BME362 Biomedical Instrumentation Design Exam #3 Spring 2017 Name: _____
Open book/notes (12 questions, 8 points each + 4 free points)

1. ( ) The Open System Interconnection (OSI) of the International Organization for Standardization (ISO) defines a 7-layer network protocol consisting of Physical, Datalink Control, Network, Transport, Session, Presentation, and Application. The IP layer of the TCP/IP protocol belongs to: (A) the Transport layer, (B) the Network layer, (C) the Data Link Control layer, (D) a sublayer between Transport and Network, (E) none of the above.

2. ( ) The PIC board sends data to the Android tablet via Bluetooth at a rate of 360 packets per second. Assume that the system takes 0.3 s to process each packet. Based on Little's theorem, how many packets on average are in the queue of the Android receiving buffer? (A) 12, (B) 36, (C) 108, (D) 360, (E) none of the above.

3. ( ) A 3-bit cyclic redundancy check (CRC) is added to a 6-bit data 110100. The generator polynomial for the CRC is $g(x) = x^3 + x + 1$. Using exclusive-OR (instead of subtraction) in the long division, what is the resulting CRC? (A) 010, (B) 101, (C) 110, (D) 011, (E) none of the above.

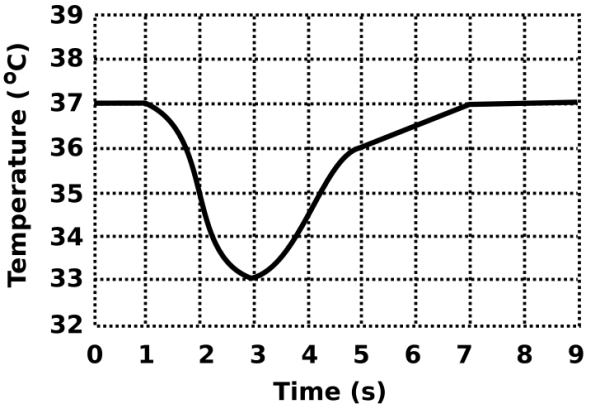
4. ( ) An cardiac pacemaker has the pacing electrode in ventricle only and senses in both atrium and ventricle. If an intrinsic P wave is sensed, it triggers ventricular pacing. If an intrinsic QRS is sensed, it inhibits ventricular pacing. What is the appropriate code for this pacemaker? (A) VDD, (B) DDD, (C) VAT, (D) DDI, (E) none of the above.

5. ( ) Which of the following is <u>not</u> one of the four key variables that affect the cardiac function? (A) preload, (B) afterload, (C) oxygen saturation, (D) contractility, (E) heart rate.

6. ( ) The heart is cable of adjusting its preload (venous pressure) by producing a hormone to regulate the kidney function. This hormone is (A) atrial natriuretic peptide, (B) antidiuretic hormone, (C) angiotensin, (D) adrenaline, (E) none of the above.

7. ( ) Which of the following is <u>not</u> one of the classes of analytes for the microdevices? (A) nanoparticles, (B) proteins, (C) cells, (D) nucleic acids, (E) small molecules.

8. ( ) The cardiac output was determined by use of the thermodilution method. A bolus of 20 cc iced saline (0 ºC) was rapidly injected into the right atrium. The temperature was measured in the pulmonary artery as shown on the right. Assume a heat loss factor of 0.85. Determine the cardiac output in terms of liters per minute. (A) 3.8 l/min, (B) 4.5 l/min, (C) 5.1 l/min, (D) 6.4 l/min, (E) none of the above.



9. ( ) Dr. Sun has a cardiac output of 5 l/min and an oxygen consumption of 250 ml/min. If his arterial oxygen concentration is 0.20 ml/ml, what is his venous oxygen concentration? (A) 0.12 ml/ml, (B) 0.13 ml/ml, (C) 0.14 ml/ml, (D) 0.15 ml/ml, (E) none of the above.

10. One of the patch-clamp techniques is to position a microelectrode on the cell with a slight suction. Then, the microelectrode is quickly withdrawn from the cell to yank away a patch of the cell membrane at the tip of the microelectrode. This patch-clamp configuration is called (A) on-cell, (B) whole-cell, (C) inside-out, (D) outside-out, (E) none of the above.

MORE QUESTIONS ON THE BACK

11. ( ) Polymerase chain reaction (PCR) is a technique to duplicate a segment of DNA by cycling through three stages of temperature changes (denaturation, renaturation, and synthesis). By repeating this cycle many times, the DNA segment can be amplified by several orders of magnitude. How long does it take to go through one cycle of temperature changes? (A) 3-5 s, (B) 3-5 min, (C) 3-5 hours, (D) 3-5 weeks, (E) none of the above.

12. ( ) Which of the following is the most commonly used material for constructing microfluidic devices? (A) polyurethane, (B) polydimethylsiloxane, (C) polytetrafluoroethylene, (D) polyvinyl chloride , (E) none of the above.