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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: MD/ET/EI **Duration: 3 hrs.**
Course Code: 19ES3GCSAM **Max Marks: 100**
Course: SENSORS AND MEASUREMENTS **Date: 14.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1.	a)	Discuss and exemplify how different types of errors contribute to the overall accuracy in measuring instruments.		**06**
	b)	A certain parameter of actual value 250 units is repeatedly measured using two instruments M1 and M2. The readings of M1 are 248, 251, 252, 247 and 249. The readings of M2 are 240,238,241, 242 and 239. Compare the accuracy and precision of M1 and M2.		**06**
	c)	Define a SECOND order instrument using its mathematical model, and also discuss its response for a step input.		**08**

UNIT - II

2.	a)	Define a sensor and justify why resistive sensors are called active types.		**04**
	b)	Explain and differentiate the two techniques of generating magnetic fields using solenoids and toroid's.		**08**
	c)	Discuss the physical principle of sensing based on Hall effect.		**08**

OR

3.	a)	Discuss the theory of operation of electrical resistance strain gauges by deriving an expression for its Gauge Factor (GF).		**10**
	b)	A strain gauge with a GF of 3.5 is strained due to a force by 10,000 microstrains. If the initial resistance is 120 Ω, determine the change in resistance, neglecting the piezoresistance effect.		**04**
	c)	Discuss the physical effect of Capacitance, and how it's used for sensing applications with an example.		**06**

UNIT - III

4.	a)	Explain the principle of an hygrometer based on thermal conductivity.		**05**

b) Discuss how acoustic signals are measured using the principle of interferometry, in an Optical hygrometer. **10**

c) Define a sound wave and explain how its intensity is generally expressed. **05**

OR

5. a) Define Humidity and the two ways of expressing humidity. **05**

b) Discuss how light intensity is measured using Phototransistors. **07**

c) Explain a Scintillation detector, constructed using photomultiplier tubes. **08**

UNIT - IV

6. a) Differentiate between RTDs and Thermistors as temperature sensors. **06**

b) A PRTD sensor with $\alpha o = 36.74 \times 10^{-4}$, $\alpha 1 = 39 \times 10^{-4}$ and $\alpha 2 = 5.82 \times 10^{-7}$ has Ro = 100 Ω and 0°C. Determine its resistance at 100°C using both linear and quadratic approximations. **06**

c) Discuss the heat exchange between an object and the sensor under dynamic conditions, in realistic conditions, highlighting its effect on measurement performance. **08**

UNIT - V

7. a) Discuss the importance of signal conditioning in sensor based measurement systems, taking any two examples of sensors and associated Op-amp based conditioning circuit. **10**

b) List out and explain the various types and sources of both inherent and transmitted noises in measurement systems. **10**

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