

(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 any four of the following questions: - 20
 - (a) What do you mean by runaway reaction?
 - (b) Explain with example use of safety interlock.
 - (c) Explain the hazard triangle.
 - (d) List primary and secondary products of refinery unit.
 - (e) Define shrinking and swelling effect in boiler.
2. (a) Classify crystallizers. Explain control scheme in circulating magma crystallizer in indirect heating. 10
 - (b) Explain with neat sketch milk pasteurization process and its control. 10
3. (a) Draw surge characteristics. Explain any one method of surge control from Centrifugal compressor. 10
 - (b) Explain the process of Penicillin-G production along with its control parameters. 10
4. (a) Explain column pressure control scheme for distillation column. 10
 - (b) Draw and explain closed gas turbine control scheme. 10
5. (a) Explain hazardous area classification as per IEC & NEC standard. 10
 - (b) Discuss feed forward and bypass control scheme of heat exchanger. 10
6. Write short note on- 20
 - (a) Intrinsic safety
 - (b) Cascade control scheme for evaporator
 - (c) Fluidized bed dryer.
 - (d) Instrumentation used in Iron and steel industry

Choice

(3 Hours)

[Total Marks : 80]

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

(2) Answer any three questions from the remaining questions.

1. Attempt the following [Any Four]:

- | | |
|--|----|
| (a) Explain the concept of action potential and resting potential with neat waveform. | 5 |
| (b) What is the function of alveoli in breathing system? | 5 |
| (c) State in your own words the need of artificial pacemaker? | 5 |
| (d) What is the main idea behind recording of electrical activity of heart? | 5 |
| (e) Tell, what are the necessary precautions that need to be taken care of during dialysis procedure? | 5 |
| | |
| 2. (a) (i) Identify and list out the different types of electrodes according to their applications in biomedical Instrumentation system. | 8 |
| (ii) What is the concept of Electrode-Electrolyte system. | 2 |
| (b) What is the function of neurons? Classify the Nervous system and describe the working of Central Nervous System (CNS) in detail with diagram. | 10 |
| | |
| 3. (a) What is Einthoven Triangle in ECG? Explain 12 lead ECG measurement system. | 10 |
| (b) Explain C.T. Imaging technique with suitable block diagram. | 10 |
| | |
| 4. (a) What do you mean by the term 'epilepsy'? Explain 10-20 electrode placement system of EEG with neat block diagram. | 12 |
| (b) Discuss the significance of medical Imaging. Sketch the block diagram of X-ray machine describing its operation and list down its various applications. | 8 |
| | |
| 5. (a) Explain the function of Heart Lung Machine with neat block diagram and discuss its applications during surgery. | 10 |
| (b) How would you examine blood flow of the patient's body? Sketch the neat labeled diagram of Electromagnetic type blood flow measurement system and explain its working. | 10 |
| | |
| 6. Write Short Notes on (Any Two) :- | 20 |
| (a) D.C. Defibrillator. | |
| (b) Measurement of Blood Pressure. | |
| (c) Ventilator System. | |

Choice

(3 Hours)

[Total Marks: 80]

Note:

1. Question one is compulsory.

2. Solve any three from remaining and assume suitable data

- | | | |
|--------------|---|-----------|
| Q1. | Solve any four | 20 |
| a. | What is Automation? Give its significance. | |
| b. | Write a note on DCS flow sheet symbols. | |
| c. | Explain with the diagram Automation Hierarchy. | |
| d. | What are the terms SIS, SIL & IEC 61508. Explain briefly. | |
| e. | Classify the types of PLC. Name the vendors and manufacturers. | |
| Q2. a | What are the different types of DCS displays? Elaborate each type with an example. | 10 |
| b | Explain Hierarchical computer system structure for a large manufacturing complex system. | 10 |
| Q3.a | List out the types of input modules and output modules of PLC. Draw the block diagram of AC input module. | 10 |
| b | Develop a ladder diagram for bottle filling application for the following sequence. | 10 |
| | 1. With a START motor should be ON till bottle is sensed. | |
| | 2. Bottle should be filled and FULL level is sensed, if empty provide logic. | |
| | 3. Motor starts again for next bottle filling. | |
| | Include I/O Listing with addressing, program description and ladder sequence. | |
| Q4.a | Discuss the features of SCADA. Also, explain functions of MTU & RTU. | 10 |
| b | Compare PLC-DCS-SCADA. | 10 |
| Q5. a | Why alarm management is important? Explain the Alarm Management Philosophy. | 10 |
| b | What are protection layers? How are they significant w.r.t. SIS. | 10 |
| Q6 | Write a short note on any two. | 20 |
| a. | Factors affecting scan interval in SCADA system | |
| b. | MES and ERP with application | |
| c. | Memory organization in PLC. | |
| d. | PLC-DCS Integration- Necessity and Methods. | |

(Choice)

(3 Hours)

(Total Marks : 80)

Please check whether you have got the right question paper.

- N.B.:**
- 1) Question No. 1 is compulsory.
 - 2) Solve any three questions of remaining five questions.
 - 3) Assume any suitable data if required.
 - 4) Figures to the right indicate full marks.

1. Attempt any FOUR :

(20)

- a) Distinguish between global, local and dynamic thresholding.
- b) Explain Haar Transform.
- c) Explain Power Log Transformation.
- d) Compare lossy and lossless compression techniques of image.
- e) Explain Image Degradation Model.

