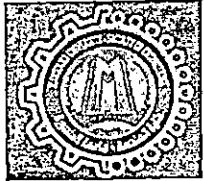
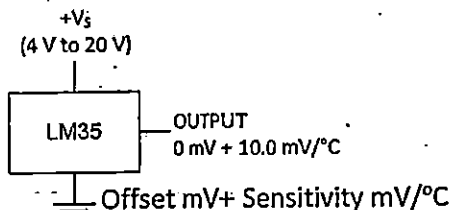
 Mansoura University	 Faculty of Engineering	Biomedical Engineering (BME) Department
		Time allowed: 1 Hour
		Exam is three pages, Full mark=30
		Assume any missing data; solve in same paper
الاسم:		الفصل:

Answer all the following questions, showing all details if possible

Question # 1: [5 points] The data sheet of the temperature sensor, LM35, contains the figures below. If the terminal +Vs is connected to 9V and the output is connected to a voltmeter. Answer the following:

1.1 Draw the input output characteristic in the linear range of the circuit (2 points)

Basic Centigrade Temperature Sensor
(2°C to 150°C)



1.2 For calibration, a known temperature of 25°C is applied to the sensor and the voltmeter reads 0.2532V. estimate the error in the sensor reading (in temperature) (2 points)

1.3 If the sensor is connected to an ADC, which reads 25.32°C, then the device resolution is (1 point)

Question # 2: [5 points] A typical electrocardiogram (ECG) is given below. Determine the following :

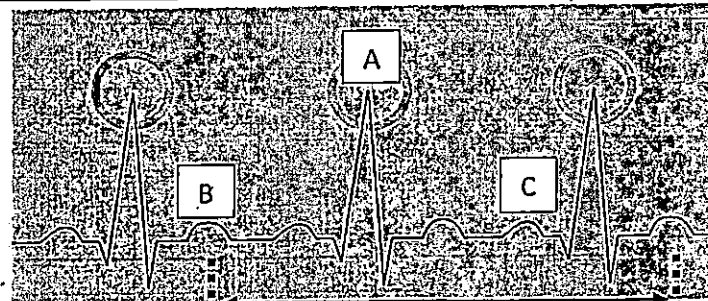
2.1 A number of electrodes is needed to capture a clear ECG signal

2.2 The type of electrode used to capture the signal is.....

2.3 The heart rate =.....

2.4 The wave at the area "B" is associated with

2.5 The action potential of the atriums is in the repolarization in



2.1

2.2

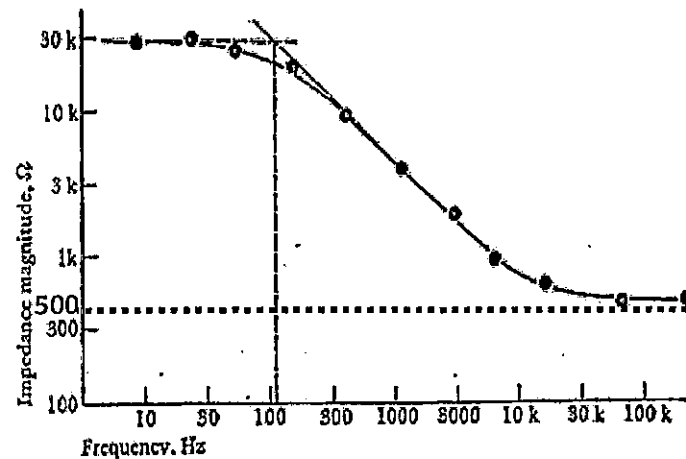
2.3

2.4

2.5 Choose (A B or C)

Question # 3: [5 points] Design a difference amplifier circuit in order to amplify the voltage between two ECG electrodes with a gain of 200. Show how the ground is connected. The output voltage must not exceed 1V for safety consideration. Which resistors should be of high accuracy/low tolerance in your design? Why?

Question # 4: [5 points] Given the following frequency response of an electrode-electrolyte. Draw the circuit model of the electrode. Suggest typical values for each component in the model. Assume that the half-cell of silver with respect to hydrogen at 25°C is 0.8V. List the chemical equations of the sensor.



Question # 5: [5 points] Design a successive approximation ADC with the following specifications:

- o Convert inputs in the range between 0V to 3V
- o Clock speed of the SAR is 6 kHz
- o Minimum resolution is 0.5V
- o Use a dual battery, each 1.5V

Determine the maximum frequency of the input to meet sampling theory and the output code sequence of the three consequent samples 0.4V, 0.8V, and 2.5V. What is the time needed to convert the three samples?

Maximum frequency of the input:

Code sequence of samples 0.4V, 0.8V, and 2.5V:

Conversion time needed:

Question # 6: [5 points] What does an Electroencephalogram (EEG) signal specifically represent? What are the electrical activities that lead to this signal? Mention two applications of the EEG device.

د. أحمد النقيب

خالص امنياتي بالتوفيق

تمت الاسئلة