Question Paper

Exam Date & Time: 06-Feb-2021 (10:00 AM - 01:15 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

MANIPAL SCHOOL OF INFORMATION SCIENCES, MANIPAL
FIRST SEMESTER MASTER OF ENGINEERING- ME (AUTOMOTIVE EMBEDDED SYSTEMS) DEGREE EXAMINATION - FEBRUARY 2021

Sensors and Transducers [AES 601]

Marks: 100 **Duration: 180 mins.**

SATURDAY, FEBRUARY 6, 2021

Answer all the questions.

1) Explain FIVE important factors effecting choice of sensors 10 marks (10)
(TLO 2.1: Understanding working principles of sensors)

2) With reference to an automobile explain the working of: (10)

a. Linear actuators
b. DC Motors (5+5) marks
(TLO 1.1: Understanding working principles of Actuators & Amplifiers)

3) A thermistor is connected with a series resistance of 5-kilo ohms & a supply voltage of 12 volts as shown in Fig.Q.3. The resistance variation of the thermistor for temperature changes is shown below. (10)

Temp in degree centigrade	0	50	100
Resistance in kilo ohms	12	0.8	0.1

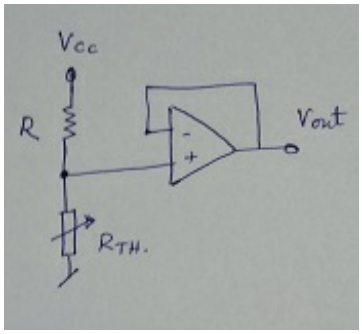


Fig.Q.3

Calculate and plot Output voltage (Vout) versus temperature graph, without and with linearization. (5+5) marks
(TLO 3.2: Designing for linearization)

4) Explain the following with suitable diagram / example: (10)

a. Need of Sample & Hold circuits
b. Need to oversample the signal (5+5) marks
(TLO 2.2: Explaining the need of circuit & process)

5) With the block diagram, explain the working of 3 bit Flash ADC. What are its advantages & disadvantages? (10 marks) (10)
(TLO 3.1: Describing the working of ADC)

6) Given an analog input signal whose voltage ranges from 0 to 5 V, and 8-bit digital encoding, (10)

calculate the correct encoding for 2.1 volts and then verify the same using successive approximation method. (10 marks)
(TLO 3.2: Design of values in an ADC)

7) Write the block diagram of a typical Data Acquisition System, which is used to measure signals from 6 different sensors. Explain the design consideration of each block. (10 marks) (10)
(TLO 3.2: Design of a Data Acquisition System)

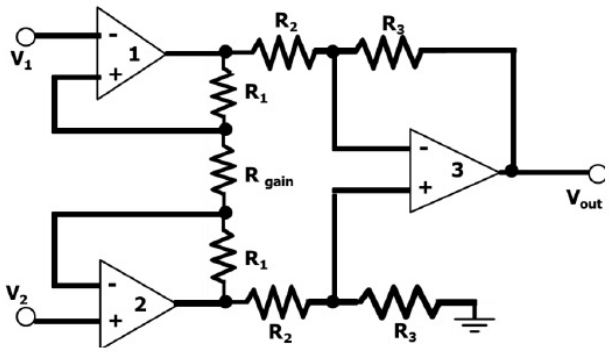
8) It is required to detect a random glitch in an ECG signal of frequency 2 Hz. The amplitude (peak to peak) of the signal is 40 mv. The duration of the glitch is 4 milliseconds and the amplitude is 20 microvolts. It is required to have 25 samples of the glitch for analysis. Calculate: (10)

a. Number of ADC bits
b. Sampling frequency
c. Conversion time of ADC
d. Memory required to store 6 minutes of ECG signal. (3+3+1+3) marks
(TLO 3.3: Design & calculation of a DAS)

9) (a) Explain with suitable diagrams how speed measurement of an automobile is done using Variable reluctance sensor. (6 marks) (10)
(b). Calculate the speed of the vehicle in km/hr. if the gear to tyre ratio is 30:1, the diameter of the tyre is 70 cm & the pulse frequency output from gear 500 Hz. (4 marks)
(TLO 3.1: Describing the working of a speed sensor)

10) Instrumentation amplifier shown in Fig.Q.10 has a differential gain of 2 (TWO). Design all resistor values to provide an overall minimum gain of 20 and maximum gain of 250. (10 marks) (10)

Fig.Q.10.



(TLO 3.1: Design considerations of an Instrumentation)

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