THE NELSON MANDELA AFRICAN INSTITUTION OF SCIENCE AND TECHNOLOGY

SEMESTER EXAMINATIONS

SEMESTER II

Mamafnca

SCHOOL OF COMPUTATIONAL AND COMMUNICATION SCIENCE AND ENGINEERING

EMoS 6222: Mobile Telecommunication Technology
Date: 16th March 2020,
Time: 09:00-12:00

1. Maximum allowed time is **3** hours
2. Mobile phones and any data storage devices are not allowed into the examination room
3. Observe all examination regulations
4. Answer any 5 questions of the 7 given questions
5. All answers are to be written in answer book provided

Question 1 (20 marks)

(a) Differentiate between ASK, FSK, PSK. [*3 marks*]
(b) Briefly explain what is QAM and what does 8QAM and 16 QAM means. [*4 marks*]
(c) Differentiate between three common multiple access techniques. [*5 marks*]
(d) Differentiate between FDD and TDD. [*4 marks*]
(e) Briefly explain how FDD/TDD works in 3G. [*4 marks*]

Question 2 (20 marks)

(a) With the help of a block diagram explain an OFDM technology[*6 marks*]
(b) Explain three important stages of obtaining OFDM signal. [*3 marks*]
(c) Name any five technologies which uses OFDM for signal transmission/reception. [5 *marks*]
(d) Briefly explain why OFDM is preffered in dowlink of 4G technology (LTE) and not in its uplink, then differentiate between 4G uplink and uplink technologies. [6 *marks*]

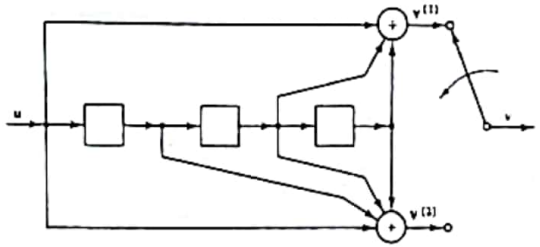
Question 3 (20 marks)

(a) Briefly explain handover and the different available handover schemes. [*5 marks*]
(b) Differentiate between the handover technology employed by 2G and 3G wireless communication systems. [*5 marks*]
(c) It is said that "*5G will have seamless connectivity*" briefly explain the statement. [*5 marks*]

(d) A *company A* is contracted to design, develop and implement the security systems of the NM-AIST. In designing the security systems the company have chosen to use 3D moving cameras with their developed 3D visualization software. You as a consultant to the company, suggest any camera handover criteria which will help the contractor to optimize coverage of their security systems. [*5 marks*]

Question 4 (20 marks)

a) What is channel coding, and briefly explain why it is important for wireless communication systems compared to wired systems. [*4 marks*]
b) Differentiate between block codes and convolutional codes. [*4 marks*]
c) Choose between **i** or **ii**
   i. Find the codeword for (7,4) cyclic Hamming Code using the generator polynomial, $1 + X + X^3$ for the message sequence 0011 [12 Marks]
   ii. Find the output message in the convolution encoder below for an input message sequence 110100 and 010101 [12 Marks]



Question 5 (20 marks)

(a) Describe how antenna works. [4 *marks*]
(b) Differentiate between the two types of directional antenna. [4 *marks*]
(c) Describe how smart antenna works. [*4 marks*]
(d) What happens if someone sets up a pair of antennas that interfere with your point-to-point link between two buildings that use an unlicensed frequency? [*4 marks*]
(e) Briefly discuss why MIMO antenna technology is preferred in advanced communication technologies like 4G and 5G. [*4 marks*]

Question 6 (20 marks)

(a) Define Radio Frequency Identification (RFID) and Near Field Communication (NFC) [2 marks]
(b) Explain the need for RFID. [4 marks]
(c) Describe how RFID or NFC works. [6 marks]
(d) List the components of an RFID or NFC system. [4 marks]
(e) Explain the challenges of RFID [4 marks]

Question 7 (20 marks)

(a) List some commonalities between mobile platform OSs and traditional desktop/laptop OSs. *[4 marks]*
(b) What unique features of mobile devices are typically accessible via APIs by programmers? [4 marks]
(c) List and briefly define the architecture layers of Android. *[4 marks]*
(d) List and briefly define some of the key Android system services. *[4 marks]*
(e) List and briefly define the capabilities provided by Mobile IP. [4 marks]