

HIGHER MATHS FOR CONTROL
ENGG

QP Code : 821401

(3 Hours)

[Total Marks : 80

- N.B. :** (1) Question No. 1 is Compulsory.
 (2) Answer **any three** out of remaining questions.
 (3) Assume suitable data wherever required.
 (4) Figures to the **right** indicate **full marks**.

1. Briefly explain any **four**

20

- (a) Euclidean Vector Space
- (b) Basic vector
- (c) Inner Product
- (d) Rank of a matrix
- (e) Orthogonal projection

2. (a) Solve the following system using Gaussian elimination

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$$x_1 + 2x_2 + x_3 = -1$$

$$x_1 - x_2 + x_3 = -1$$

$$x_1 + x_2 = 3$$

(b) If Transformation T_A is defined as $T_A : \mathbb{R}^n \rightarrow \mathbb{R}^n$ is multiplication by matrix A and if A is an ' $n \times n$ ' invertible matrix, classify the following statements as **true / false** and justify your answer. 10

- (i) $Ax = b$ is consistent for every ' b '
- (ii) The column vectors of A are linearly independent.
- (iii) $Ax = 0$ has only the trivial solution
- (iv) ' A ' has rank ' n '

3. (a) Explain the concept of eigen values and eigen vector. Find the general solution for the following system using this concept. 10

$$\dot{y}_1 = -y_1$$

$$\dot{y}_2 = 3y_1 + 2y_2$$

(b) Differentiate between

- (i) linear independence and linear dependence.
- (ii) Givens' matrix and Model matrix.

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[TURN OVER]

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4. (a) Obtain the least squares solution to $Ax = b$ where

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$$A = \begin{bmatrix} -2 & 3 \\ 1 & -2 \\ 1 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$$

- (b) Given the data of (x, y) as $(-4, 22)$, $(-2, 4)$, $(2, 4)$ and $(4, -2)$, interpolate a polynomial of third degree to this data.

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5. (a) Identify whether the set of real numbers over complex number is a linear vector space. Justify.

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- (b) Explain the significance of singular value decomposition in image processing.

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6. Differentiate between

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- (a) Ill Conditioned system and Rank deficient system.
(b) LU decomposition and Cholesky decomposition.

(3 Hours)

[Total Marks: 80]

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

(3) Assume suitable data if necessary.

1. (a) Explain important considerations involved in selecting feedback resistor in current to Voltage convertor used for processing signals from photo diodes. **20**
(b) Discuss advantages of Kelvin sensing system used for sensing signals from remotely driven bridge circuits when voltage driven and current driven bridges are used.
(c) Explain advantages and disadvantages of reverse biasing photodiodes.
(d) Explain whether a Single channel analyzer can respond to higher radioactivity as compared to Multichannel analyzer .
2. (a) Draw equivalent circuit of resistance transducer and explain it. **10**
(b) Explain fabrication process of micro sensors. **10**
3. (a) Explain circuit used for processing signals from capacitive transducers. **10**
(b) Explain important features of a smart transducer. **10**
4. (a) Explain advantages and methods of implementation of ratio metric measurement. **10**
(b) Explain the need and methods used for guarding techniques in processing signals from transducers with high output impedance . **10**
5. (a) Explain working of multichannel analyzer with block diagram. **10**
(b) Explain signal processing circuit used for processing output of LVDT. **10**
6. Write short notes on any **two** of the following: **20**
(a) Performance parameters of nuclear ADC.
(b) Signal processing for Piezoelectric transducers.
(c) Need of preamplifiers in processing signals from radioactivity.

ROBUST CONTROL

Q.P. Code : 821600

3 Hours

Max. Marks 80

N.B.

1. Q.1 is compulsory. Attempt any three from the remaining questions.
2. All questions carry equal marks.
3. Figures to the Right indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt any four

20

- a. Prove the stability of $\dot{x} = -\text{sgn}(x)$ via Lyapunov method.
- b. How the QFT design objectives can be achieved?
- c. Explain the advantages of the sliding mode control.
- d. Write the properties of Hurwitz polynomial?
- e. Establish the relationship between classical controller 'c' and IMC controller 'q'.
- f. What is perfect control? State limitations of it

Q.2 A. Design a sliding mode control for following system

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$$\dot{x}_1 = x_2 \quad (1)$$

$$\dot{x}_2 = u + d(t) \quad (2)$$

so that sliding motion exhibit the response with time constant of 0.2sec. Assume that disturbance is $d = 0.6 \sin 20t$.

