Second Semester Examination 2013

BIO-MEDICAL INSTRUMENTATION AND SIGNAL PROCESSING

Full Marks: 70

Time: 3 Hours

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

1. Answer the following questions: (2 x 10)

   a) Explain Polarization, Depolarization and Repolarization of cell.

   b) What is half-cell potential?

   c) List the techniques used for measurement of heart rate.

   d) Write the names and their bands of frequency of EEG signal for the purpose of analysis.

   e) Improper grounding of the system is one of the most common causes of measurement problems and noise. Suggest a method to prevent these problems.

   f) How does the magnitude of voltage picked up by an Electromagnetic blood flow meter varies with respect to the diameter of the blood vessel?

   g) Define power spectral density.

   h) State and prove of final value theorem of Laplace transform.

   i) Write the convolution theorem of Fourier transform.

   j) Define ROC for various infinite discrete time signals.

2. a) Describe basic principle of measurement of pressure using LVDT and strain gauge. Mention their applications as physiological pressure transducer. (5)

   b) Describes basic principal of operations of various transducers used for body temperature measurement. (5)

3. a) Compare between direct and indirect methods of blood pressure measurement. Briefly discuss different automated indirect methods used for measurement of blood pressure. (5)

   b) What are the types of Lead connections for recording ECG signal? Comment on electric field of the heart and describe the effects of Artefacts on ECG recording. (5)

4. a) Draw a neat block diagram of an Electrocardiograph. (3)

   b) What are the origins of heart sound? Describe different types microphones employed for phonocardiograph. What are the desirable (7)

characteristics of amplifier for phonocardiography applications? What are the writing methods for phonocardiography?

5. a) State and explain Doppler effect. (3)

   b) Describe the basic principle of measurement using NMR blood flow meter. (7)
   What is Larmour frequency? What is the significance of Larmour frequency? With neat diagram, show the arrangement of arterial blood flow measurements using NMR principle.

6. a) Compute the Fourier transform and sketch the magnitude and phase (5)
   function of causal sequence given by
   $X(n) = 1/3 \; ; 0 \leq n \leq 2$
   $\qquad = 0 \; ;$ else

   b) Perform Crosscorrelation. (5)
   $x(n) = \{1, 1, 2, 2\} \quad y(n) = \{1, 3, 1\}$

7. a) Find out one sided Z-transform of the discrete time signals (3)
   $x(n) = (0.5)^n [u(n) - u(n-2)]$

   b) Determine the transfer function and impulse response for the systems (7)
   described by the equation:
   $y(n) - 2y(n-1) - 3y(n-2) = x(n-1)$

8. Write short notes on any two: (5 x 2)

   a) Intelligent and PC based medical instrumentation system

   b) Calculation of size of blood cells

   c) Biosensors

   d) X-Ray