



PAMIBIA 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: JULY 2025	SESSION: 1
DURATION: 3 HOURS	MARKS: 100

SECOND OPPORTUNITY/ SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER(S)	PROF DHARM SINGH JAT
MODERATOR:	DR LINOH MAGAGULA

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). What is an Uplink in a Cellular network?
 - A. Sending of data from Base Station to Mobile
 - B. Sending of data from Mobile to the Base Station
 - C. Sending of data from Base Station to Base Station
 - D. None
- (ii). 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
- (iii). 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
- (iv). How many OFDM symbols are available in one Time slot in Normal CP and Extended CP in an LTE E-UTRAN Frame Structure?
 - A. Four OFDM symbols in Normal CP and three OFDM symbols in Extended CP
 - B. Five OFDM symbols in Normal CP and four OFDM symbols in Extended CP
 - C. Six OFDM symbols in Normal CP and six OFDM symbols in Extended CP
 - D. Seven OFDM symbols in Normal CP and six OFDM symbols in Extended CP
- (v). If the frequency of a radio wave is 5.0 GHz, what is the wavelength of the wave (velocity of light= 3×10^8 m/s)?
 - A. 66 meters
 - B. 16.3 millimeters
 - C. 60 millimeters
 - D. None of the options
- (vi). What is the bandwidth of a GSM channel?
 - A. 100 kHz
 - B. 150 kHz

- C. 200 kHz
 - D. 250 kHz
- (vii). Which core technology is used in 3G networks?
- A. OFDMA
 - B. FDMA
 - C. WCDMA
 - D. SC-FDMA
- (viii). Which of the following is NOT a feature of 4G?
- A. IP-based communication
 - B. High latency
 - C. High-speed data transmission
 - D. Support for HD video streaming
- (ix). What is the key target data rate for 6G networks?
- A. 10 Gbps
 - B. 100 Gbps
 - C. 1 Tbps
 - D. 100 Mbps
- (x). Which technologies are not expected to be a core part of 6G?
- A. Intelligent Reflecting Surfaces (IRS)
 - B. Blockchain-enabled security
 - C. Circuit Switching
 - D. Holographic Beamforming

- Q2 (i). Write two differences between UTRAN and eUTRAN? [4]
- (ii). Explain the hand-off mechanism in mobile communications. [4]
- (iii). Explain two functions of the Physical layer in a wireless and mobile environment. [4]
- (iv). Give two advantages and two disadvantages of wireless LANs. [4]
- (v). Explain Multi-path propagation. [4]

SECTION B [60Marks]

*This section contains **FOUR** questions*

*Attempt any **THREE** questions.*

- Q3 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 user when the calling station is outside the GSM network. [12]
- b) With the help of an appropriate diagram discuss how authentication is achieved in a GSM network. [8]

- Q4 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]
 - (iii.) What is the cell area? [5]
- b) If the available spectrum is divided into 35 channels and TDMA is employed within each channel:
What is the data rate per channel? [5]
- Q5 a) Assume a spectrum of 240 kHz is allocated over a base frequency for communication between station A and B.
- (i) Divide the entire bandwidth into 4 sub-bands. [2]
 - (ii) Why do we divide the entire bandwidth into sub-bands? [2]
 - (iii) Should we allocate a guard band? Why? [2]
- b) Calculate the maximum distance between the cell site and mobile if the Guard time is 123 μ s and the electromagnetic radio waves propagate at the speed of light ($c= 3 \times 10^8$ km/s). [6]
- c) Sketch and explain E-UTRAN architecture. [8]
- Q6 a) I. What are the three primary types of network slices defined by 3GPP in 5G networks, and what are their intended purposes? [6]
- II. List at least two practical use cases for each primary network slice type defined by 3GPP in 5G networks. [6]
- b) In LTE E-UTRAN Frame Structure
- (a). What is the number of samples per second in LTE FDD full-duplex system [8]
 - (b). How many Sub-frames are present in a single Frame-Structure, and what is the size of each Sub-Frame in time-domain?
 - (c). How many Time-Slots are present in a Sub-Frame?
 - (d). What is a Cyclic Prefix(CP) in a Frame-Structure?

GOOD LUCK!