ME / INST & CNTL / Sem-II (choice Base) / Electronics System Design /

Q.P.Code: 013665

Duration 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.

Q. 1 **20**

a) Explain important considerations involved in use of FET and BJT as analog switch.

b) Discuss advantages and disadvantages of Delta sigma ADC over successive approximation type ADC..

c) Explain working and advantages of chopper stabilized amplifier.

d) Explain effect of R-C coupling circuits used at input of Instrumentation amplifier on Common mode rejection ratio.

Q. 2 a)Explain working of millivolt Peak detect circuit. 10

b) Explain important considerations in design and fabrication of high speed circuits . 10

Q.3 a) Explain important performance parameters of analog multiplexer. 10

b) Explain working of sample & hold circuit with circuit diagram. Explain effect of each component on performance parameters of this circuit. 10

Q.4 a) Explain design of a reference current source for grounded load and discuss effect of each component on performance of this circuit. 10

b) Explain the design of DC.to DC. Converter and explain its important uses. 10

Q.5 a) Explain various methods of power supply noise reduction. 10

b). Explain problems associated with mixed signal processing circuits and methods to overcome these problems. 10

Q.6 Write short notes on any **two** of the following - 20

a) Use of Hysteresis in comparator circuits..

b) Methods of Quantization noise reduction in delta sigma ADC.

c) Need and Methods to improve dynamic range of instrumentation amplifier .

May 2022

M.E. Sem II (IMST & Comp) Choice Base
State Estimation & Stochastic Process

Q.P. Code :09628

[Time: 3 Hours] **[Marks:80]**

N.B: Please check whether you have got the right question paper.
1. Question no. 1 is compulsory
2. Answer any three questions out of the remaining questions.
3. Assume suitable data wherever necessary.

Q.1 Briefly explain any four 20
a) Monte carlo method
b) Sandwich formula
c) Unbiased Estimate
d) Random Walk
e) Mittag Lefler function

Q.2 Differentiate between the following 20
a) White noise and shot noise
b) Ergodicity and stationarity
c) Hilbert space and Banach Space.
d) Gaussian pdf and exponential pdf

Q.3 a) Derive kalman filter as a Bayesian filter. 10
b) Explain the significance of kalman filter in engineering applications. 10

Q.4 a) Compare the Extended Kalman filter and unscented kalman filter as applied to non-linear systems 10
b) Explain the square root kalman filtering 10

Q.5 a) Obtain 'm' th derivative of function $y(t)=t^n$ where 'm' is a fractional number and n is an integer. Use gamma function. 10
b) Explain how the same can be derived using Riemann Louiville definition. 10

Q.6 Write short notes on 20
a) Particle filtering
b) Poisson distribution

ME
INST & / Sem-II / T7532 / T4040 ADVANCED PROCESS CONTROL & AUTOMATION / MAY-2017
CNTL [Choice Base]

Q.P.Code: 10918

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

Note:

1. **Question No.1 is compulsory**
2. **Solve any THREE questions out of remaining FIVE questions.**
3. **Figure to the right indicate full marks.**
4. **Assume suitable data if required.**

1. Answer the following (any 04) :- (20)
   a) Write evolution of communication protocol and their advantages.
   b) Explain the generic architecture of DCS.
   c) Explain safety integrity level (SIL).
   d) Explain entity concept.
   e) What is meant by process modeling? Explain its need?

2. Answer the following:-
   a) Write a note on Devicenet. (10)
   b) Write and explain the procedure to calculate power requirement and I/O modules in case of PLC based system with suitable example. (10)

3. Answer the following:-
   a) Select the appropriate control loop configuration for the following input output relationship:- (10)

$$\bar{y}_1(s) = \frac{2}{(s^2+5s+1)}\bar{m}_1 + \frac{1}{(0.1s+1)}\bar{m}_2$$

$$\bar{y}_2(s) = \frac{-3}{(0.5s+1)}\bar{m}_1 + \frac{10}{(7s+1)}\bar{m}_2$$

   b) Explain the life cycle of SIS. (10)

4 Answer the following :-
   a) Explain SCADA technology. (10)
   b) Explain the term constraint control. Explain MISO constraint control with suitable example. (10)

5. Answer the following:-
   a) Explain **Foundation Fieldbus** in detail. (10)
   b) Derive the model equation of evaporator. (10)

6. Write short notes on any (2) (20)
   a) PLC HMI interfacing
   b) High Power trunk Concept
   c) Profibus-PA

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
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

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}	$I_{startup}$
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	Ic	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_{IS}**	
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

