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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Automation & Robotics) (2012 & Onwards)
(Sem.-7)

SENSORS AND SIGNAL PROCESSING

Subject Code : BTAR-701

M.Code : 71806

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt ANY FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt ANY TWO questions.

SECTION-A

1. Answer Briefly :

- a) How smart sensors are useful in medical diagnosis?
- b) What is a smart sensor?
- c) Considering Z-transformation of $x(n)$ as $X(z)$, what is Z-transform of $x(-n)$?
- d) What do you mean by finite precision effect in digital filters?
- e) Write mathematical expression for Hamming window.
- f) What do you mean by region of convergence in Z-transformation?
- g) What is difference between data acquisition system and data logger?
- h) What is most critical part in design of smart sensor?
- i) What is meant by proportional band in case of proportional controller?
- j) What are drawbacks of Zeigler-Nichol method of PID controller tuning?

SECTION-B

2. Discuss application of MEMS in environmental monitoring.
3. Draw a block diagram for multichannel data acquisition system and discuss each block.
4. Consider a discrete time signal given as follows :

$$x(n) = a^n u(-n - 1)$$

Determine its Z-transform.

5. Differentiate between fixed point and floating point representations in digital filters.
6. Discuss process control system in a chemical process industry.

SECTION-C

7. Discuss Ziegler-Nichol ultimate gain method for controller tuning. Assume that the Ziegler- Nichols ultimate gain method is used to tune a PID controller for a plant with model

$$G_o(s) = 2 \frac{e^{-s}}{(2s+1)^2}$$

Determine the parameters of the PID controller.

8. Given the system function $\frac{1}{(1+s)}$ for a first order analogue Butterworth low-pass filter with cut-off frequency 1 radian/second, use the bilinear transformation to design a second order IIR discrete time band-pass filter whose 3 dB cut-off frequencies are at 1467 Hz and 2500 Hz when the sampling frequency is 10 kHz.
9. What is importance of sample and hold circuit with analog to digital signal converter? Discuss sample and hold using an operational amplifier with the help of a circuit diagram.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.