NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Faculty of Computing and Informatics

Department of Computer Science

QUALIFICATION : BACHELOR OF COMPUTER SCIENCE	
QUALIFICATION CODE: 07BCCS & 07BACS	**LEVEL: 7**
COURSE: WIRELESS TECHNOLOGIES	**COURSE CODE: WLT620S**
DATE: NOVEMBER 2024	**SESSION: 2**
DURATION: 3 HOURS	**MARKS: 100**

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

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 ***[40 Marks]***

*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). In which layer do Wireless LANs implement security measures?
   A. System Layer
   B. Data Link Layer
   C. Sub Layer
   D. Multi-Layer

(ii). Which of the following multiple access techniques allocates different time slots for the different users?
   A. TDMA
   B. CDMA
   C. FDMA
   D. FGMA

(iii). 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

(iv). What is a cluster in a cellular system?
   A. Group of frequencies
   B. Group of cells
   C. Group of subscribers
   D. Group of mobile systems

(v). An administrator receives reports from users in an office that their 802.11 wireless connectivity has been problematic since the installation of the new wireless phone system. At which of the following frequencies are both systems operating at to cause this issue?
   A. 2.4GHz
   B. 900MHz
   C. 1.1GHz
   D. 6.0GHz

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

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

(vii). 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

(viii). In wireless LAN, there are many hidden stations so we cannot detect the

A. Frames
B. Collision
C. Signal
D. Data

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

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

(x). In Bluetooth technology, radio waves can communicate with other Bluetooth devices up to the range of :

A. 60-100 feet
B. 15-50 feet
C. 100-120 feet
D. None of the above

Q2 (i). What is wireless communications? Explain. [4]

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

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

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

(iv). What is the use of Tethering (Hotspot) in Wireless Networks? [4]

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

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

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

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

Q3 a) Assume a spectrum of 960 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]

b) What is the wavelength if frequency of a radio wave is (a) 15KHz (b) 1.5MHz, and (c) 6GHz? [6]

c) Describe the hidden node problem in wireless network using a diagram? [6]

Q4 a) What is Multi-path propagation? Explain. [4]

b) (i) Of the following, what values are possible for a cluster size in a cellular topology? Assume a hexagonal geometry: 2, 4, 5, 6, 8, 9, 12, 19, 20 [4]

(ii) Explain your answer in (i). [6]

(iii) What is the Normalised repeat distance for the possible values in (i)? [6]

Q5 a) If a total of 36 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 channels available per cell if a system uses:

(i). four-cell reuse [3]

(ii). nine-cell reuse, and [3]

(iii). 12-cell reuse [4]

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

- duration of a TDMA voice frame = 40ms
- 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 [2]

d) the duration of guard time [2]

Q6 a) Draw and explain the Infrastructure wireless local area network (LAN) architecture. [10]

b) i. Explain a Man-In-The-Middle (MITM) attack; use diagrams to aid your explanation. [7]

ii. Explain also why an attacker may perform the MITH attack. [3]

GOOD LUCK!