CS/B.TECH/EIE(New)/SEM-7/EI-703/2013-14

2013

PROCESS CONTROL - II

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Question)

1. Choose the correct alternatives for any *ten* of the following: 10 x 1 = 10

   i) A real sampler when sampling an analog signal acts as

      a) impulse modulator

      b) pulse amplitude modulator

      c) pulse width modulator

      d) pulse code modulator

   ii) Minimum sampling interval required to avoid aliasing for the analog signal given by:

      $x(t) = 5\sin(200\,\pi)\,t + 3\cos(100\,\pi)\,t$ is

      a) 10 m.sec b) 5 m.sec

      c) 2.5 m.sec d) 20 m.sec

iii) Z transform can be used for

a) any system

b) any continuous system

c) any discrete time system

d) any LTI system

iv) In 1st order hold for reconstruction of signal

a) last sampled data are used

b) last two sampled data are used

c) last three sampled data are used

d) more than three sampled data are used.

v) Sampled data system characteristics polynomial is given by $F(z) = z^2 - \frac{1}{4}$. The system is

a) stable b) unstable

c) marginally stable d) unpredictable.

vi) For a sampled data system to be stable the z-domain poles must be

a) within unit circle

b) outside unit circle

c) anywhere in z-place

d) none of these.

vii) Network protocol used in multidrop DCS communication is

a) Token passing

b) Token ring

c) both (a) and (b)

d) none of these.

viii) The output of a closed loop sampled data system is given by $y(z) = \frac{z}{(z-0.5)(z-1)}$. The steady state output is

a) 0 b) 1

c) 2 d) intermediate.

ix) In Fuzzy logic system the membership function is a part of

a) rule base b) database

c) fuzzification d) none of these.

x) Fuzzy logic rules are

a) IF THEN rules b) MIT rules

c) GOTO rules d) None of these.

xi) What will be the steady state output of

TF $Y(z) = z(z + 0.2)/(z - 0.2)(z - 1)$

a) 0 b) 1.25

c) 1.5 d) infinite.

xii) The W transform is given by

a) W=ln z/T b) $W = z - 1/T$

c) W= $z - 1/zT$ d) z =ln W/T

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 x 5 = 15

2. What is a sampler with zero order hold(ZOH)? Derive the TF of ZOH in s-domain and z-domain. 2+3

3. a) What is W-transform?

   b) Derive an expression to show the relation between w-plane and s-plane frequency. 2+3

4. What is an ideal sampler? Derive the equation for the output of an ideal sampler when a continuous time signal $f(t)$ is sampled by it? 2+3

5. Draw and discuss the clock diagram with different elements in multi-loop control of process using control computer. Write the disadvantages of Z-transform/domain over s-domain. 4+1

6. Draw a schematic block diagram of a fuzzy logic control system and outline the function of each block element. 2+3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 x 15 = 45

7. a) Design a dead-beat controller for system given by open loop gain G(s) = 10 $e^{-2s}/(0.5 + 1)$. Consider sampling interval as T-1 sec.

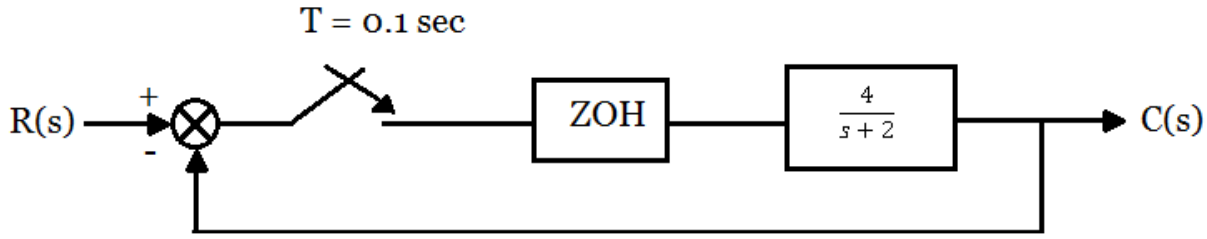
   b) Find the closed loop TF in Z-domain for sampled data linear time invariant system, where the plant preceded by an ideal sampler & zero order hold element.

   c) Deduce a transfer function for Zero element. 7+5+3

8. a) Derive the difference equation for a first order system.

   b) Derive the transfer function of a zero-order hold (ZOH) circuit.

c) Obtain the unit step response for the closed loop system for T=0.1 sec.



4+3+8

9. a) Explain the structure of a DCS with a neat sketch. Discuss the functioning of its various parts.

b) What is a network access protocol? Discuss the methods used for distributed control highways.

c) What are the advantages of distributed control system?

d) How is the fuzzy logic different from crisp logic?

5+3+4+3

10. a) Draw a basic diagram of a heat exchanger control and explain its control strategy.

b) Explain the operation of a sample *ph* control logic.

c) Draw and explain the boiler drum level control. 5+5+5

11. a) Explain CSMA/CD and token passing methods.

b) Explain bus topology, ring topology and star topology with proper diagram.

c) What do you mean by redundant controller? 4+9+2

12. Write short notes on any *three* of the following: 3 x 5

a) Combustion control

b) Bilinear Transformation

c) ARMA model

d) Pole zero matching

e) Dahlin's algorithm

f) Boiler drum level control.

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