B. Compute the maximum reaching time for the system $\dot{x} = -3\text{sgn}(x)$ 10

Q.3 A. Derive the expression for sensitivity and complementary sensitivity functions for the IMC control structure. 10

B. The nominal characteristic polynomial of the system is given by 10

$$P(s) = s^3 + a_2 s^2 + a_1 s + a_0$$

The nominal values of the coefficients are $(a_0^0, a_1^0, a_2^0) = (-6, -5, 2)$ and the uncertainty range for them is

$$(\Delta a_0, \Delta a_1, \Delta a_2) = (2, 1, 2)$$

Design the robust state feedback control.

Q.4 A. (e) How the filter is designed to improve disturbance rejection in IMC design? 10

B. Design the IMC controller for the plant 10

$$\tilde{G}(s) = \frac{\exp(-2s)(s+1)}{10s+1}$$

to achieve the step response with 3sec time constant.

TURN OVER

- Q.5 A. What is interlacing of polynomials? State Hermite-Biehler theorem for real polynomial. 10
- B. Determine the stability of the interval system, 10

$$G(s) = \frac{1}{s^3 + [1, 2]s^2 + [0.5, 1]s + [0.06, 0.1]}$$

- Q.6 A. Explain solution of differential equation with discontinuous right hand side using equivalent control. 10
- B. Explain the reaching law based sliding mode control? 10
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Duration: 03 hrs

Marks: 80 Marks

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

2) Attempt any 3 questions from remaining 5 questions.

1. a. Explain in brief, specification requirements of Biotelemetry system. (05)
b. Justify that Instrumentation amplifiers are used as Bio-amplifiers. (05)
c. Write short notes on, TENS. (05)
d. Explain in brief, about Chopper amplifier. (05)
 2. a. Explain working of Muscle stimulators with different types of waveforms. (10)
b. Explain with a neat diagram, the working of each block of 6-lead ECG signal Conditioning system. (10)
 3. a. Explain the various Image Reconstruction techniques used in CT system. (10)
b. What is a Cardioverter? Explain its working with a neat diagram. (10)
 4. a. Explain the principle and working of Carrier-type of Isolation amplifier. (10)
b. Explain the working of Multichannel Radio-telemetry system, with Frequency Division Multiplexing. (10)
 5. a. Explain the different types of Lasers used in medicine and their working Concept. (10)
b. Explain with a neat diagram, working of Short wave diathermy. (10)
 6. Write short notes on (any two): (20)
 - a. Endoscopy
 - b. Atrial triggered Pacemaker circuit design
 - c. Electrosurgical Diathermy
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E-Sem-I-CCBCS)-INST&CONT, EXTC, INFT - NOV-16
Management Information System

Q. P. Code : 855301

(3 Hours)

[Total Marks : 80

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

- (2) Attempt any 3 questions out of rest.
- (3) Figure to the right indicate full marks.
- (4) All questions carry equal marks.

1. College wants to design database for examination system.
 - a) Design tables with assuming suitable attributes and normalize the database. 5
 - b) Define primary key, foreign key with its importance in database design. List Primary and foreign key in each table of above tables. 5
 - c) Draw Star schema and Snowflake schema for above design. 5
 - d) Explain difference between star schema and snowflake schema with purpose of normalization. 5
 2.
 - a) Explain Several ways in which IT impacts employees at work. Also explain how IT might change manager's job. 10
 - b) Explain E-Commerce with its various types. 10
 3.
 - a) Explain Characteristics of data warehouse. Differentiate between data warehouse and data marts. 10
 - b) Explain Customer relationship Management with its various types. 10
 4.
 - a) Define Big Data. Explain various characteristics and issues in Big Data. 10
 - b) Explain various Business intelligence Applications for presenting Results. 10
 5.
 - a) Explain traditional system development life cycle. 10
 - b) Explain various threats to information system. 10
 6. Write short notes on any two 20
 - a) Enterprise Resource planning
 - b) Pervasive Computing
 - c) Cloud computing model
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