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R 3318

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Sixth Semester

Mechatronics Engineering

EC 1364 — SENSORS AND SIGNAL PROCESSING

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List four criteria adopted to classify sensors. Give one example for each.

2. How does quartz - resonator helps to make stress measurements?

3. What is seeback effect?

4. What is the principle of Hall device as a magnetic sensor?

5. What standards are adopted for smart sensor interface with network?

6. List various film deposition techniques employed in micro-sensor fabrication.

7. Why is sample and hold process needed in signal processing?

8. Define conversion time and resolution in A/D process.

9. List the advantages of digital filters over analog filters.

10. What is the relationship between band width and sample rate in DAS?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain with sketch the operation of pressure transmitter using capacitive sensors. (10)

(ii) The diaphragm diameter of capacitive sensor is 2.8 cm, separation between fixed and movable plate is 0.4 cm in normal condition, and diaphragm is kept taut with a tension of 2 kg/cm, calculate the change in capacitance for the input differential pressure of 1 kg/cm^2? (6)

Or

(b) (i) Describe the operation of LVDT for measuring displacement. (8)

(ii) Derive the expression for gauge factor of a strain gauge. (8)

12. (a) (i) What are different types of magnetic sensors? (8)

(ii) Describe with sketch, the principle of operation of a co-axial type torque sensor. (8)

Or

(b) (i) Describe eight characteristics of photo detectors as radiation sensors. (8)

(ii) Describe an optical-fibre sensor for temperature measurement. Comment on its range, accuracy and resolution. (8)

13. (a) (i) What are the properties of an intelligent field device? Explain. (8)

(ii) Show with the help of diagrams, how the primary sensors are integrated with signal processing ensembles. (8)

Or

(b) (i) Draw a block diagram to show how sensors interact with automated manufacturing process. (6)

(ii) Draw the sketch of a laser beam operated system of distance sensing and explain its operation. (10)

14. (a) Explain in detail the operation of successive approximation type of analog to digital converter. What are its merits and demerits?

Or

(b) Explain how the following operations are carried out in signal conditioning process.

(i) Amplification

(ii) Filtering

(iii) Linearisation

(iv) Buffering $(4 \times 4 = 16)$

15. (a) Draw the block diagram of multi channel data acquisition system and explain the function of each block.

Or

(b) (i) Explain the principle of digital transmission system with block diagram. (8)

(ii) Write a detailed note on digital filters. (8)