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 2019	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.

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). Which of the following is the world's first cellular system to specify digital modulation and network level architecture?
    a) GSM
    b) AMPS
    c) CDMA
    d) IS-54

(ii). Which of the following memory device stores information such as subscriber's identification number in GSM?
    a) Register
    b) Flip flop
    c) SIM
    d) SMS

(iii). Which of the following does not come under subsystem of GSM architecture?
    a) BSS
    b) NSS
    c) OSS
    d) Channel

(iv). Which of the following subsystem provides radio transmission between mobile station and MSC?
    a) BSS
    b) NSS
    c) OSS
    d) BSC

(v). What is the responsibility of MSC in cellular telephone system?
    a) Connection of mobile to base stations
    b) Connection of mobile to PSTN
    c) Connection of base station to PSTN
    d) Connection of base station to MSC

(vi). What is the shape of the cell present in the cellular system?
    a) Circular
    b) Square
    c) Hexagonal
    d) Triangular

(vii). Why the size of the cell is kept small in cellular network?
  a) Increase capacity
  b) Decrease capacity
  c) Increased size of base station electronics
  d) Slow process of handoffs

(viii). What is handoff?
  a) Forward channel
  b) Switching technique
  c) Roamer
  d) Guard channel

(ix). Which is one of the disadvantages of 2G standards?
  a) Short Messaging Service (SMS)
  b) Digital modulation
  c) Limited capacity
  d) Limited Internet Browsing

(x). Which of the following is not a standard of 3G?
  a) UMTS
  b) Cdma2000
  c) TD-SCDMA
  d) LTE

Q2 (i). Assume a spectrum of 480 KHz is allocated over a base frequency for communication between station A and B.

  (i) Divide the entire bandwidth into 4 sub bands. [4]

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

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

(ii). Explain Multi-path propagation? [4]

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

- one mark for each advantage
- one mark for each disadvantage

(iv). Describe frequency division multiplexing techniques in wireless communication. [4]

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 is divided into 35 channels and TDMA is   [5]
           employed within each channel:
           What is the bandwidth and data rate per channel?

Q4   Windhoek city has an area of 5,133 km² and is covered by a cellular system using a seven-cell (hexagon) reuse pattern. Each cell has a radius of four (04) kilometers and the city is allocated 20 MHz of spectrum with a full duplex channel bandwidth of 50 kHz. Assume a GOS of 2% for an Erlang B system is specified. If the offered traffic per user is 0.02 Erlangs.
     For number of channels =57 and 2%GoS, traffic intensity that can be supported per cell is 46.82 Erl.

     Compute:
            (a). the number of cells in the service area,   [4]
            (b). the number of channels per cell,   [4]
            (c). the maximum carried traffic,   [4]
            (d). the total number of users that can be served for 2% GoS,   [4]
            (e). the number of mobiles per unique channel (where it is understood that   [4]
                 channels are reused).

Q5   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 mobile   [12]
           user when the calling station is outside the GSM network or another mobile
           station.
           [Each correct steps = 1 Mark]

     b)   With the help of an appropriate diagram discuss how authentication is
           achieved in a GSM network.

           [Correct event in diagram   = 1Mark]
                                                                                                                [8]
           [Correct statements =1Mark]

Q6   a)   Describe how CSMA/CA solves the Hidden and Exposed terminals problems.   [6]

b)   (i)   Of the following, what values are possible for a cluster size in a
             cellular topology?   Assume a hexagonal geometry: 5, 8, 11, 13, 20,   [4]
             21   [5]
     (ii) Why?   [5]
     (iii) What is the Normalised repeat distance for the possible values in (i)?

GOOD LUCK