

### Medical Equipment I (Part 2) Term Exam Sample - January 2014

Solve as Much as You Can – Maximum Grade for Both Parts 1 and 2: 70 Points

#### Part I. Complete the following sentences [1.5 points each]:

- 1. When computing the heart rate in a surgical operation that uses cautery, using ... signal is preferred.
  - a. ECG
  - b. Pulse oximeter
  - c. Auscultation method
- 2. Stroke volume depends on ...
  - a. Contractility of myocardium
  - b. Systolic pressure
  - c. Heart rate
- 3. The measured output of a piezoelectric force transducer is in the form of ...
  - a. Electric charge
  - b. Electric current
  - c. Electric voltage
- 4. When measuring blood pressure using oscillometric method, the measurement cuff placed at the level of the head gives ... blood pressure measurement.
  - a. Incorrectly high
  - b. Incorrectly low
  - c. Correct
- 5. While electrical activity of the heart is measured by ECG, the mechanical activity is measured by ... signal.
  - a. Pulse oximeter
  - b. Heart rate
  - c. Blood pressure
- 6. Invasive pressure measurement has the advantage of ...
  - a. Continuous monitoring blood pressure
  - b. Using catheters
  - c. Better patient comfort
- 7. The bioelectric signal from needle electrode is ... signal from surface electrode from the same location.
  - a. Larger than
  - b. Smaller than
  - c. Same as
- 8. If tip of catheter rests against wall of pulmonary artery, this is called a ... position
  - a. Wedge
  - b. Pseudo-wedge
  - c. Anti-wedge

- 9. In case of septic shock patients, ... cannot be used.
  - a. PiCCO technology
  - b. Right heart catheterization
  - c. Impedance cardiograpgy
- 10. An example of biothermal signal is ...
  - a. Body temperature
  - b. Color of skin
  - c. Cardiac output

# Part II. Mark the following statements as True (T) or False (F) [1 point each]:

- 11. Random errors can be avoided by designing different method of measurement.
- 12. Continuous monitoring of blood pressure is better than intermittent measurements.
- 13. The heart rate can be computed by counting number of QRS complexes in 10 s interval.
- 14. Cardiac output is computed as the stroke volume divided by the heart rate.
- 15. In the oscillometric method, oscillations are largest at the systolic pressure.
- 16. Resistive strain gauge measurements change linearly with strain.
- 17. The chopper in infra-red spectrometer allows one monochromator and one detector to be used.
- 18. PiCCO technology is based in theory on the thermodilution method.
- 19. Signal processing is used to correct for sensor nonlinearity in medical devices.
- 20. Subjective methods requiring cooperation of patient are sometimes needed in medical devices.

# Part III. Answer the following problems:

- 21. [3 points] For a quartz microbalance of surface area of 10 mm<sup>2</sup> and resonance frequency at no load of 7 MHz, determine the frequency shift for a load of 2 ng.
- 22. [3 points] For Doppler flowmeter, assuming original frequency to be 1 MHz, speed of sound in tissue to be 1540 m/s, an angle of inclination of 45 degree, what would be the Doppler shift range for the range of blood flow velocities in humans?

# **Best of luck!**