53 (IE 712) CCPR

2017

COMPUTER CONTROL OF PROCESS

Paper : IE 712

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of **seven**.*

1. *(a)* What is periodic sampling ? Draw and explain the operation zero order hold circuit. 2+4

   (b) Check for stability of the sampled data control systems represented by the following characteristics equations.

   (i) $z^3 - 0{\cdot}2z^2 - 0{\cdot}25z + 0{\cdot}05$

   (ii) $z^4 - 1{\cdot}7z^3 + 1{\cdot}04z^2 - 0{\cdot}268z + 0{\cdot}024$ 5+5

(c) Find the Z Transform of the following function.

$$f(t) = e^{at} \cos wt .$$ 4

2. (a) A discrete-time system has the transfer function

$$T(z) = \frac{4z^3 - 12z^2 + 13z - 7}{(z-1)^2 (z-2)}$$

Determine the state model of the system in

(i) Phase variable form

(ii) Jordan canonical form. 5+5

(b) Using root locus technique investigate the stability of the system shown in *Fig. 2. (b)* for sampling period, $T = 0{\cdot}5\, sec$. 10

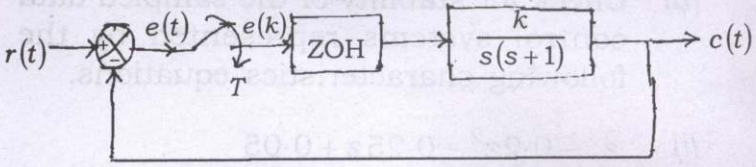

Fig. 2. (b)

3. *(a)* Briefly explain the basic building blocks of PLC with neat sketch. 8

(b) Define ladder diagram. Prepare the physical ladder diagram for the control problem shown in *Fig. 3. (b)*. The global objective is to heat a liquid to a specified temperature and keep it there with stirring for 30 minutes. 2+10

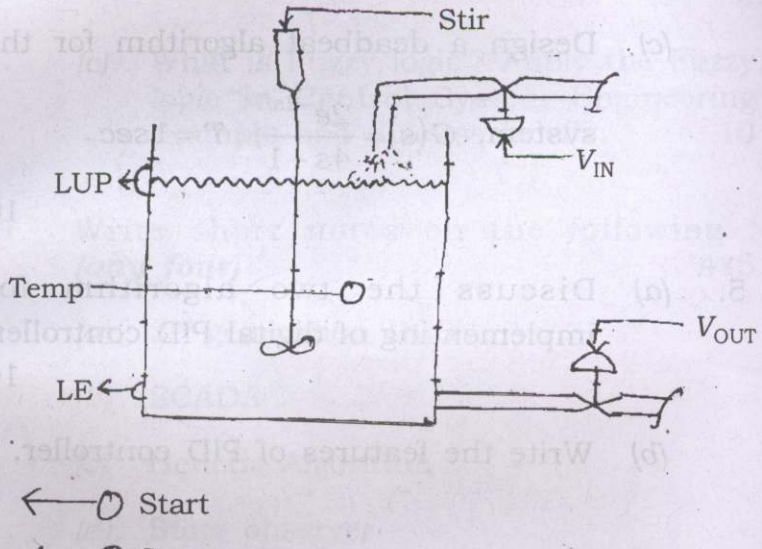

Fig. 3. (b)

4. *(a)* Draw schematic and the PLC ladder diagram for the following logic functions.

AND, OR, NAND, XOR, NOR

5

(b) Write a short note on Automation hierarchy in Distributed Control System (DCS). 5

(c) Design a deadbeat algorithm for the system, $G(s)=\frac{2e^{-2s}}{4s+1}$, $T=1sec$.

10

5. *(a)* Discuss the two algorithm for implementing of digital PID controller.

10

(b) Write the features of PID controller.

5

(c) Show how a timer in PLC can be used to turn a red light on for 2500*ms* when a NO start push button is pushed. The PLC timer tick is 10*ms*. An NC stop button resets the system. 5

6. *(a)* An ADC that will encode temperature data as required. The input signal is $666{\cdot}6 mV/°C$. If the resolution of $0{\cdot}5°C$ is required, find the number of bits necessary for the ADC. The reference is 10 volt. 5

(b) Prove that for a 4 bit R-2R ladder DAC : If the input is $(0010)_2$, the output is $V_R/8$

where V_R is the reference voltage. 5

(c) What is Fuzzy logic ? Apply the Fuzzy logic in Control System Engineering example and discuss briefly. 10

7. Write short notes on the following : ***(any four)*** 4×5

(a) 3rd generation DCS

(b) SCADA

(c) Genetic Algorithm

(d) State observer

(e) Counters in PLC

(f) Dalhin's algorithm.
