ME - Sem - II (CBGS - Inst & control - Stochastic Process

QP Code : **30574**

(3 Hours) [Total Marks : 80

N.B. : (1) Question no.1 is **compulsory**.
(2) Attempt any **three** question out of the remaining **five** questions.
(3) Assume any suitable data wherever necessary.

1. Briefly explain(**any four**) 20
   a) Probability space
   b) Poisson distribution
   c) Gamma Distribution
   d) Fractional integration
   e) Random process

2. Differentiate between 20
   a) Probability density function and probability Distribution function
   b) Covariance and correlation
   c) Stationarity and Ergodicity
   d) Marginal pdf and joint pdf

3. a) Briefly explain the acceptability conditions of an optimal estimate 10
   b) Kalman filter is the best linear filter. Explain. 10

4. a) Explain the concept of fractional derivative. What are the different definitions of fractional order derivative? Define any two of them. 10
   b) Obtain 0.9^{th} derivative of unity. 10

5. a) What is autocorrelation function? Explain its significance in engineering applications. 10
   b) Explain how the pdf of a function of a random variable can be determined, given the pdf of the random variable. 10

6. Write short note on: 20
   a) Bayes theorom
   b) Orthogonality Principle

BB-Con. 7269-15.

ME Sem II CBSGS Adv Process Inst & Cont Nov-15
(INST & CONT

Q.P. Code : **30576**

(3 Hours) [Total Marks :80

N.B. : (1) Question No.1 is compulsory.
(2) Answer any three questions from Question Nos. 2 to 6.
(3) Assume suitable data if necessary.

1. Answer the following questions:-
   (a) Discuss partially decoupled controller using ratio method. 5
   (b) Compare process and factory automation. 5
   (c) Explain the methods of SIL determination. 5
   (d) Compare IMC control strategies with conventional PID control. 5

2. (a) Discuss the optimization aspect in H.E and explain cascade and feedforward temperature control strategies. 10
   (b) What is the need of dead time and inverse response compensation and how it is handled? 10

3. (a) What is constraint control? Explain MIMO constraint control with example. 8
   (b) Design a Fieldbus network for H1 FF-assume the distance between control room and plant unit is 1000 meters. There are 06 field devices- 01 PT, 02- LT, 02- FT and 01 -positioner in safe area. 12

4. (a) What is SIS? Discuss the phases of implementation. 10
   (b) Explain the procedure of power requirement calculation of PLC system. 10

5. (a) Explain the advantage and disadvantages of HPT and DART. 10
   (b) Explain the topologies used by H1 and HSE of FF. 10

6. Write short notes (any TWO):- 20
   (a) Compare FISCO and FNICO.
   (b) Trends in modem process automation.
   (c) Wireless HART.

[TURN OVER

Data Sheets for FF Segment Calculations

Table 1: Power supply and conditioner for FF

Type	Us	Is	R_Q	Remarks
MTL 5053	18.4 V	80 mA	105 Ω	IS power supply with power conditioner and switchable terminator
MTL 5995	19.0 V	max. 350 mA	1 Ω	Non IS power supply with power conditioner and switchable terminator
Relcom FCS-PC	V_{Input} – 5 V	Min. 330 mA	-	power conditioner
Relcom FCS-PCT	V_{Input} – 5 V	Min. 330 mA	-	power conditioner with terminator
Siemens 6ES7-157-0-AD00 0XA0	12.5 V	100 mA	-	PROFIBUS Segment Coupler EEx[ia] IIC
Siemens 6ES7-157-0-AC00 0XA0	19.0 V	400 mA	-	PROFIBUS Segment Coupler for safe area
Pepperl+Fuchs – KFD2-BR-EX1.2PA.93	13.0 V	110 mA	-	PROFIBUS Segment Coupler EEx[ia] IIC
Pepperl+Fuchs – KFD2-BR-EX1.1PA.93	25.0 V	380 mA	-	PROFIBUS Segment Coupler for safe area

Table 2: Cable specification:

Property	Type A	Type B	Type C	Type D
Cable Construction	Twisted pairs, shielded	One or more twisted pairs, common shield	Several twisted pairs, unshielded	Several twisted pairs, unshielded
Core cross-section	0.8 mm^2 AWG 18	0.32 mm^2 AWG 22	0.13 mm^2 AWG 26	1.23 mm^2 AWG 16
Loop resistance (DC)	44 Ω/km	112 Ω/km	254 Ω/km	40 Ω/km
Characteristic impedance at 31.25 KHz	100 Ω ± 20 %	100 Ω ± 30 %	-	-
Attenuation constant at 39 KHZ	3 db/km	5 db/km	8 db/km	8 db/km
Capacitive unsymmetry	2 nF/km	2 nF/km	-	-
Envelope delay distortion (7.9 … 39 KHz)	1.7 µs/km	-	-	-
Max. bus length (including spur length)	1900 m	1200 m	400 m	200 m

Table 3: FISCO concept:

Coupler	Type A	Type B	Type C
Type of protection	EEx [ia/ib] II C	EEx [ib] II B	None
Supply voltage	13.5 V	13.5 V	24 V
Max power	1.8 W	3.9 W	9.1 W
Max. supply current	≤ 110 mA	≤ 280 mA	≤ 400 mA
No. of devices	Approx. 10	Approx. 20	Max 32

