

Code : 041706

B.Tech 7th Semester Exam., 2015

INTELLIGENT INSTRUMENTATION

Time : 3 hours

Full Marks . 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the most appropriate answer/
Answer the following (any seven) : $2 \times 7 = 14$

(a) Which one of the following is an active transducer?

- (i) Strain gauge
- (ii) Selsyn
- (iii) Photovoltaic cell
- (iv) Photoemissive cell

(b) If a transducer has an output impedance of 1Ω and a load resistance of $1 \text{ k}\Omega$, it behaves as

- (i) a constant current source
- (ii) a constant voltage source
- (iii) a constant impedance source
- (iv) None of the above

(2)

(c) The order of the output resistance of 741 OPAMP is

- (i) 0.1Ω to 10Ω
- (ii) 10Ω to $10^5 \text{ k}\Omega$
- (iii) $10 \times 10^3 \Omega$ to $10^9 \Omega$
- (iv) $10^3 \Omega$ to $10^6 \Omega$

(d) A 741 OPAMP has an open-loop gain of 200000. The input offset voltage is 2 mV. If the input terminals are shorted, output voltage is

- (i) 0 V
- (ii) ∞
- (iii) 400 V
- (iv) $\pm 400 \text{ V}$

(e) A low-pass filter has a time constant τ . Its gain at frequency ω is

- (i) $\sqrt{1 + (\omega\tau)^2}$
- (ii) $\frac{\omega\tau}{\sqrt{1 + (\omega\tau)^2}}$
- (iii) $\frac{1}{\sqrt{1 + (\omega\tau)^2}}$
- (iv) None of the above

(3)

- (f) A high-pass RC filter acts as a pure differentiator when

- (i) $\omega\tau = 0$
- (ii) $\omega\tau \gg 1$
- (iii) $\omega\tau \ll 1$
- (iv) $\omega\tau = 1$

where τ is the time constant and ω is the frequency.

- (g) An 8-bit converter is used for a d.c. range of 0 V-10 V. Weight of LSB is

- (i) 39 mV
- (ii) 78 mV
- (iii) 39.2 mV
- (iv) None of the above

- (h) Define transducer and inverse transducer. Give examples.

- (i) What is the difference between accuracy and precision?
- (j) Convert octal number 7654 to binary.

2. (a) What is the difference between an OPAMP and an instrumentation amplifier? Give schematic circuit.

- (b) Mention the scheme and configuration for linearizing signal using OPAMP.

(4)

3. (a) Give the block diagram of intelligent instrumentation. Mention the features characterizing intelligence.

- (b) Describe phase-locked loop with block diagram.

4. (a) Brief on serial and parallel interfacing and mention their advantages and disadvantages.

- (b) Describe the operation of LAN mentioning the three basic network structures like star, bus and ring structures.

5. Write notes on the following :

7+7=14

- (a) Primary sensors

- (b) Standard for smart sensor interface

6. Write notes on the following :

7+7=14

- (a) Digital encoder

- (b) High-pass filter

7. Discuss autocorrelation and cross-correlation operation in signal conditioning technique.

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(5)

8. (a) Describe the operating principle of successive approximation-type analog-to-digital converter.

(b) Find the successive approximation analog-to-digital output for a 4-bit converter to an 8.217 V input if the reference is 5 V.

9. (a) Describe the following terms used in conjunction with D/A conversion :

(i) Resolution

(ii) Quantization error

(iii) Aperture time

(b) Explain the following terms in connection with an OPAMP :

(i) Input offset voltage

(ii) Input offset current

(iii) Slew rate
