M.E. IYR (INST) SEM II (CBSGS) NOV '16

STOCHASTIC PROCESSES.

QP Code : 62887

(3 Hours) [Total Marks :80

N.B. : (1) Question No. 1 is compulsory.
(2) Attempt any **three** questions out of remaining **five.**
(3) **Figures** to **right** indicate full **marks.**
(4) **Assume** suitable **data** if **required** and **mention** the **same** in **answer sheet.**

1. (a) Explain in brief different methods used to combating frequency-selective fading. 10
(b) A DMS has an alphabet of seven letters Xi, i = 1, 2,..... 7 with probabilities of 0.36, 0.14, 0.13, 0.12, 0.10, 0.09, 0.06.Generate a Huffman code for source. Also find Entropy and efficiency. 10

2. (a) Describe the basic concept of ISI.State and prove Nyquist theorem for band limited Signals. 10
(b) Explain Average cost of decision in Bays detection of received signal. 10

3. (a) Give the schematic for M-ary using optimum receiver using correlator and explain the operation for optimum detection of received message signal. 10
(b) Design the optimum coherent receiver for Rician channels. 10

4. (a) Derive waveform receiver in coloured Gaussian Noise using Time Sampling approach. 10
(b) Explain Optimum waveform receiver in White Gaussian Noise. 10

5. (a) What do you mean by relevant and Irrelevant Noise. Explain their role in signal Detection. 10
(b) Explain I-Q modulator and demodulator using real signals with functional diagram. 10

6. (a) Describe in detail process of model based source coding. 10
(b) Explain time- variant nature of the channel in Doppler-shift domain. 10

M.E. IYR SEM II NOV '16

(INST)

ADV. PROCESS INST. & CONTROL

Q.P. Code : 688800

(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 (Any FOUR):-
(a) Explain the methods of SIL determination. 5
(b) Compare IMC control strategies with conventional PID control. 5
(c) Discuss partially decoupled controller using ratio method. 5
(d) Compare process and factory automation. 5
(e) Explain topologies used in FF. 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. 10
(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. 10

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

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

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

TURN OVER

Data Sheets for FF Segment Calculations

Table 1: Power supply and conditioner for FF

Type	Us	Is	R_O	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

[TURN O

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
Load 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

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Table 5: Ratings of PS and devices

Power Supply	U_s	I_s	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}	$I_{startup}$
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_{La}	
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

M.E. - 1st YR (INST) Sem II (CBSGS) NOV/DEC '16

INTRO TO NON-LINEAR CONTROL THEORY

QP Code : 63133

(3 Hours) [Total Marks: 80]

N. B.: (1) Question No. 1 is compulsory.
(2) Attempt any four questions from remaining six questions.
(3) Assume suitable data if necessary.
(4) Figures to the right indicate full marks.

1. Answer the following **20**
   (a) Derive the describing function for replay with saturation.
   (b) Explain Lyapunov indirect method of stability analysis.
   (c) Explain piecewise linearization method for nonlinear systems.
   (d) Explain different singular points.

2. (a) Explain MIMO system linearization by state feedback. **10**
   (b) Explain phase plane with example. Discuss the limitation of phase plane method. **10**

3. (a) Explain how describing function method can be used for stability analysis of nonlinear systems. **10**
   (b) Discuss stability of the following nonlinear system. **10**
   $\dot{x}_1 = -x_1 + x_1x_2$
   $\dot{x}_2 = x_1 - x_2$
   Select the Lyapunov function $V(x) = x_1^2 + x_2^2$.

4. (a) Linearize the following system at equilibrium **10**
   $$\dot{x}_1(t) = x_1(t) + x_1(t)x_2^2(t)$$
   $$\dot{x}_2(t) = x_2(t) - x_2(t)x_3(t)$$
   $$\dot{x}_3(t) = 6x_2(t) - 8x_3(t)x_2(t) + u(t)$$
   (b) Explain the classification of nonlinear systems into minimum phase systems. and weakly minimum phase system. **10**

5. (a) Explain the following terms with example **10**
   i) continuously differentiable ii) continuous
   iii) locally Lipschitz iv) Globally Lipschitz

   (b) Design sliding mode controller for the following system **10**
   $$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

6. Write short notes on **20**
   (a) Feedback linearization
   (b) Local and global stability
   (c) Bifurcation
   (d) Limit cycles

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E / Inst & Control / Sem-II (CBSGS) / Advance Nuclear Instrumentation / Nov-16

Q.P. Code : 689101

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

Note : 1) Question **No. 1** is **compulsory.**
2) Attempt **any three** questions from remaining **five** questions.
3) Assume suitable data if necessary.

1. a) Explain various factors which decide resolution of nuclear pulse spectroscopy System. **5**
   b) Explain why liquid scintillators are preferred over solid scintillators for counting beta particles emitted from tritium. **5**
   c) Explain method of fabrication of HPGE detector. **5**
   d) Explain important performance parameters of nuclear ADC. **5**

2. a) Explain the need and working of a spectrum stabilization system. **10**
   b) Explain important facilities and controls provided in multichannel analyzer **10**

3. a) Explain how coincidence detection technique helps to reduce effect of noise. Explain one use of this technique with block diagram. **10**
   b) Explain in core and out of core instrumentation for nuclear reactors **10**

4. a) Explain working of Charge to Digital convertor with circuit diagram **10**
   b) Explain need and principle of working of a Trigger system in astrophysics experiments **10**

5. a) Explain working of gamma camera with block diagram. **10**
   b) Explain various methods of neutron detection **10**

6. Write short notes on **any two** of the following:- **20**
   a) Channel profile of nuclear ADC.
   b) Interferences encountered in liquid scintillation counting.
   c) Gatti's Sliding scale technique.

ME/INST/Sem-II(CBSGS)/Intelligent & Autonomous/ Nov-16.

QP CODE: 687500

(3 Hours) [Total Marks 80

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

Q. 1	(a)	Explain the importance of Endomorphism in an autonomous architecture.	(5)
	(b)	Train the network for OR gate using perceptron learning rule.	(5)
	(c)	Explain the functions of Job Planner in BG block.	(5)
	(d)	Discuss various types of membership functions.	(5)
	(e)	Explain the main components of the functional architecture of any autonomous system.	(5)
Q. 2	(a)	Develop the PN/CPN for a Traffic signal Control System.	(10)
	(b)	Use either a Adaline Network and train it to learn the following (1, 1,-1,-1) and (-1, -1, -1, -1) belong to class 1 (1, 1, 1, 1) and (-1, -1, 1, -1) belong to class -1	(10)
Q. 3	(a)	Discuss in detail the main blocks of RCS 4.	(10)
	(b)	Describe in detail the adaptive structural analogy in AI based planning system.	(10)
Q. 4	(a)	Develop the Fuzzy Logic based controller for auto geared vehicle. State the assumptions clearly.	(10)
	(b)	Implement ANDNOT function using McCulloch-Pitts neuron (use binary data representation).	(10)
Q. 5	(a)	Explain the steps of GA with suitable example. Comment on the mutation rate and crossover rate.	(10)
	(b)	Explain with the help of flowchart the participation of SES and PES in task planning methodology.	(10)
Q. 6	(a)	Discuss the World modelling and Value Judgment block of autonomous system.	(10)
	(b)	Design a Hebb net to implement OR function (consider bipolar inputs and targets).	(10)
