

**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 2022	SESSION: 1
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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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.
5. 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). A wireless network uses ___ waves to transmit signals.
 - A. Mechanical
 - B. Sound
 - C. Radio
 - D. Water
 - (ii). Five channels, each with a 100 kHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference?
 - A. 550 kHz
 - B. 540 kHz
 - C. 560 kHz
 - D. 500 kHz
 - (iii). Which multiple access technique is used by IEEE 802.11 standard for wireless LAN?
 - A. CDMA/CA
 - B. CSMA
 - C. ALOHA
 - D. None of the mentioned
 - (iv). In wireless LAN, there are many hidden stations, so we cannot detect the
 - A. Frames
 - B. Collision
 - C. Signal
 - D. Data
 - (v). What is the name of the database that stores subscriber information and the services that the subscriber is eligible to use under an MSC ?
 - A. MSC
 - B. AuC
 - C. EIR
 - D. HLR
 - (vi). In LTE E-UTRAN Frame Structure, the number of timeslots present in one Sub-Frame is:
 - A. Five
 - B. Three
 - C. Four
 - D. Two

- (vii). Which of the following is the world's first cellular system to specify digital modulation and network-level architecture?
- GSM
 - AMPS
 - CDMA
 - IS-54
- (viii). 3G W-CDMA is also known as
- UMTS
 - DECT
 - DCS-1800
 - ETACS
- (ix). What is the interface between NodeB and RNC in a WCDMA network?
- Luc
 - Lub
 - Lud
 - Lue
- (x). Which of the following is a component of a 3G network architecture?
- User Equipment (UE)
 - Radio Access Network (RAN)
 - Core Network
 - All the above options

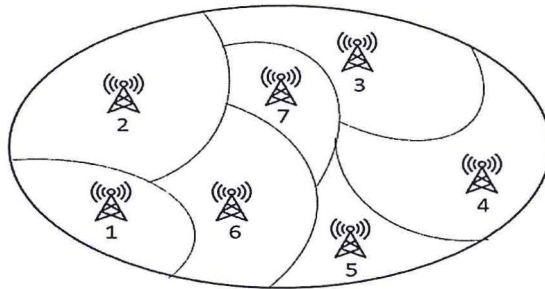
- Q2 (i). Assume a spectrum of 480 kHz is allocated over a base frequency for communication between station A and B.
- Divide the entire bandwidth into 4 sub-bands. [4]
 - Why do we divide the entire bandwidth into sub-bands? [2]
 - Should we allocate a guard band? Why? [2]
- (ii). What is the wavelength if frequency of a radio wave is (a) 15 kHz (b) 30 kHz (c) 1.5 MHz, and (d) 6 GHz? [4]
- (iii). Give two advantages and two disadvantages of wireless LANs. [4]
- one mark for each advantage
- one mark for each disadvantage
- (iv). Why is Temporary Mobile Subscriber Identity (TMSI) required when we have an international mobile subscriber identity (IMSI)? [4]

SECTION B [60Marks]

This section contains **FOUR** questions

Attempt any **THREE** questions.

- Q3 a) Describe how CSMA/CA solves the Hidden and Exposed terminals [6]
problems.
- 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
- (ii) Why are there specific possible values for a cluster size? [5]
- (iii) What is the normalized repeat distance for the possible values in (i)? [5]
- Q4 (a) With the help of an appropriate diagram, explain the basic steps of [10]
Mobile originated call (MOC).
- (b) Consider a simple high-power transmitter that can support 100 voice [10]
channels covering a given service area. Let the service area be divided into
seven smaller area cells, as shown in the figure below, each supported by
lower power transmitters. The available spectrum of the 100 voice
channels is divided into 4 groups of 25 channels each. The cells (1,7) (2,4)
(3,5) and 6 are assigned distinct four channel groups.



What is the total number of voice channels the new cellular networks can carry? Explain your answer.

- Q5 a) With the help of an appropriate diagram discuss how Encryption is [8]
achieved in a GSM network.
[Correct event in diagram = 1 mark]
[Correct statements =1 mark]

b) In a full-rate TDMA system used in United States Digital Cellular (USDC) IS-54 standard the

- duration of a TDMA voice frame = 40 ms
- number of time slots in a frame = 6
- number of bits in a voice frame = 1944
- Number of bits in guard band = 6

Calculate

- a) the duration of a time slot of a voice frame [3]
b) the number of bits in a time slot of a voice frame [3]
c) the duration of a bit [3]
d) the duration of guard time [3]

Q6 a) What is the difference between LTE FDD and LTE TDD? [6]

b) In LTE E-UTRAN Frame Structure

- (i). How many samples per second is full-duplex system in LTE FDD? [2][4
(ii). How many Sub-frames are present in single Frame-Structure, and]
what is the size of each Sub-Frame in time-domain? [2]
(iii). How many time-slots are present in a Sub-Frame? [2]
(iv). What is Cyclic Prefix (CP) in a Frame-Structure? [4]
(v). How many OFDM symbols are available in 1 time slot in Normal CP
and Extended CP?

GOOD LUCK!