NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

## FACULTY OF COMPUTING AND INFORMATICS

### DEPARTMENT OF COMPUTER SCIENCES

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| **QUALIFICATION: BACHELOR OF COMPUTER SCIENCE** | |
| **QUALIFICATION CODE: 07BCCS & 07BACS** | **LEVEL: 7** |
| **COURSE CODE: WLT620S** | **COURSE NAME: WIRELESS TECHNOLOGIES** |
| **SESSION: NOVEMBER 2023** | **PAPER: 1** |
| **DURATION: 3 HOURS** | **MARKS: 100** |

| **FIRST OPPORTUNITY EXAMINATION QUESTION PAPER** | |
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| **EXAMINER(S)** | **PROF DHARM SINGH JAT** |
| **MODERATOR:** | **MS LOINI IIYAMBO** |

**INSTRUCTIONS**

1. Answer ALL the questions in section A and any THREE questions in section B.
2. Read all the questions carefully before answering.
3. Number the answers clearly
4. NUST's examination rules and regulations apply.

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

***SECTION A*** ***[40Marks]***

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

Q1 Choose the correct answer for each of the following multiple-choice question
[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). A group of Cells is called ____ ?

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

(iii). Which of the following wireless standards has the highest maximum data rate?

A. 802.11n
B. 802.11b
C. 802.11a
D. 802.11g.

(iv). 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.

(v). 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.

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

A. circular
B. square

C. oval
D. hexagon.

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

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

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

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

(ix). 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.

(x). 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

Q2 (i). Explain two functions of the Physical layer in a wireless and mobile environment. [4]

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

(iii). Describe Multi-path propagation. [4]

(iv). What is Wi-Fi Protected Access 2 (WPA2)? [4]

(v). If the frequency of a radio wave is 30 GHz, what is the wavelength of the wave (velocity of light=$3x10^8$m/s)? [4]

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

*This section contains **FOUR** questions*

*Attempt any **THREE** questions.*

Q3 a) 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.

(i.) How much bandwidth is available per cell using FDD? [5]

(ii.) How many users per cell can be supported using FDMA? [5]

b) Assume a spectrum of 960 KHz is allocated over a base frequency for communication between station A and B. [4]

(i) Divide the entire bandwidth into 4 sub bands. [3]

(ii) Why do we divide the entire bandwidth into sub-bands? [3]

(iii) Should we allocate a guard band? Why?

Q4 a) Calculate the maximum distance between the cell site and mobile if the Guard time is 123 μs and the electromagnetic radio waves propagate at the speed of light (c= $3x10^5$ km/s). [10]

b) Draw and explain the following Mode in Wireless Networking: [10]

(i) Infrastructure Mode and

(ii) Ad-Hoc mode

Q5 a) Why does wireless networking use CSMA/CA instead of CSMA/CD? Explain. [10]

b) Describe how a man-in-the-middle attack may be performed on a Wi-Fi network and the consequences of such an attack. [10]

Q6 a) (i) Of the following, what values are possible for a cluster size in a cellular topology?
Assume a hexagonal geometry: Assume a hexagonal geometry: 5, 8, 11, 13, 20, 21. [2]

(ii) Explain your answer in (i). [4]

(iii) What is the Normalised repeat distance for the possible values in (i)? [4]

b) With the help of a suitable diagram explain the following inter-frame spacing: [10]

- Short inter-frame spacing (SIFS)
- PCF inter-frame spacing (PIFS)
- DCF inter-frame spacing (DIFS)

***GOOD LUCK!***