

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. Determine steady state error for unit step, ramp and acceleration inputs for the following system.

$$\frac{0.049545(z + 2.972)(z + 0.2045)}{(z - 1)^2(z - 0.3679)}$$

- b. What do you mean by discretization? List various methods of discretization and explain any one.
- c. Check controllability and observability of the given system.

$$\begin{aligned} z(k+1) &= \begin{bmatrix} 0 & 1 \\ 0.05 & -0.4 \end{bmatrix} z(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k) \\ y(k) &= [1 \ 1.5] z(k) \end{aligned}$$

- d. Explain block diagram of digital control system by giving appropriate example.
 - e. What is meant by internal stability? How it is different from BIBO stability?
 - f. Map the region from s-plane to the z-plane which is bounded by constant frequency lines at $\pm 5j$ and constant damping ratio lines at $\pm 60^\circ$.
- Q.2 A. Determine the values of K for asymptotic stability of the system given by characteristic equation using Jury's stability criteria 10

$$P(z) = z^4 + 0.2z^3 - 0.25z^2 - 0.05z + K = 0$$

- B. Explain discrete-time PID controller in detail. 10

- Q.3 A. Design the state feedback control law for the open loop system having all the poles at 0.5. 10

$$\begin{aligned} x(k+1) &= \begin{bmatrix} 3 & 1 & 0 \\ -3 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix} x(k) + \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix} u(k) \\ y(k) &= [1 \ 0 \ 0] x(k) \end{aligned}$$

- B. What is multirate sampling? Explain multirate output feedback based state estimator. 10

Q.4 A. Obtain state transition matrix for the system defined by

10

$$z(k+1) = \begin{bmatrix} 1 & 2 & 0 \\ 3 & -1 & -2 \\ 1 & 0 & -3 \end{bmatrix} z(k)$$

B. Explain sampler as an impulse modulator.

10

Q.5 A. The discrete time control system is given by

10

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

C matrix?

Design a dead beat observer.

B. Discretize the given system

10

$$G(s) = \frac{s+3}{s^2+3s+2}$$

with sampling period of $T_s=0.2$ sec.

Q.6 A. Represent the given system in controllable and diagonal canonical form along with its block diagram realization.

10

$$T(z) = \frac{z^3 + 8z^2 + 17z + 8}{(z+1)(z^2+5z+6)}$$

B. The block diagram of the system is shown in Figure 1, using signal flow graph determine transfer function of the system

10

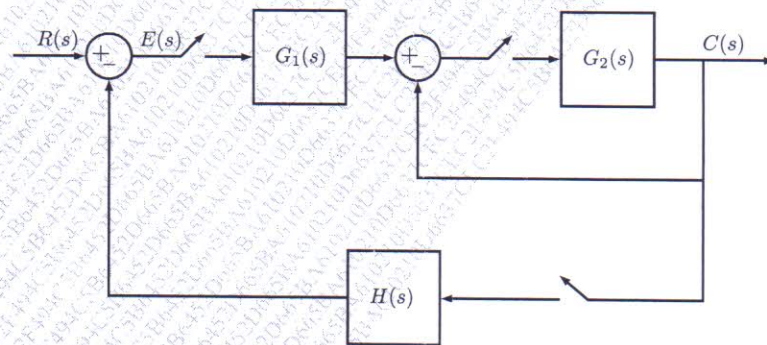


Figure 1:

Duration: 03 Hours.

Total marks: 80

Marks assigned to each question are stated against each question.

Instructions to the candidates if any:-

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

(2) Answer any Three out of remaining Five questions.

(3) Assumptions made should be clearly stated.

- Q. 1** Explain any Four 20
- Define project and explain types of project.
 - Explain the role of constructor.
 - Describe Cable scheduling.
 - Explain the PUNCH list.
 - What is Tender and its types.
- Q.2** a) Explain the project deliverables in detail 10
- b) Explain the importance of specification sheet. Explain the specification sheet For Pressure transmitter. 10
- Q.3** a) Compare project scheduling technique CPM And PERT 10
- b) Write short notes on procurement methods and procedure. 10
- Q. 4** a) Draw and explain electronic loop wiring diagram for level control loop. 10
- b) Draw and explain hook-up diagram for flow and temperature measurement. 10
- Q.5** a) Explain different standard used in Instrumentation projects. 10
- b) Discuss in detail advantages of using software packages for documentation. 10
- Q.6** write a short note on (ANY TWO) 20
- Checkout procedure for Temperature transmitter and control valve.
 - Draw and explain instrument location plan with example.
 - What is HMI? Explain the importance of graphics in process control industry. Prepare graphical user interface template.

