

Date:

Registration number:

ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27

B.Sc. ELECTRONICS- V SEMESTER

SEMESTER EXAMINATION: OCTOBER-2022

(Examination conducted in December 2022)

**EL5118- DATA ACQUISITION AND INSTRUMENTATION**

**Time- 2 ½ hrs Max Marks-70**

This question paper contains two printed pages and three parts

**Part A**

**Answer any 5 questions:**  **5 X 8 = 40**

1. a) Mention various processes involved in a digital measuring instrument.

b) Define any 3 parameters of a sensor / transducer.

c) Give classification of analog transducers (2+3+3)

1. a) What is the principle of a capacitance transducer?

b) What is Peltier effect, Johnson effect and Seebeck effect?

c) Draw the diagram of a photomultiplier tube and mention its application. (2+3+3)

1. a) What is piezo electric effect? Explain the application of piezo electric transducer as a flow meter.

b) Draw block diagram of a multi-channel data acquisition system and mention how the system selects one channel at a time. (4+4)

1. a) Draw the circuit of a 3 bit binary weighted resistor digital to analog converter and arrive at the expression for its output.

b) With block diagram, explain the working of a successive approximation register (SAR) analog to digital converter. (3+5)

1. a) Draw the block diagram of a RAMP type DVM and state its working principle.

b) Explain with suitable diagram, the working of frequency meter. (4+4)

1. a) Draw block diagram of a digital multimeter.

b) Differentiate between resolution and sensitivity of a digital voltmeter.

c) Explain alternate mode and chop mode switching operation in a dual trace CRO. (3+2+3)

1. a) Draw the block diagram of a function generator.

b) Explain the working of a 7 segment display. (4+4)

**PART- B**

**Answer any 5 of the following: 5 x 4 = 20**

1. A resistive displacement transducer uses a potentiometer wire of length 10 cm and of resistance 5 kΩ. A dc voltage of 12 V is applied across the potentiometer wire. The sliding contact is initially pointed at the middle of the potentiometer wire. Calculate the output voltage versus displacement for the sliding contact 3cm on either side from the middle.
2. A thermistor has negative temperature coefficient of resistance and a resistance of 10 kΩ at 25 0C. Calculate the resistance at 100 0C if the β value of the thermistor is 3400.
3. An LVDT with a maximum secondary voltage of 6V has a range of + 25 mm. Find the output voltage versus position for a core movement going from +18.75 mm to -10 mm.
4. Design a four bit R-2R DAC whose full scale output is -12 V. Given VREF = 5V and R = 1kΩ.
5. A 3 bit flash ADC uses 8 identical resistors in the potential divider circuit. The reference voltage is 10V. What would be the minimum input voltage if the binary output is 101?
6. A dual slope digital voltmeter has an integrator of resistance 100 kΩ and capacitance 1 µF. If the input d.c. voltage is 2V, what would be the output of the integrator after 1 Second? If a reverse voltage reduces the output to zero in 0.2 seconds, what is the value of the reverse voltage?
7. In a capacitance meter, an astable multivibrator using ic555 is used before the frequency counter. RA = RB = 5 kΩ and the counter counts 180 during discharge of capacitor (OFF time). The frequency of the clock gate pulse is 100 KHz. Calculate the value of unknown capacitance.

**PART-C**

**Answer any 5 of the following: 5 x 2 = 10**

1. What is gauge factor in a strain gauge?
2. Give one example each for a thermistor and photo emissive materials?
3. What is the step size of a 3 bit DAC if the full scale output is -7 V?
4. What are half digit and full digit in a digital voltmeter display?
5. Frequency of sinusoidal signal applied to vertical deflecting plates and horizontal deflecting plates of CRO are in the ratio 1:2. Draw the nature of the Lissajous figure.
6. What is the full form of MEMS? Mention one example of MEMS application.
7. Differentiate between LED and photodiode.

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