



Mansoura University



Faculty of Engineering

Biomedical Engineering (BME) Department

Time allowed: 2 Hours, August 25th, 2019

Exam is four pages, Full mark=50

Assume any missing data; solve in same paper

Include and name all steps

Answer the following, showing details if possible [50 points, each is 5 points]

1. Sketch showing details the action potential curve and complete the sentences below:

- Sketch (3 points)

- Types of cells that submit action potentials (1 points)
- Condition for a cell to submit an action potential: (1 points)

2. Sketch a normal electrocardiogram signal of heart rate 70 beat per minutes and complete below:

- Sketch (3 points)

- The time between a p-wave and the next p-wave=.....sec (1 points)
- Muscle contraction occurs during cell whereas muscle expansion occurs during (1 points)

3. Complete the following Table: (5 points)

	Electroencephalogram (EEG)	Electromyogram (EMG)
Results from		
One application		
Do use internal or surface electrodes?		

4. Sketch electrode structure, circuit model and behavior with frequency (5 points)

Structure	Circuit model	Behavior with frequency

5. Sketch in details the fluorescence microscope and complete the sentences below

<ul style="list-style-type: none"> Sketch (3 points)
<ul style="list-style-type: none"> Stokes shift = (1 point) If a fluorescence process, with a quantum efficiency of 75%, has the number of emitted photons=120, then the number of absorbed photons (1 point)

6. Design a 2-bit digital analog converter (DAC) with minimum resolution=225mV

(4 points)

- Using the designed DAC, convert the digital codes 01 and 11 to analog:,

(1 point)

7. Design a fast analog digital converter (ADC) to convert samples between -2 V to 2V with a minimum resolution of 600mV

- Design

(4 points)

- Using the ADC, convert the samples -0.6V,0V,1.5V to digital codes:,

(1 points)

8. Smooth the ECG samples=[65,85,67,66,67,55,65] using the following:	
i) Average moving filter of length 6 Output filtered signal = (3 points)	ii) Median filter of length 5 Output filtered signal = (2 points)
9. Design a LED-based alarm circuit such that if the sensor reading at Arduino PIN3 exceed half of the Arduino reference voltage, Vref , the LED flashes with 1.5 sec between ON and OFF	
• Design:	• Code (5 point)
10. Write an Arduino code to compute the value of temperature, if a temperature sensor LM35 with sensitivity 10mV/1°C is connected to Arduino PIN3 and the Arduino reference voltage Vref=3.3V . (5 points)	
<div>تمت الاسئلة</div> <div>خالص امنياتي بالتوفيق</div> <div>د. أحمد النقيب</div>	
Code appendix: pinMode(pin , mode); digitalWrite(pin , value); digitalRead(pin); analogRead(pin); analogWrite(pin , value); delay(time in ms); int x = digitalRead(pin, value) If (condition) {expression 1;} else {expression 2});	