Q.P. Code : 722200

3 Hours   **80 MARKS**

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

1.   Answer the following.(ANY FOUR)   20
    a. Explain the bilinear transformation maps the left half of the s plane into unit circle in z plane.
    b. Define position, velocity and acceleration error constants for a digital control system.
    c. Explain the effect of sampling on stability and steady state performance of digital control system.
    d. State and explain Kalman's principle of duality.
    e. Explain Aryabhatta's identity.

2. a) Obatin the pulse transfer function for the following system.   10

$$x(k + 1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.12 & -0.01 & 1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$$

b) A discrete time regulator system has a plant-   10

$$x(k + 1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ -4 & -2 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(k)$$

Design a state feedback controller which will place the closed loop poles at $-0.5 \pm j0.5$.

3.a) A discrete time system has a state equation given by-   10

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

use Caley Hmilton theorem to obtain state transition matrix. Verify the result with z transform approach.

b) Represent the following systems in controllable, observable and diagonal   10
    canonical forms along with its block diagram realization.

$$G(Z) = \frac{Z^{-2} + 0.5Z^{-3}}{1 - Z^{-1} + 0.01Z^{-2} + 0.12Z^{-3}}$$

$$G(Z) = \frac{1.65(Z + 0.1)}{Z^3 + 0.7Z^2 + 0.11Z + 0.005}$$

TURN OVER

4. a) What do you understand by dead beat response of an observer? Design a state observer   10
to obtain dead beat response for the system given below:-

$$G = \begin{bmatrix} 1 & T \\ 0 & 1 \end{bmatrix}, \quad H = \begin{bmatrix} \frac{T^2}{2} \\ T \end{bmatrix}, \quad C = \begin{bmatrix} 1 & 0 \end{bmatrix}$$

Use transformation matrix method and verify your result using Ackerman's Formula.

b) Derive the expression for transfer function of first order hold with neat input/output   10
characteristics.

5. a) The block diagram of the system is shown below, using concept of signal flow graph   10
determine C(Z)/R(Z).
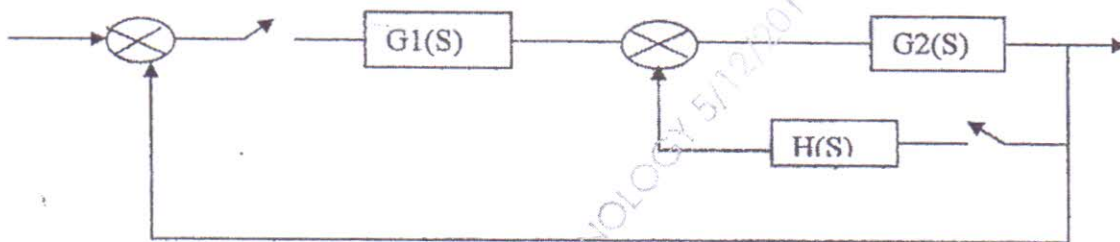
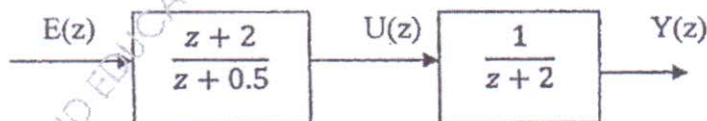b) b) Check the stability of the system using Jury's stability test.   10
i) $z^4 - 1.368z^3 + 0.4z^2 + 0.08z + 0.002 = 0$
ii) $z^3 - 1.8z^2 + 1.05z - 0.2 = 0$

6. a) Write short note on bumpless PID controller with $T_c=S_c$. Determine discrete time PID   10
controller if we have following continuous time PID settings: K=2, τ_d=2.5 s, τ_i= 40 s,
τ_s=1 s.
b) Study the effect of stabilizing the following system with controller that has a zero at   10
z=-2.
$G(z) = \frac{1}{z+2}$ as shown in figure below

Q.P. Code : 728202

(3 Hours) [Total Marks : 80

N.B. : (1) Q 1 is **compulsory**
   (2) Solve any **three** questions out of remaining **five** questions
   (3) Assume any suitable data if required
   (4) Draw neat diagram wherever required

1. Explain any Four 20
   (a) Define project and explain project structure with the help of success triangle.
   (b) Explain the role of constructor.
   (c) Describe Junction box scheduling.
   (d) Explain types of cables.
   (e) Explain ISA tagging process to indicate the instrument and its function.

2. (a) Explain the project deliverables in detail 10
   (b) Explain the importance of specification sheet. Explain the specification sheet For Control valve 10

3. (a) Explain project scheduling technique. 10
   (b) Write short notes on procurement methods and procedure. 10

4. (a) Explain DCS or SCADA graphics in detail. 10
   (b) Draw and explain hook-up diagram for flow and temperature measurement. 10

5. (a) Explain different standard used in Instrumentation projects. 10
   (b) Discuss in detail advantages of using software packages for documentation. 10

6. write a short note on (ANY **TWO**) 20
   (a) Checkout procedure for Temperature transmitter and control valve.
   (b) Draw and explain instrument location plan with example.
   (c) What is HMI? Explain the importance of graphics in process control industry. Prepare graphical user interface template.

