
 Mansoura University	 Faculty of Engineering	Biomedical Engineering Department
		Full mark is 50 marks
		Time allowed: 2 hours
		Exam is one page
		Assume any missing data
		Include and name all steps

Question # 1: [16 marks] (equally distributed)

- Compare between in-vivo and in-vitro measurements.
- How the electrode impedance behave with high signal frequencies? Explain using a circuit diagram for the electrode-electrolyte interface electrical model.
- List one medical application for (i) the electroencephalogram (EEG), (ii) electromyogram (EMG), and (iii) electrogoniometer. Determine what each of these devices measure.
- Using an illustrative figure, illustrate the stages of the fluorescence process.

Question # 2: [5 marks] Using one active element (an operational amplifier), design an integrator (low pass filter) with a negative gain of -10. List an example of the application of this integrator in medical instrumentation

Question # 3: [7 marks] Design an R-2R ladder D/A converter for a biomedical instrumentation that has the following specifications:

- Two-bit ($n = 2$) D/A converter
 - Resolution is 3 volt
 - Hint: you may use a maximum of six (6) resistors in your design
- Derive the relation of the output analog voltage.

Question # 4: [7 marks] A beta wave in an electroencephalogram signal that has a maximum frequency of 31 Hz. Design a flash A/D converter that has the following specifications:

- Its digital binary output $V_o = '10'$ for an input of 5 volt, with no quantization error
- Determine the range of the clock speed of the sample and hold circuit
- Determine the output for an input of 3 volt

Question # 5: [5 marks] If a normal subject has a heart rate of 60 beat per minute, draw a typical electrocardiogram (ECG) signal showing its main period. Which part of the wave will be affected if there is a problem in the expansion of the atrial?

Question # 6: [5 marks] Determine the output of a median filter of length $M = 5$ that is applied on the following sequence: $X(n) = \{2.5, 5.0, 3.5, 2.5, 2.0, 3.0, 3.5, 4.0, 7.0, 4.5, 5.0, 4.0\}$

Question # 7: [5 marks] Apply the iterative thresholding algorithm to cluster the following medical data points into two clusters (two classes):

Data = [5, 10, 15, 25, 35, 45, 60, 75, 80, 95]

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خالص امينياتي بالتوفيق

تمت الاسئلة