

<b>University</b> : Menoufia <b>Faculty</b> : Electronic Engineering <b>Program</b> : Electronics and Communication Engineering <b>Academic level</b> : 4 <b>Course Name</b> : Elective Course (5): Wireless Sensor Networks <b>Course Code</b> : ECE 416		<b>Date</b> : 16/1/2020 <b>Time</b> : 3 Hours <b>No. of pages</b> : 2 <b>Full Mark</b> : 70 Marks <b>Exam</b> : Final Exam <b>Examiner</b> : Dr. Mohamed Rihan
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**Answer all the following questions:**

**Question No 1:**

**(15 Marks)**

- What are the main differences between wireless sensor networks (WSNs) and mobile ad-hoc networks (MANETs)? **(5 Marks)**
- What are the different applications of WSNs (explain briefly)? **(5 Marks)**
- What are the characteristics that should be taken into account when selecting an appropriate receiver? **(5 Marks)**

**Question No 2:**

**(15 Marks)**

- What are the characteristic requirements for most of the applications of wireless sensor networks? **(3 Marks)**
- What are the most commonly considered aspects for calculating the energy efficient in wireless sensor networks? **(3 Marks)**
- What are different measures that could be used in WSN to quantify the quality of service (QoS)? Explain briefly **(3 Marks)**
- Draw the block diagram of sensor node architecture and briefly explain the function of each block. **(3 Marks)**
- What are the important mechanisms that affect the operation of different parts of the wireless sensor networks? **(3 Marks)**

**Question No 3:**

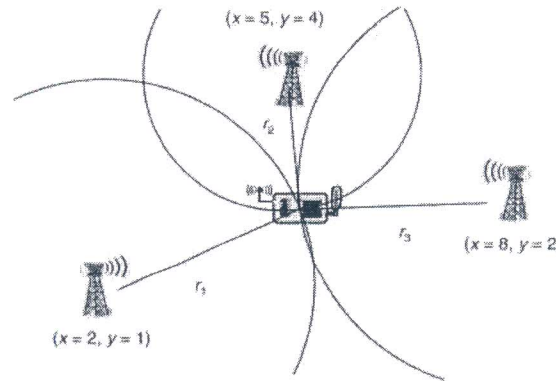
**(15 Marks)**

- Explain and draw the block diagram of the carrier sense multiple access with collision avoidance (CSMA/CA). **(3 Marks)**
- If a transmitter produces 50 watts of power, express the transmit power in units of (a) dBm, and (b) dBW. If 50 watts is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna, what is P (10 km)? Assume unity gain for the receiver antenna. Assume that there is no hardware loss in the system. **(4 Marks)**
- What are the different WSNs transceivers operational states? **(4 Marks)**
- Write down the mathematical equations and plot an example waveform for the modulated signal out of the following modulation techniques:  
A) ASK                      B) FSK                      C) PSK **(4 Marks)**

Question No 4:

(15 Marks)

- A) Explain briefly different mobility types in wireless sensor network? (3 Marks)
- B) Explain briefly the following propagation phenomena:  
Reflection, Diffraction, Scattering, Doppler fading (4 Marks)
- C) Consider the wireless sensor network scenario shown in the below figure:



Assume that there are three anchors with known positions  $(x_i, y_i)$ ,  $i = 1, \dots, 3$ , and a node at unknown position  $(x_u, y_u)$ , and perfect distance values  $r_i$ ,  $i = 1, \dots, 3$ . Using the lateration problem, derive an expression for the unknown position. (5 Marks)

- D) Based on the results derived in part (C), evaluate the unknown position  $(X_u, Y_u)$ , where  $(x_1, y_1) = (2, 1)$ ,  $(x_2, y_2) = (5, 4)$ , and  $(x_3, y_3) = (8, 2)$  and the distances between anchors and node of unknown position  $r_1 = \sqrt{10}$ ,  $r_2 = 2$ ,  $r_3 = 3$ . (3 Marks)

Question No 5:

(10 Marks)

- A) Please explain briefly between the following localization contexts: (5 Marks)
1. Physical position vs symbolic location.
  2. Absolute vs relative coordinates.
  3. Localized vs centralized computation.
  4. Accuracy vs precision.
- B) Compare between different wireless sensor networks (LEACH, STEM, S-MAC, CSMA Protocols, PAMAS, TRAMA)? (5 Marks)

**Good Luck**  
**Best wishes**