53 (IE 712) CPCN

2018

COMPUTER CONTROL OF PROCESS

Paper : IE 712

Full Marks : 100

Time : Three hours

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

Symbols have their usual significance.

*Answer **any five** questions taking **at least two** questions from **each** group.*

Group-A

1. *(a)* Draw the schematic diagram of a direct digital control (DDC) system and explain its operation. 10

   (b) List and explain the network components of an integrated control system (ICS). 10

2. *(a)* Explain the operation of a distributed control system (DCS). 10

(b) Mention the advantages and disadvantages of DCS. 5

(c) Describe the characteristics of different Buses. 5

3. (a) Explain how you correlate the hierarchical level, the response time and data quantity. 10

(b) Write a short note on : 10

(i) OSI model and

(ii) forward & backward chaining.

4. (a) Draw the sehematie block diagram of a PLC and explain the operation of each block. 10

(b) Draw the PLC ladder diagram for the logic gates :

(i) NAND

(ii) NOR and

(iii) XOR. 5

(c) What do mean by $T_{ON} = 10\,sec$ and $T_{OFF} = 10\,sec$ in PLC timer operation. 5

Group-B

5. *(a)* What are the different algorithms used for implementation of analog controllers ? Derive the algorithms for PI controller using forward rectangular rule for integration. 10

(b) Derive the difference equation of $u(k)$ vs. $c(k)$ for PI Control using trapezoidal rule for integration term. Find the change in output at third sample for the following data :

$K_p = 1{\cdot}5$, $T = 0{\cdot}6\,sec$, reset time $= 1{\cdot}8\,sec^{-1}$. derivative time $= 8\,sec$, $e_1 = 2$, $e_2 = 1$ and $e_3 = 4$. 10

6. *(a)* State initial value theorem (IVT) and final value theorem (FVT) for Z-transformation. Find the final value of $f(k)$ using FVT for the following function

$$F(z) = \frac{0{\cdot}792z^2}{(z-1)(z^2 - 0{\cdot}416z + 0{\cdot}208)}$$ 10

(b) For the following discrete transfer function, obtain the difference equation $u(k)$. 10

$$\frac{U(z)}{E(z)} = \frac{z^2 + z}{z^2 - 1{\cdot}2z + 0{\cdot}5}$$

7. *(a)* Derive the generalized equation of a controller for a digital control system. Using this equation, derive Daedbeat controller algorithm. 8

(b) The open loop transfer function of a plant is given by $G(s)=\frac{e^{-2s}}{10s+1}$.

Design a Deadbeat digital controller for the system. Assume that the desired closed loop transfer function is $T(z)=z^{-k}$, $k>=1$ and $T=1sec$.

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8. Write short notes on ***any four*** of the following: 4×5=20

(a) Merits and demerits of digital control system

(b) Stability analysis of discrete data system

(c) Signal discretization techniques

(d) Jury's stability test

(e) Dahlin's controller.