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Q.P. Code : 733401

(3 Hours)   [Total Marks : 80

N.B. : (1) Question **No. 1** is **compulsory**.
      (2) Attempt **any three** out of remaining questions.
      (3) Assume suitable data if required and state it clearly.

1. Answer the following:- **(Any Four)**
   - (a) State True/False and hence justify- "Man-Machine interaction forms a closed loop".   5
   - (b) Explain the physical significance of piping geometry factor in valve sizing.   5
   - (c) Define Reliability and explain the terms MTTF, MTBF and MTTR.   5
   - (d) Explain GA drawing.   5
   - (e) List the methods of thermocouple calibration. Give name of the most accurate method and justify it.   5

2. (a) Size a control valve for the following:-   10
   Fluid; Dry saturated steam
   Flow rate: 6000 lb/hr
   Upstream pressure: 50 psig
   Downstream pressure: 55.7 psia
   Pipe Diameter: 4" sch 40
   Valve style: Globe valve
   $C_d = 13$, $X_T = 0.75$.
   - (b) Write a short note on system engineering.   10

3. (a) Draw a typical control room layout diagram and explain the guidelines used to design the same.   10
   - (b) Explain IP standards used for enclosure design.   10

4. (a) Discuss the factors to be considered while designing transducer.   10
   - (b) Draw and explain Bath tub curve with its significance.   10

TURN OVER

5. (a) Find the predicted SPL at 1.2 meter downstream of the valve and 3 feet   10
horizontally from the pipe surface it -
   · Upstream pressure = 125 psia
   Downstream, pressure = 65 psia
   Pipe diameter = 2"sch 40 (O.D = 2.735")
   Thickness = 0.154"
   $X_T = 0.7$, $C_v = 35$.
   Insulation one inch thermal (4dB/inch)
   Location: open area 30" above ground.

(b) Write a short note on - Grounding and shielding.   10

6. (a) Explain illeffects of cavitation with remedies to refuce it.   10
   (b) Size a control valve for the following:-   10
   Fluid: water, flow rate = 1600 gpm
   Upstream pressure: 27.9 psig
   Downstream pressure: 34.7 psia
   Valve style: 60^0 Butterfly Valve, Cd =17

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Q.P. Code : 722700

(3 Hours)   [Total Marks :80

N.B. : (1) Q No. **1** is **compulsory**.
     (2) Answer any **Three** out of remaining **Five** questions.
     (3) Use **legible** handwriting.
     (4) Draw neat **diagram** with proper **labeling**.

1. Answer the following:-   20
    (a) Briefly explain the nature of alpha, beta and gamma radiations.
    (b) Explain half life time .
    (c) Mention the **types** of Scintillator.
    (d) Explain **Isotopes and Isobars** with example.

2. (a) Explain the **properties** of alpha, beta and gamma radiations in **detail**.   10
    (b) What is **Scintillation detector**? What are the **properties** of good   10
       Scintillator?

3. (a) Explain different **working regions** of gas filled detectors.   10
    (b) Explain **G.M counter** with its V - I characteristics.   10

4. What is **Gamma camera**? Explain Gamma camera with neat block diagram.   20
How it can be used in medical application?

5. (a) Explain the factors affecting resolution of gamma- energy for nuclear   10
       instruments.
    (b) Explain application of nuclear instrumentation for **leak detection and**   10
       locating.

6. (a) Explain the principle and architecture of **MCA** (multi channel analyzer).   10
    (b) Explain solid state detectors (**Ge - Li or Si - Li**) with neat diagram. Also   10
       list the advantages of semiconductor detectors.

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QP Code :732501   MAY-16

(03 Hours)   (Total Marks 80)

N.B: 1. Question No. 1 is compulsory.
    2. Attempt **any Three** from remaining questions.
    3. Assume suitable data wherever necessary.
    4. Figure to right indicates full marks.

1. a) Explain Multi mode interference coupler (MMIC).   05
    b) Describe fiber optic mechanical displacement measurement.   05
    c) What are the advantages of optical fiber communication over electrical 05
        communication?
    d) Differentiate LED and LASER.   05

2. a) Explain different types of optical fiber sensors and explain in detail 10
        flow type sensor.
    b) Explain in details any one application of laser in medical application. 10

3. a) Explain Fiber grating and Bragg grating technology.   10
    b) What is opto isolator? Draw and explain how it is useful in transmission 10
        link.

4. a) What are the different coupling losses? Explain with net diagram.   10
    b) Explain optical fiber characteristics.   10

5. a) Explain various platforms used for remote sensing.   10
    b) Explain in details splices and connectors.   10

6.   Write short note on-   20
    a) Types of optical fiber with suitable diagram.
    b) Lensing scheme for coupling improvement.
    c) Differentiate photovoltaic and photoconductive mode of operation of
        photo detector.
    d) Dispersion measurement.