S.E.(Instrumentation Engineering)(SEM-IV)(Choice Based) / DEC 2019 / 17.12.2019

[Time: Three Hours] [Marks:80]

N.B: 1. Question.No.1 is compulsory.
2. Attempt any three questions from remaining five questions.
3. Assume suitable data wherever necessary.

1 **Attempt any four questions.** 20

a. Describe the following terms with suitable examples
   i. Signal Level and Bias Changes
   ii. Signal Conversion
b. Explain lead compensation in bridge.
c. Draw and explain circuit for window detector.
d. A current balance bridge is used for potential measurement. The fixed resistors are $R_1=R_2=5K\Omega$, $R_3=1\ K\Omega$, $R_4=990\ \Omega$ and $R_5=10\ \Omega$ with a 10V supply. Find the current necessary to null the bridge if the potential is 12mV.
e. A Sensor output range of 20.0 to 250mV as a variable varies over this range. Develop signal conditioning so that it becomes 0 to 5V. The circuit must have very high input impedance.

2 a. Discuss the holding time and acquisition time for the sample and hold circuit and write the equations for determining the capacitor size and minimum acquisition time. 10

b. Design the Butterworth second order low pass filter to have 12 KHz cutoff frequency. Use the selected components to calculate the actual cutoff frequency for the circuit. 10

3 a. Sketch the circuit of 555 Astable multivibrator. Explain how it operates and discuss the determination of component values. 10

b. A control valve has a linear variation of opening as the input voltage varies from 0 to 10V. A microcomputer outputs an 8-bit word to control the valve opening using an 8-bit DAC to generate the valve voltage. 10
   i. Find the reference voltage required to obtain a full open valve.
   ii. Find the percent of valve opening for 1-bit change in the input word.

4 a. The RTD is used in the bridge circuit. If $R_1=R_2=R_3=100\ \Omega$ and the supply voltage is 10.0 V calculate the voltage the detector must be able to resolvein orderto resolve a1°C change in temperature. 10

b. Draw and explain the principle and construction of metal strain gauges.What is the signal conditioning associated with it. 10

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5 a. A photovoltaic cell is to be used with radiation of intensity from 5 to12 mW/cm^2. Measurementsshow that its unloaded output voltage ranges from 0.22 to 0.41 V over this intensitywhile it delivers current from 0.5 to 1.7 mA into a 100-Ω load. 10

i Find the range of short-circuit current.

ii Develop signal conditioning to provide a linear voltage from 0.5 to 1.2 V as the intensity varies from 5 to 12 mW/cm^2.

b. Explain Optical encoder signal conditioning for linear displacement and linear velocity applications with suitable diagram. 10

6 Write short notes on:

a. Phase locked loop 8
b. Data Acqusition System 6
c. SMPS 6

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