?   [2]

Q5 a)   Write three differences between UTRAN and eUTRAN.   [6]

    b)   Calculate the maximum distance between the cell site and mobile if the   [6]
         Guard time is 123 µs, and the electromagnetic radio waves propagate at
         the speed of light (c= 3×10^5 km/s).

    c)   Sketch and explain E-UTRAN architecture.   [8]

Q6 a)   With the help of an appropriate diagram, discuss how authentication is   [6]
         achieved in a GSM network.

    b)   Give two advantages and two disadvantages of wireless LANs.   [4]

    c)   In LTE E-UTRAN Frame Structure   [10]

            (a). How many numbers of samples per second in LTE FDD is a full-
                 duplex system

(b). How many Sub-frame are present in a single Frame-Structure, and what is the size of each Sub-Frame in time-domain?

(c). How many Time-Slot are present in Sub-Frame?

(d). What is Cyclic Prefix(CP) in Frame-Structure?

(e). How many OFDM symbols are available in 1 Time slot in Normal CP and Extended CP? In Time-domain?

GOOD LUCK!