**Exam # 1** (ECE 493/593 Telehealthcare Engineering)

Grade:

Oct 16, Tuesday, 2012

* 50 minutes; 10% of your final grade; Closed book & notes;
* Covers Mobile-Health + sensor circuit + ECG sensor;

**Q1 (30%): Fill out the following blanks (each 3 pts):**

(1) List three ISM (free, unlicensed) radio frequencies:

(2) What are the IEEE standards for WiFi and Zigbee, respectively?

(3) WiFi supports two laptop internetworking topologies: and

(4) If each hop has a packet loss rate 10%, after 5 hops, the successful packet arrival rate is:

(5) The main advantage of RFID tags over conventional barcodes is

(6) The main principle of using SpO2 to measure oxygen saturation is:

(7) If a receiver sensor keeps radio on however does not receive any real data, can we save a good amount of energy? Justify your answer:

(8) How does CodeBlue find a sensor's indoor location?

(9) Why do we use modulation before sending out sensor data wirelessly to another sensor?

(10) The meaning of CMRR is

**Q2 (5%):** Use pictures below to show the following radio propagation phenomena:

**shadowing reflection refraction scattering diffraction**



**Q3 (10%)** Point out each step operations (from sensing a heart beat signal to the air transmissions).

Leads



Air

RF Transceiver

Microcontroller

ADC

Analog EKG voltage levels

**Step 1 Step 2 Step 3 Step 4**

**Q4 (10%)** Now, point out what happens in the receiver side:

Show ECG signals

Application Layer

Microcontroller

RF Transceiver

Air

Physical Layer

**Q5 (10%)** Explain 4 different ways to handle medical signal transmission loss.

**Q6 (10%)** Draw the circuit diagram (no need to make each electronic unit accurate) on CodeBlue EKG sensor.

**Q7 (10%)** How do we use 3 base motes and triangulating theory to determine a sensor's location? Explain the principle in details.

**Q8 (5%)** Suppose we receive a huge amount of ECG signals. We have two ways to handle such data. The first way is to use complex machine learning algorithm to process the data such as removing noise, get rid of some redundant data, etc. Those complex algorithms will occupy some CPU time. The other way is to send out the data to a 30-feet receiver without complex local CPU processing. From energy consumption viewpoint, which way is better? Why?

**Q9 (5%)** Why do we need the Right Leg Driver circuit in ECG sensor?

**Q10 (5%)** Draw a telehealthcare mobile network architecture with body sensors, PDA and cellular networks.