

B.E., DEGREE EXAMINATIONS: MAY/JUNE 2013

Sixth Semester.

MECHATRONICS ENGINEERING

MCT 113: Sensors and Signal Processing

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following statements is correct?
 - a) Sensors and actuators are both examples of transducers
 - b) Sensors and transducers are both examples of actuators.
 - c) Actuators and transducers are both examples of sensors
 - d) Sensors and transducers are example of sensing elements
2. The change of humidity is measured by
 - a) Hydrometer
 - b) Hygrometer
 - c) Psychrometer
 - d) Photometer
3. The information to be communicated in a data communications system is the _____
 - a) Medium
 - b) Message
 - c) Protocol
 - d) Transmission
4. If a sampling rate of 4 channel data acquisition system is 24 KHz, then what will be the sampling rate of two channels operated simultaneously
 - a) 24 KHz
 - b) 12 KHz
 - c) 18 KHz
 - d) 6 KHz
5. A signal contains components with frequencies up to 10 kHz, although no useful information is contained at frequencies above 6 kHz. What is the minimum frequency at which the signal should be sampled?
 - a) 6 kHz.
 - b) 12 kHz.
 - c) 14.4 kHz.
 - d) 20 kHz.
6. What would be a typical settling time for a general-purpose 8-bit ADC?
 - a) 1 to 10 nanoseconds.
 - b) 10 to 100 nanoseconds.
 - c) 1 to 10 microseconds.
 - d) 100 microseconds to 1 millisecond
7. Which method provides fastest conversion.
 - a) Flash type
 - b) Successive approximation type
 - c) Integrating type
 - d) All the above

8. What is meant by a single-chip data acquisition system?
- a) A single integrated circuit containing a DAC and a demultiplexer. b) A single integrated circuit containing an ADC and a multiplexer.
- c) A single integrated circuit containing an ADC and a DAC. d) A single integrated circuit containing all the elements of a data acquisition system.
9. The ratio of output signal or response of the instrument to a change in input or measured variable is called:
- a) Sensitivity b) Precision
- c) Resolution d) Threshold
10. The difference between the spectrum analyzer (SA) and CRO is:
- a) CRO and SA both measures time domain signal b) CRO and SA both measures frequency domain signal
- c) CRO measures frequency domain signal and SA measures time domain d) CRO measures time domain signal and SA measures frequency domain

PART B (10 x 2 = 20 Marks)

11. Differentiate active sensor from passive sensor.
12. Describe the operation of an ultrasonic sensor.
13. Define smart sensor.
14. What is frequency shift keying?
15. What is meant by quantization distortion?
16. Why voltage controlled oscillator is called voltage to frequency converter?
17. What are the requirements for a digital filter to be stable and causal?
18. How resolution is calculated in ADCS?
19. What is seven segment display?
20. Write a note on X-Y recorders.

PART C (5 x 14 = 70 Marks)

21. a) Discuss the sensor characterization methods. How is a sensor electrically characterized? Support your answer with diagrams.
- (OR)**
- b) Explain in detail about sound intensity microphones and array microphones.
22. a) (i) What is the concept of smart sensing? Explain the essential components of such system with suitable diagram. (9)

(ii) Explain the properties of smart sensors. (5)

(OR)

b) Write short notes on different wireless communication systems used in smart sensors.

23. a) Why signal conditioning elements are necessary? Explain. What are the applications of signal conditioning elements?

(OR)

b) Explain the principal operation of a V/F and F/V converter.

24. a) Explain the working of single channel and multi channel data acquisition systems with the help of a neat block diagrams.

(OR)

b) Explain the process of digital companding.

25. a) Explain the basic differences between transmissive and reflective type LCD.

(OR)

b) (i) Explain in detail, the components of magnetic tape recorder. (7)

(ii) Explain the operation of x-y recorders. (7)