2. a) Code the following data stream using Huffman Coding :

(10)

{a, a, a, a, a, a, a, b, b, b, b, b, c, c, c, c, d, d, d, d, e, e, f, f, g}

b) With a neat block diagram, explain the fundamental steps involved in digital image processing system. (10)

3. a) Explain Hough Transform with a suitable example. (10)

b) Calculate the distance measure for the given image between two pixel p and q : (10)

- i) Euclidean Distance
- ii) City block Distance
- iii) Chess Board Distance
- iv) M- adjacency Distance

1	2	3	4 (q)
2	0	2	1
3	1	3	1
4 (p)	1	0	2

4. a) Explain discrete cosine Transform and compute DCT for the given image : (10)

2	0	0	0
1	2	1	1
1	0	0	1
1	1	2	1

b) Name different types of image segmentation techniques and explain region splitting and region growing technique with suitable explain. (10)

5. a) Equalize the below Histogram :

(10)

Gray Level	0	1	2	3	4	5	6	7
No. of Pixel	790	1023	850	656	329	245	122	81

- b) Explain Homomorphic filter with the help of a neat diagram.

(10)

- 6 Write short notes on :

(20)

- i) Wiener Filter
- ii) Dilation and Erosion in Morphological Operations
- iii) Predictive Coding(DPCM)

Choice/

Duration: 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. Explain block diagram of digital control system and show all the signal forms in it.
- b. What are the limiting factors that may affect choice of sampling rate for a given system?
- c. What will be the output of first order hold when an impulse at $t = 1$ is passed through it?
- d. Derive expression for pulse transfer function matrix for a given system represented by state space model.
- e. Explain use of bilinear transformation in stability analysis of discrete time systems.
- f. What is principle of duality by Kalman?

Q.2 A. Derive transfer function of Zero order hold and explain its frequency response.

10

B. Discretize the given system using Zero order hold with transfer function

10

$$G(s) = \frac{5}{s(s+5)}$$

Assume sampling period $T=0.1$ sec.

Q.3 A. Obtain state transition matrix using Cayley Hamilton theorem for the system described by :

10

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -10 & -7 \end{bmatrix} x(k)$$

B. What is meant by completely controllable and completely observable systems? Check controllability of the following discrete time system :

10

$$x(k+1) = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0.5 & 0 \\ 0 & 0 & 2 \end{bmatrix} x(k) + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u(k)$$

Q.4 A. Explain digital PID controller in detail.

10

B. The discrete time control system is given by

10

$$\begin{aligned} x(k+1) &= \begin{bmatrix} 0 & 1 \\ 20.6 & 0 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k) \\ y(k) &= [1 \ 0] x(k) \end{aligned}$$

Design a full order observer such that the response to observation error is deadbeat.

Q.5 A. Obtain the discrete time state model of the following continuous time system with sampling time of 1 sec :

10

$$\begin{aligned} \dot{x}(t) &= \begin{bmatrix} 0 & 0 & -0.25 \\ 1 & 0 & 0 \\ 0 & 1 & 0.5 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u(t) \\ y(t) &= [1 \ 0 \ 0] x(t) \end{aligned}$$

B. Using Jury's stability criteria determine the range of K for asymptotic stability of the system given by characteristic equation

10

$$P(z) = z^3 + 0.5z^2 + Kz - K = 0$$

Q.6 A. Determine steady state error for unit step, ramp and acceleration inputs for a unity feedback system characterized by transfer function :

10

$$G_{ho}G(z) = \frac{1.266z + 0.5702}{z^2 - 1.082z + 0.08208}$$

B. Determine state feedback gain matrix K for the system given by :

10

$$\begin{aligned} x(k+1) &= \begin{bmatrix} 1 & 0.2 \\ 0 & 1 \end{bmatrix} x(k) + \begin{bmatrix} 0.02 \\ 0.2 \end{bmatrix} u(k) \\ y(k) &= [1 \ 0] x(k) \end{aligned}$$

Place closed loop poles at $0.5 \pm 0.5j$.

(3 Hours)

(Total Marks : 80)

- N.B:** 1) Q.1 is compulsory.
2) Attempt **any THREE** questions from the remaining questions.
3) Assume suitable data if necessary.

Q.1 Attempt any four :

- a) Compare active attacks vs Passive attacks. [5]
- b) Explain various types of key-loggers in brief. [5]
- c) Classify the cybercrimes and explain any one briefly. [5]
- d) Explain how the appeals can be made under The IT ACT 2000. [5]
- e) Write brief note on : Cyber-terrorism. [5]

Q.2 a) How criminals plan the attack? Discuss various steps involved [10]

- b) Explain how Intellectual property laws protect the rights of the owner of the intellectual Property. [10]

Q.3 a) Compare Vishing, Phishing and Smishing in cyber security. [10]

- b) What is E-commerce? Explain different types of e-commerce with suitable examples. [10]

Q.4 a) What is Bluetooth hacking? Explain Bluetooth hacking tools in brief. [10]

- b) How the Indian penal code IPC 1860 addresses cybercrime? [10]

Q.5 a) Discuss basic security precautions to be taken to safeguard Laptops and wireless devices. [10]

- b) What is E-contract? Discuss E-contract Act 1872. [10]

Q.6 Write short note on (Any 2) : [20]

- 1) Computer Sabotage.
- 2) Indian Information Technology Act 2000
- 3) Write key IT requirements for SOX and HIPAA.