

College of Electronic Technology - Tripoli  
Department of Communication Engineering

Final Exam: Spring Semester  
Subject Wireless Communication System  
Date: 26<sup>th</sup> of July 2018

7<sup>th</sup> Semester  
Examiner: Dr. Masoud Eddaghel  
Examination time: 120 Minutes

Q.1/ [8 marks] Explain

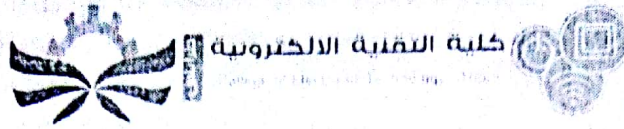
- MIMO system.
- Alamouti STC Technique.
- Narrowband channel.
- Wideband channel.

Q.2/ [24 marks] For a BFSK, 8ASK and 16QAM modulation schemes, operating with an information bit rate 1024 *kbps*.

- Draw the BASK modulator and coherent demodulator.
- Find the symbol rate (baud) for all schemes.
- Find the BW for all schemes.
- Find the BW efficiency for all schemes.
- Which modulation scheme is not recommended to use in wireless communications? Why?
- Draw the constellation points for all schemes.
- If the channel BW=10kHz, find the Nyquist capacity for all modulation schemes.
- Find SNR, which is needed for each modulation scheme.

Q.3/ [14 marks] A MIMO system contains of 2 transmit antennas and 5 receive antennas.

- Draw the block diagram of this system.
- Draw the schematic diagram of this system over flat fading channel.
- Find the received equations  $r$ .
- Find out the channel matrix  $H$  and  $H^H$ .
- Find  $H^H H$ .



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- f) Find estimated received signals.
- g) What is the diversity gain of this system?

**Q.4/[14 marks]** A 4G wireless communication system based on an OFDM system with 1024 subcarriers uses IDFT/DFT algorithm and exploits 16QAM modulation scheme.

- a) Draw the simple block diagram of this OFDM system (Transceiver).
- b) Why OFDM chosen as multiple access in 4G wireless communication systems?
- c) What is the function of cyclic prefix in OFDM system?
- d) What is the condition of cyclic prefix?
- e) Find the number of arithmetic operations, which are needed in this system.
- f) What is the main disadvantage of this system?
- g) Find the maximum bit rate of this system.

**Good luck**

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**Q1/ [6 marks]**

- Draw the block diagram of digital communication system.
- What are the challenges of wireless communication system?
- Defined the diversity and what its goal?
- What are the performance evaluation criteria of wireless system?
- What is the BER reference of wireless system?
- What is the function of Matched filter?

**Q.2/ [8 marks]** For an 8PSK and BFSK schemes, operating with an information bit rate 64 *kbps*.

- Draw the BFSK modulator.
- Find the symbol rate (baud) for both schemes.
- Find the BW for both schemes.
- Find the BW efficiency for both schemes.
- Which scheme has efficient BW?
- Draw the constellation points for both schemes.
- Which scheme has higher BER?
- Which scheme has higher data rate?

**Q3/ [22 marks]** A practical wireless system operating with carrier frequency,  $f_c = 900$  MHz. This system exploiting SIMO scheme with one transmit antenna and four receive antennas. Assuming the system is working in faded channel.

- Draw the schematic diagram of this SIMO system.
- Find the received equations  $r$ .
- Find out the channel matrix  $H$  and  $H^H$ .
- Find  $HH^H$ .
- Find estimated received signal.
- Determine the distance (cm / m) between receive antennas.
- Identify the expected physical size of this receiver.
- What is the main disadvantage of this system? Where is it use?
- If the SNR = 20 dB & channel gains = 1, find the normalized capacity of this system.
- If the BW = 4KH. Find the maximum possible data rate.
- How many signalling levels ( $M$ ) are required for a modulation scheme?



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**Q4/ [20 marks]** A MIMO system contains of two transmit antennas and four receive antennas.

- Draw the block diagram of this system.
- Draw the schematic diagram of this system over flat fading channel.
- Find the received equations  $r$ .
- Find out the channel matrix  $H$  and  $HH$ .
- Find  $HHH$ .
- Find estimated received signal.
- What is the diversity gain of this system?
- If the SNR = 20 dB & channel gains = 1, find the normalized capacity of this system.
- If the BW = 4KH. Find the maximum possible data rate.
- How many signalling levels ( $M$ ) are required for a modulation scheme?

**Q5/ [4 marks]**

- Draw the block diagram of coded SISO-OFDM system.
- What are the advantages of OFDM system?

Good luck