Table 4: The cable specification for IS

Type of protection	EEx [ia/ib] II C	EEx [ia/ib] II C
Loop resistance (DC)	15 … 150 Ω/km	15 … 150 Ω/km
Specific inductance	0.4 … 1 mH/km	0.4 … 1 mH/km
Specific capacitance	80 … 200 nF/km	80 … 200 nF/km
Max. spur length	≤ 30 m	≤ 30m
Max. bus length	≤ 1000 m	≤ 1900 m

Table 5: Ratings of PS and devices

Power Supply	**Us**	**Is**	**R_O**	
MTL 5995	19V	350 mA	< 2 Ω	
Cable	**R_{loop}**	**L_{max}**		
Cable Type A	44 Ω/km	1900 m		
Device	**U_{Basic}**	**I_{Basic}**	**I_{FDE}**	**$I_{starting}$**
Promag 53 - Flow	9 ... 32 V	12 mA	0 mA	0 (<I_B)
Cerebar S – Pressure	9 ... 32 V	10.5 mA	0 mA	0 (<I_B)
Micropilot FMR 23 x - level	9 ... 32 V	11 mA	0 mA	0 (<I_B)
Positioner	9 ... 32 V	13 mA	4 mA	0 (<I_B)
Max fault current I_{FDE}			4 mA	

Table 6: Specifications of PS, cable and Devices for IS:

Power supply	**Uo**	**Io**	**Po**		
MTL 5053	22 V	216 mA	1.2 W		
Property	**Explosion Group**				
	IIC	**IIB**	**IIA**		
Capacitance Co	0.165 μF	1.14 μF	4.20 μF		
Inductance Lo	0.32 mH	3.00 mH	7.00 mH		
L/R ratio	31 μH/Ω	126 μH/Ω	242 μH/Ω		
Cable	**R'**	**C'**	**L'**	**C_{LS}**	
Beldon 3076	44 Ω/km	82 nF/km	623 μH/Ω	147 nF/km	
Device	**Ui**	**Ii**	**Pi**	**Li**	**Ci**
Promag 53 - Flow	30 V	500 mA	5.5 W	10 μH	5 nF
Cerebar S - pressure	24 V	500 mA	1.2 W	10 μH	5 nF
Terminator (MTL FBT 1)	30 V	-	1.2 W	-	negligible

Table 7: Maximum spur length

Participants	**1 – 12**	**13 – 14**	**15 – 18**	**19 – 24**	**25 – 32**
Max. Spur length	120 m	90 m	60 m 30 m	30 m	1 m

Maximum Cable Length for an IEC 61158-2 Segment as a Function of Cable Type and Type of Protection

	Max. Length as a Function of Cable Type			
Type of Protection	*Type A*	*Type B*	*Type C*	*Type D*
Safe area/Ex i/Ex d	1900 m/6200 ft	1200 m/3900 ft	400 m/1300 ft	200 m/650 ft
FISCO EEx ia IIB/IIC	1000 m/3250 ft	1000 m/3250 ft	Not suitable	Not suitable
FISCO EEx ib IIB	1900 m/6200 ft	1200 m/3900 ft	Not suitable	Not suitable

E- Sem-II-(CBSGS) - INST & CONT. - Intelligent & Autonomous control

QP Code : 30604

(3 hours) **Total Marks 80**

i. Q. 1. Compulsory. Attempt any 4.
ii. Attempt any three from the remaining.
iii. Assume suitable data.

Q.1	(a)	Explain the term Controllability / Reachability in control system.	5
	(b)	Discuss the various operations on Fuzzy sets along with their properties.	5
	(c)	Explain the term non-determinism with one good example.	5
	(d)	Explain the limitations of *roulette-wheel selection method.*	5
	(e)	Explain the evolution of RCS in brief.	5
Q.2	(a)	Develop the PN/CPN for any one example.	14
	(b)	Explain any one level of the autonomous controller functional architecture.	6
Q.3	(a)	Discuss in detail the behavior generation block of RCS 4.	10
	(b)	Show the adaptive structural analogy in AI planning system.	10
Q.4	(a)	Discuss the selection mechanisms in GA.	10
	(b)	Describe the signal functions in NN.	10
Q.5		Develop the Fuzzy Logic based environment control for any one example of your choice. State the assumptions clearly.	20
Q.6	(a)	Explain the main tasks at management and organization level of autonomous controller.	10
	(b)	Explain the functions of BG, VJ, WM and SP in RCS 4.	10

ME / Sem II (CBSGS) / INST & Control / Nov 2015
Advance Nuclear Instrumentation

Q.P. Code : 30586

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Answer any **three** from remaining.

1. Answer following questions : 20
   (a) Explain meaning and method of spectrum stabilization.
   (b) Explain Fabrication process for HPGE detectors.
   (c) Explain meaning and working of self powered Neutron Detectors.
   (d) Explain meaning of functional imaging and how it is useful.

2. (a) Explain meaning and important performance parameters of Nuclear ADC. 10
   (b) Explain Wilkinson technique with help of a block diagram. 10

3. (a) Explain a set up for timing spectroscopy with the help of block diagram. 10
   (b) Describe different techniques for Time to Amplitude convertors. 10

4. (a) Explain principle of noise reduction using coincidence technique. 10
   (b) Explain working of Liquid Scintillation counting system with block diagram. 10

5. (a) Explain working of imaging system using positron Emission tomography. 10
   (b) Describe use and working of trigger system for Astrophysics Experiments. 10

6. Write short notes on **any two** : 20
   (a) Gamma camara
   (b) Instrumentation for Nuclear Reacter
   (c) Instrumentation for accelerators

BB-Con. 8868-15.