GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2020-2021
PROCESS CONTROL-II
EI702

TIME ALLOTTED: 3 Hrs **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 Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **1×10=10**

		Marks	CO No
1(i)	The z-transform of a unit step function is a) $1/(1+z^{-1})$ b) $1/(1-z^{-1})$ c) $1/(1+z)$ d) $1/(1-z)$	1	CO2
1(ii)	Example of Industrial Control System is a) PLC b) DCS c) Both a and b d) None of the above	1	CO3
1(iii)	For a first-order hold device, reconstruction of signal is based on: a) last sampled data b) last two sampled data c) last three sampled data d) more than three sampled-data	1	CO1
1(iv)	A signal has frequency 20 Hz. The Nyquistfrequency is a) 10 Hz b) 20 Hz c) 40 Hz d) none of these	1	CO1
1(v)	The absolute stability of a discrete time system can be determined by a) Jury's test b) Bode plot c) Routh Hurwitz criteria d) None of these	1	CO3
1(vi)	For a sampled-data system to be stable, the z-domain poles must be a) within the unit circle b) outside the unit circle c) exactly on the perimeter of the unit circle d) anywhere in the z-plane	1	CO3

1(vii)	In fuzzy-logic system, the membership function is part of a) rule base b) data base c) defuzzification technique d) none of these	1	CO6
1(viii)	The defuzzifier is used in the a) Mamdani's model b) Sugeno's model c) Tsukamoto's model d) None of these	1	CO6
1(ix)	An example of an Industrial Control System (ICS) is a) PLC b) DCS c) Both PLC & DCS d) None of these	1	CO5
1(x)	Redundancy is a feature of a) supervisory control system b) distributed control system c) open control system d) field control system	1	CO5
1(xi)	Which type of network connectivity is supported by DCS? a) LAN b) WAN c) MAN d) None of these	1	CO3
1(xii)	Gain margin of discrete-time control system can be found by using: a) Jury's test b) Routh-Hurwitz criteria c) Root locus in r-plane d) Nyquist plot in w-plane	1	CO3

GROUP – B
(Short Answer Type Questions)

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

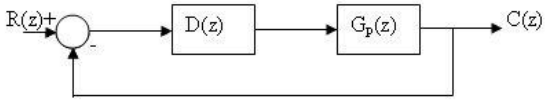
		Marks	**CO No**
2. a)	State and prove the real convolution theorem of z-transform.	2	CO2
2. b)	Derive the closed loop transfer function of a discrete-data system. Assume that an ideal sampler is placed in the forward path.	3	CO2
3.a)	A unit step signal is sampled by an ideal sampler and then reconstructed by using a zero order hold (ZOH). Find the z-transform of the reconstructed signal. Give diagram of the reconstructed signal.	3	CO2
3.b)	What are the different International Field Bus standards for DCS?	2	CO2
4.	Why is the zero order hold preferred to first order hold? Justify with the help of suitable mathematical expressions and diagrams.	5	CO1
5.	Map the region of stability in s-plane into z-plane.	5	CO3

6. a)	Draw the basic block diagram of a fuzzy logic based control system (Mamdani's model) and briefly describe the role of each block.	4	CO6
6.b)	What is fuzzification?	1	CO6

GROUP – C
(Long Answer Type Questions)

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

		Marks	CO No
7. a)	How is signal reconstruction carried out for a discrete-time signal?	2	CO1
7.b)	Briefly describe the method used to reconstruct a signal from a sequence of data points.	5	CO1
7.c)	Why is Laplace transform not suitable for analysis of discrete-data systems?	2	CO2
7.d)	State and prove the final value theorem of z-transform.	3	CO2
7.e)	Find inverse-z transform of the function $F(z) = 2z/(z^2- 2z +3)$. Use any method.	3	CO2
8. a)	Compare the position and velocity forms of a digital PID controller with the help of suitable mathematical expressions.	5	CO4
8.b)	What is a deadbeat controller?	2	CO4
8.c)	Design a deadbeat controller for the all-digital system given below, for unit step, where $G_p(z) = (z+0.2)/(z^2-z-1)$.	3	CO4



8.d)	What are the drawbacks of deadbeat controller?	5	CO4
9.a)	Draw the basic architecture of a DCS.	4	CO5
9.b)	What is safety interlock in a DCS?	2	CO5
9.c)	Why is redundancy used in DCS?	1	CO5
9.d)	Briefly describe the network topologies used in implementing a DCS network.	6	CO5
9.e)	What is engineering station in DCS?	2	CO 5
10.	Answer any three from the following: 3x5		
10.a)	Dahlin's algorithm	5	CO4
10.b)	pH control	5	CO4
10.c)	HART protocol	5	CO5
10.d)	PLC operation	5	CO4
10.e)	OSI model	5	CO4