Marks: 100



MANIPAL UNIVERSITY

SCHOOL OF INFORMATION SCIENCES FIRST SEMESTER MASTER OF ENGINEERING - ME (AUTOMOTIVE EMBEDDED SYSTEMS) DEGREE EXAMINATION- NOVEMBER 2017 DATE : Friday, November 17, 2017 Time : 10:00AM - 1:00PM

Sensors and Transducers [AES 601]

Α

Duration: 180 mins.

Answer all the questions.

1)	With reference to the automotive industry explain the need of the following ⁽¹⁰⁾)
	a. Sensors b. Microcontrollers c.	
	Actuators	
2)	With suitable diagram explain the working principle of the below sensors. ⁽¹⁰⁾)
	a. LVDT b. Position sensors (5+5) marks	
3)	A thermistor is connected with a series resistance of 5 kilo ohms & a supply ⁽¹⁰⁾ voltage of 10 volts. The resistance variation of the thermistor for temperature changes is shown below.	1
	Temperature in degree centigrade0 50 100Resistance in kilo ohms8 1 0.2	
	Draw a graph of voltage across thermistor vs resistance with and without linearization.	
4)	With reference to an ADC explain the following with suitable examples (10)	1
	a. Output resolution b. Conversion time c. ADC types (2+2+6) marks	
5)	Given an analog input signal whose voltage ranges from -5 to +5 V, and 8- (10) bit digital encoding, calculate the correct encoding for 1.2 volts and then verify the same using successive approximation method. (10 Marks)	
6)	Write the block diagram of a typical Data Acquisition System which is used ⁽¹⁰⁾ to measure signals from 8 different sensors. Explain the design consideration of each block. (10 Marks)	I
7)	It is required to detect a random glitch in an ECG signal of frequency 1.2 Hz. $^{(10)}$	ł

The amplitude (peak to peak) of the signal is 60 mv. The duration of the glitch is 10 milliseconds and the amplitude is 25 microvolts. It is required to have 30 samples of the glitch for analysis. Calculate:

- a. Number of ADC bits
- b. Sampling frequency
- c. Conversion time of ADC
- d. Memory required to store 7 minutes of ECG signal.
- (3+3+1+3) marks
- ⁸⁾ (a) Explain the working of a typical Charge coupled Device used to capture an image ⁽¹⁰⁾ in a video

camera.

(5 marks)

(b) It is required to capture 7-minute video whose image dimensions are 800×600 pixels with a frame rate of 30 frames per second using an eight-bit Data Acquisition System. Calculate

- 1. Sampling frequency
- 2. Conversion time of the ADC
- 3. Memory size required
- (2+1+2) marks

9)

a. Data from the 10 temperature sensors are to be monitored from different ⁽¹⁰⁾ locations in an automobile at a regular interval of 1 sec. The temperature varies from -40 degrees to 125 degrees centigrade. The system need to have an accuracy of one degree centigrade & operated by 10 volts. Write a system block diagram which can be implemented. (2 marks)

b. For the specification given in Q 9 (a) calculate the following:

- i. Numbers of a ADC bits
- ii. Gain of the system
- iii. Sampling frequency
- iv. Conversion time of the ADC.

(8 marks)

- ¹⁰⁾ a. Explain the working of Anti Breaking System in an automobile with ⁽¹⁰⁾ suitable figures.
 - b. Explain the working and application of Rotary encoders.

(6+4) marks

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