



**PAMIBIA UNIVERSITY**  
**OF SCIENCE AND TECHNOLOGY**  
**Faculty of Computing and Informatics**

Department of Computer Science

<b>QUALIFICATION: BACHELOR OF COMPUTER SCIENCE HONOURS</b>	
<b>QUALIFICATION CODE: 08BCHC</b>	<b>LEVEL: 8</b>
<b>COURSE: MOBILE NETWORKS AND ARCHITECTURES</b>	<b>COURSE CODE: MNA810S</b>
<b>DATE: JUNE 2025</b>	<b>SESSION: 1</b>
<b>DURATION: 3 HOURS</b>	<b>MARKS: 100</b>

<b>FIRST OPPORTUNITY EXAMINATION QUESTION PAPER</b>	
<b>EXAMINER(S)</b>	<b>PROF DHARM SINGH JAT</b>
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**THIS QUESTION PAPER CONSISTS OF THREE 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). In which multiplexing technique are multiple signals transmitted by sharing the same frequency at different time intervals?
    - A. FDM
    - B. TDM
    - C. Wavelength Division Multiplexing
    - D. Code Division Multiplexing
  - (ii). Which multiplexing method is generally more efficient in systems where users transmit in bursts?
    - A. TDM
    - B. FDM
    - C. Frequency Hopping
    - D. None of the above
  - (iii). What is the Normalised repeat distance when a cluster size in a cellular topology is 13:
    - A. 6.5
    - B. 13.0
    - C. 3.6
    - D. 2.0
  - (iv). What is the bandwidth of a GSM channel?
    - A. 100 kHz
    - B. 150 kHz
    - C. 200 kHz
    - D. 250 kHz
  - (v). 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
  - (vi). 3G W-CDMA is also known as
    - A. UMTS
    - B. DECT
    - C. DCS-1800
    - D. ETACS

- (vii). Which multiple access technique is primarily used in 4G?  
 A. FDMA  
 B. TDMA  
 C. CDMA  
 D. OFDMA
- (viii). Which of the following technologies is 6G expected to rely heavily on?  
 A. Circuit switching  
 B. Analog Modulation  
 C. Artificial Intelligence (AI) and Machine Learning  
 D. Morse Code Signaling
- (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). Which of the following is part of a BSS (Base Station Subsystem) in a GSM network?  
 A. BTS - Base Transceiver Station  
 B. BSC - Base Station Controller  
 C. BTS and BSC  
 D. None
- Q2 (i). Write two functions of the Mobility Management (MM) protocol in UMTS. [4]
- (ii). Write two functions of the eNB in E-UTRAN systems. [4]
- (iii). Give two advantages and two disadvantages of wireless LANs. [4]
- (iv). Why is Temporary Mobile Subscriber Identity (TMSI) required when we have an International Mobile Subscriber Identity (IMSI)? [4]
- (v). Explain how CSMA/CA solves the Hidden and exposed terminals problems. [4]

**SECTION B [60Marks]**

*This section contains FOUR questions*

*Attempt any THREE questions.*

- Q3 a) A TDMA/FDD-based GSM cellular system has a band of 25 MHz for the forward link, divided into radio channels of 200 kHz each. Suppose eight speech channels (time slots) are supported on a single radio channel. Calculate the maximum number of simultaneous subscribers that can be accommodated in the GSM system. [4]

- b) The GSM System uses a frame structure where each frame consists of eight-time slots and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find:
- a. Time duration of a bit [4]
  - b. Time duration of a slot [4]
  - c. Time duration of a frame and [4]
  - d. How long must a user occupy a single slot and wait between two simultaneous transmissions? [4]
- Q4 a) With the help of an appropriate diagram, explain the basic steps of Mobile originated call (MOC) in a GSM network. [8]
- b) With the help of an appropriate diagram discuss how Encryption is achieved in a GSM network. [6]
- c) What is the difference between LTE FDD and LTE TDD? [6]
- Q5 a) If a total of 33 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). seven-cell reuse, and [3]
  - (iii). 12-cell reuse. [3]
- b) What is 6G, and how does it differ from 5G technology? Provide four key differences. [11]
- Q6 a) Draw and explain the three main parts of 5G Network Architecture. [10]
- b) Draw and explain the 3GPP security architecture for 5G. [10]

**GOOD LUCK!**