

NB.:

- Question No. 1 is compulsory.
- Answer any **three** from the remaining five questions.
- Assume suitable data if necessary and justify the same.
- Figures to the right indicate the marks.

- Briefly explain the following:- 20
 - Minimal Polynomial and Characteristic polynomial.
 - Inner product and Cross product of vectors.
 - Algebraic and Geometric multiplicities of eigen value.
 - Column space and Null space.
- Explain the concept of Linear independence of vectors. Find the values of 'x' such that the vectors $(1 \ 2 \ 1)$, $(x, 3, 1)$ and $(2, x, 0)$ are linearly dependent. 10
 - What is meant by Linear transformation? Define Kernel and range as applied to linear transformation. 10
- Prove Cayley Hamilton Theorem. 10
 - What is orthogonal Vector? Extend $(2, 3, -1)$, $(1, -2, -4)$ to an orthogonal basis of \mathbb{R}^3 . 10
- Explain the concept of Vector space, Basis, Span and Dimension. 10
 - Investigate for what values of ' λ ' and ' μ ', the equations $x+y+z=6$, $x+2y+3z=10$ and $x+2y+\lambda z=\mu$ have a unique solution. 10
- Explain Singular value Decomposition and its application. Find the Singular values of the matrix $A = \begin{bmatrix} 4 & 0 & 1 \\ 3 & -5 \end{bmatrix}$ 10
 - Explain Row Echelon form. Find the row- reduced echelon form of the matrix $A = \begin{bmatrix} 0 & -1 & 2 & 0 \\ 2 & 2 & 1 & 5 \\ 1 & 3 & -1 & 0 \end{bmatrix}$ and hence find its rank. 10
- Write short note on Gram Schmidt process of orthogonalization. 10
 - Define eigen values and eigen vectors of a matrix. Compute all the eigen values and eigen vectors of $A = \begin{bmatrix} 8 & 4 \\ 2 & 6 \end{bmatrix}$ and comment whether A is diagonalizable or not. 10

MARKS -80

TIME 3 hrs.

Instructions:

- 1) Question no. 1 is compulsory.
- 2) Attempt any Three out of remaining questions.
- 3) Assume suitable data wherever required.

Q.1) Answer the following—

- a) Explain dark current compensation for photodiodes. (05)
- b) Discuss dissipation constant of RTD. (05)
- c) State true/false and justify the same--- (05)
Resolution is limited in case of wire wound potentiometers.
- d) Explain the use of charge sensitive amplifier (05)

Q.2a) Explain signal processing of inductive sensors. (10)

- b) Describe a Kelvin sensing system with 6-wire voltage driven bridge using single resistance transducer element. (10)

Q.3 a) Explain how direction and velocity can be measured with encoders. (10)

- b) Explain DC to DC converter for transducer signal processing system. (10)

Q.4 a) List the noise sources introduced at different stages of measurement system and suggest remedy. (10)

- b) Explain architecture of smart transducer with its advantages. (10)

Q.5 a) Discuss the need of guarding techniques used for processing signal from transducers with high output impedance. Describe various techniques. (10)

- b) Distinguish between operation of photoconductive and photovoltaic diodes. (10)

Q.6) Write short notes: (20)

- a) Fabrication process of microsensors
- b) Accelerometers.

M.E. - INST (CBSSGS)

SEM I

MAY '16

QP Code : 14409

ADAPTIVE CONTROL THEORY
(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) Differentiate between MIAC and MRAC.
 - (b) Obtain discrete time process model for a system with $y(s)=g(s).u(s)$ where $y(t)$ is output and $u(t)$ is input.
 - (c) What is system identification?
 - (d) Explain cancellation controller.
2. (a) Explain any two methods of DC value estimation. 10
(b) Describe the characteristics of PI, PD and PID controllers. 10
3. (a) Derive the linear response of a linear system if stationary stochastic signal is applied via estimation of ACF of i/p and CCF of i/p and o/p signal. 10
(b) Define MIT rule and obtain the MIT rule for feedforward gain. 10
4. (a) Derive the equation for parameter estimator using non recursive LS method. 10
(b) Write a note on dual adaptive controllers. 10
5. (a) What are the various methods of building deterministic state controller? Draw the general adaptive state controller scheme and briefly explain it. 10
(b) Explain dead beat controller. 10
6. Write short notes on: 20
 - (a) Square root filtering
 - (b) Minimum variance control
 - (c) Tuning of controllers.

BB-Con. 9668-16.

Q.P. Code : **14412**

(3 Hours)

[Total Marks : 80]

N.B. : (1) Question No.1 is compulsory.

(2) Answer **any Three** from the remaining **Five** questions.

1. (a) Explain the need for Sub-carriers in Bio-telemetry system. 5
(b) Explain the principle and working of PET imaging system. 5
(c) Explain need and working of Chopper Amplifier with neat diagram. 5
(d) Explain the concept behind Driven Right leg configuration. 5
2. (a) Explain working of 8-channel EEG machine with 10-20 electrode placement. 10
(b) Explain with a neat diagram working of SPECT scanner system. 10
3. (a) What is Cardio version? Explain working of cardioverter with diagram. 10
(b) Explain the various techniques used for reducing noise and interference in Biomedical systems for optimal performance. 10
4. (a) What is a Retinal Implant? Explain working of different types of retinal implants with a neat diagram. 10
(b) Explain working of Muscle stimulators with different types of waveforms. 10
5. (a) Explain the working of Multichannel Radio-telemetry system with Frequency Division Multiplexing. 10
(b) Explain the principle and working of any one type of Isolation amplifier. 10
6. Write Short Notes on (5 Marks each) : 20
 - (i) Electrode Electrolyte Model
 - (ii) Telemedicine
 - (iii) Advanced Instrumentation Amplifier
 - (iv) Cochlear implant

QP Code : 14430

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 clearly meaning and uses of voltage references and current references. 05
b) Explain working of logarithmic amplifier and its applications. 05
c) Explain the fastest method of Analog to Digital Conversion. 05
d) Explain why separate analog and digital grounds are used in mixed signal processing. 05
- Q. 2 a) Explain working of a Millivolt Peak detect circuit with circuit diagram. 10
b) Explain working of switched capacitor low pass filter. 10
- Q. 3 a) Explain working of analog multiplexer and its applications. 10
b) Explain need of hysteresis in comparator circuit using circuit diagram. 10
- Q. 4 a) Explain working of DC to DC convertor and mention its uses in signal processing. 10
b) Explain important performance parameters of Digital to Analog Convertor. 05
c) Explain advantages of R-2R ladder network over weighted resistor network for use in Digital to Analog Convertor. 05
- Q. 5 a) Explain effect on performance of instrumentation amplifier due to C-R coupling at its inputs and explain remedies to improve the performance. 10
b) Discuss important issues involved in power management of electronic circuits. 10
- Q. 6 Write short notes on any **two** of the following - 20
a) Working of voltage to frequency convertor.
b) RF shielding techniques.
c) Delta Sigma technique for Analog to Digital Conversion..

BB-Con. 10418-16.