

Reg. No. :

J 3208

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

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. Define sensor.
2. List the three types of parameters that affect the capacitance.
3. State Seebeck effect.
4. What materials are used for solid state radiation detectors?
5. List the limitations of cubic spline interpolation method.
6. Draw a block diagram to show how sensor interacts with automated manufacturing process.
7. What is the need for an amplifier in signal conditioning?
8. Why is D/A converter usually considered a decoder?
9. List any four functions of data loggers.
10. What is the purpose of data acquisition system?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain how quartz resonators are used as stress sensors. On what factors does the resonance frequency of a resonator depend? (12)
- (ii) Distinguish between selectivity and specificity. (4)

Or

- (b) (i) What are the different types of inductive sensors? How is displacement measured by such sensors? How does the inductance change in such a system? (8)
- (ii) Calculate the normalized sensitivity of an inductive type transducer formed with a core material of permittivity 10.5 and the closed length of path of 10 cm for a gap length of (1) 1 cm and (2) 0.05 cm. (8)
12. (a) Sketch the scheme of a transformer type magnetoelastic force transducer. What is piezoelectric? How does it work and where is it used? What is the range of such sensors? (16)

Or

- (b) (i) What is a Geiger-Müller counter? Discuss the variations in its design to suit different purposes. (8)
- (ii) What are the important detectors in a total radiation pyrometer? How are they characterized? (8)
13. (a) (i) Discuss, with suitable diagrams, the techniques of diffusion and ion implantations required in micro sensor systems. In which stage of the sensor development are these methods of processing used? (10)
- (ii) Describe briefly any two micromachining techniques. (6)

Or

- (b) (i) What is a ring oscillator? How has it been integrated? Where in a smart sensor, is it likely to be used? (8)
- (ii) What is GMR effect? Where is it being used presently? What special advantage does it compare to the earlier components used in that equipment? (8)

14. (a) (i) State the differences between low pass and high pass filter. (4)
(ii) What is Multiplexer? Where is it used? Explain with a neat sketch. (6)
(iii) Write short notes on sample and hold circuit. (6)

Or

- (b) Describe the circuit operation of the following :
(i) Digital to analog converter and (8)
(ii) Analog to digital converter. (8)

15. (a) (i) Explain the subsystems of multi channel data acquisition system. (10)
(ii) Discuss briefly on ratiometer conversion. (6)

Or

- (b) Describe the following :
(i) Digital filtering (8)
(ii) Digital data transmission system. (8)