Duration: 03 Hrs.

Total Marks: 80

Note:

- 1) Q. No 1 is compulsory.
- 2) Attempt any THREE questions from Q No 2 to Q No 6.
- 3) Assume suitable Data wherever necessary.

Q.1. Answer any Four.

(20)

- a) Explain piping geometry factor with its significance in control valve sizing.
- b) Explain ergonomics in brief.
- c) Explain Cavitation with pressure profile diagram.
- d) Explain IP classifications.
- e) Prove that expansion factor is $2/3$ for choked flow.

Q.2.

- a) Explain Control Room Design Criteria. (10)
- b) Explain bath tub curve with its significance. (10)

Q.3.

- a) Write short note on System engineering. (10)
- b) What are different methods used to increase reliability of the System. (10)

Q.4.

- a) Discuss different methods for abatement of noise in Control valves (10)
- b) Design a C_v for control valve with following application: (10)

$P_1=169.6$ psia , $P_2=20$ psia , $P_{vp}=20$ psia , $C_d=6.5$, $F_L=0.73$, Pipe Size= 3"sch 40
 $w=2,10,000$ lb/hr , sp. weight. (γ_1)= $1/0.01683$ lb/ft³ , $P_c=3200$ psia.

Q.5.

a) Explain different guidelines for grounding and shielding of equipments. (10)

b) Design a C_v for following application: (10)

Fluid= Saturated Steam, $w=63000$ lb/hr, $P_1=235$ psia, $P_2=215$ psia, Pipe size= 6"sch 40,
 $C_d=27$, $X_T=0.25$.

Q.6.

a) Explain absolute method of Thermocouple calibration. (10)

b) Explain control room design and layout. (10)

X

(3 Hours)

[Total Marks: 80]

NB: (1) Question No. 1 is compulsory.

(2) Attempt any **Three** questions from remaining.

(3) Figures to the right indicate full marks.

1. Answer the following:-

[20]

- Explain renewable and non-renewable energy resources with suitable examples.
- Explain Boiler safety interlocks.
- Why is regenerator used in a gas turbine power plant?
- What is the role of control and instrumentation in power plants?

2. (a) A Power generating station has a maximum demand of 10,000KW and the daily load on the station is as follows:

[05]

Time	6am to 8am	8am to 12noon	12noon to 1pm	1pm to 5pm	5pm to 7pm	7pm to 9pm	9pm to 11pm	11pm to 6am
KW	3,500	8,000	3,000	7,500	8,500	10,000	4,500	2,000

Draw the Load Curve and the Load Duration Curve.

(b) Explain Shrinking and Swelling effects in boiler.

[05]

(c) Explain the following different loops/circuits involved in thermal power plant,

- Feed Water and Steam Flow
- Fuel Circuit.
- Air and Gas Circuit
- Cooling water circuit.

[10]

3. (a) Explain wind turbine aerodynamics using Betz model.

Find maximum power extracted.

[10]

(b) Describe the principle of solar photovoltaic energy conversion system with neat sketch. What are the major advantages and disadvantages of solar PV system?

[10]

4. (a) Sketch a neat labeled diagram of Pressurized Water Reactor (PWR) and explain its operation with advantages and limitations.

[10]

(b) What is the function of following essential elements of hydroelectric power plant:

- Headrace
- Tailrace
- Surge Tank
- Spillways
- Draft Tubes.

[10]

5. (a) Explain the energy extraction process from Biomass and Geothermal energy.

[10]

(b) Give the detailed classification of Solar Collector and explain flat plate collector with neat sketch.

[10]

6. Write Short note on:- (Any Two)

[20]

- Compare Thermal, Nuclear and Hydroelectric power plant.
- Horizontal Axis Wind Turbine.
- Diesel Power Plant.