TURN OVER

Data sheet for PLC

SLC 500 DISCRETE INPUT MODULE POWER			SLC 500 DISCRETE OUTPUT MODULE POWER		
Module	+5 Volts	+24 Volts	Module	+5 Volts	+24 Volts
120 VAC Input Modules			120–240 VAC Output Modules		
1746-IA4	.035	0	1746-OA8	.185	
1746-IA8	.050	0	1746-OA16	.370	0
1746-IA16	.085	0	1746-OAP12	.370	0
24 V dc Input Modules			24 V dc Output Modules		
1746-'B8	.050	0	1746-OB8	.135	0
1746-'B16	.085	0	1746-OB16	.280	0
1746-IB32	.106	0	1746-OBP16	.250	0
1746-ITB16	.085	0	1746-OB32	.452	0
1746-IV8	.050	0	1746-OV8	.135	0
1746-IV16	.085	0	1746-OV16	.270	0
1746-ITV16	.085	0	1746-OV32	.452	0
1746-IV32	.106	0			
200–240 VAC Input Modules			Relay AC/DC Output Modules		
1746-IM4	.035	0	1746-OW4	.045	.045
1746-IM8	.050	0	1746-OW8	.085	.090
1746-IM16	.085	0	1746-OW16	.170	.180
			1746-OX8	.085	.090
5 V dc TTL Input Module			5 V dc TTL Output Module		
1746-IG16	.140	0	1746-OG16	.180	0

Selected Allen-Bradley SLC 500 I/O module loading specifications. (Chart data used with permission of Rockwell Automation, Inc.)

PROCESSOR SPECIFICATIONS		POWER SUPPLY LOADING IN AMPS	
Processor	User Instructions	+5 V dc	+24 V dc
5/01	1 K	.350	.105
5/01	4 K	.350	.105
5/02	4 K	.350	.105
5/03	12 K	.500	.105
5/04	12 K	1.00	.200
5/04	28 K	1.00	.200
5/04	60 K	1.00	.200

SLC 500 processor power supply loading specifications. (Chart data used with permission of Rockwell Automation, Inc.)

ME / INST & CNTL / T7532 / T4043 / ELECTIVE I : ADVANCED NUCLEAR INSTRUMENTATION / May - 2017

Sem - II [Choice Base]

Q.P.Code:16925

Duration 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.

Q. 1 a) Explain need and working of Constant fraction Time pick-off circuit. 05

b) Explain use of coincidence detection technique for noise reduction.. 05

c) Explain need and working of Self powered neutron detectors. 05

d) Explain importance of differential nonlinearity and conversion time for nuclear ADC 05.

Q. 2 a) Explain working and performance parameters for multichannel analyzer. 10

b) Explain need and working of spectrum stabilization system in multichannel analyzer . 10

Q.3 a) Explain working of liquid scintillation counting system with block diagram. 10

b) Explain in core and out of core instrumentation for nuclear reactors 10

Q.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

Q.5 a) Explain performance parameters of gamma camera . 10

b). Explain various methods of neutron detection 10

Q.6 Write short notes on any **two** of the following - 20

a) Channel profile of nuclear ADC.

b) Signal processing in accelerator Instrumentation .

c) Wilkinson ADC.

E-/sem-II/ T5732 TO T8432T / T8050 ELECTIVE II RESEARCH METHODOLOGY / May-2017

All branch

Q.P.Code:13395

hoice based

(3 hours) [Max Marks-80]

N.B. (1) Attempt any four questions out of six questions

(2) Assume any additional data if necessary and state it clearly

(3) Explain answers with neat sketches wherever necessary

1.	a)	Explain in detail the essentials of a good research report	[10]
	b)	Explain the statistics for Data Analysis and Reporting.	[10]
2.	a)	Explain in brief the stages in Scientific Research process	[10]
	b)	Briefly describe various types of research	[10]
3.	a)	What do you mean by 'Sample Design'? What points should be taken into consideration by a researcher in sample design for any research project?	[10]
	b)	Formulate a research problem, taking into consideration all the aspects	[10]
4.	a)	Explain in details the characteristics of research	[10]
	b)	Enumerate the different methods of collecting data giving one example each	[10]
5.	a)	State the objectives of research and illustrate the issues and problems in research	[10]
	b)	Explain validity testing for research and the ethical issues faced	[10]
6.	a)	What do you understand by Research Design? State its types and significance	[10]
	b)	What are the Characteristics of a good hypothesis? Explain (i) Type I and Type II errors (ii) Level of Significance (iii) variables in Hypothesis	[10]