BE/INST/SEM-VIII (CBSGS)/Digital Control System/MAY-17

Q.P.Code:13429

(3 Hours) [Total Marks: 100

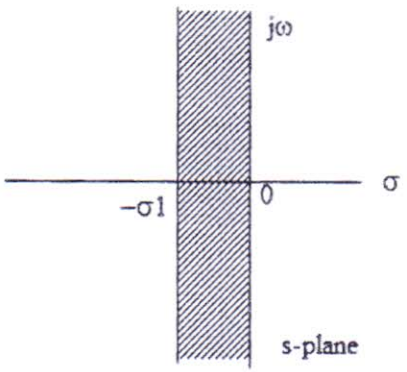
N.B.: 1) Question No. 1 is compulsory.
2) Attempt any three questions from the remaining questions.
3) Figures to the right indicate full marks.
4) Assume suitable data if necessary.

Q1. Answer any four from the following: 20

(a) Obtain state space representation of the following system in controllable canonical form

$$\frac{Y(z)}{R(z)} = \frac{-2z^3 + 2z^2 - z + 2}{z^3 + z^2 - z - \frac{3}{4}}$$

(b) Obtain the image of the shaded region in the z plane.



(c) What is a pulse transfer function? A first order discrete time LTI system is represented by the state model

$$x(k+1) = e^{-aT} x(k) + \frac{1 - e^{-aT}}{a} u(k)$$

$$y(k) = x(k)$$

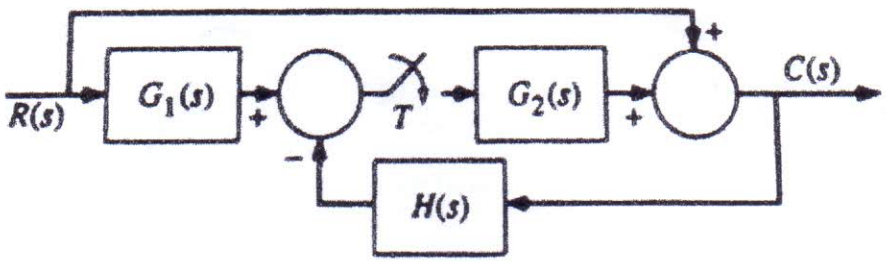
Obtain its pulse transfer function.

(d) Define controllability, stabilizability, observability and detectability

(e) Explain 1-DOF (degree of freedom) and 2-DOF feedback controller.

Turn Over

Q2. (a) Find the pulse transfer function of the following system using sampled signal flow graph approach. 10



(b) Explain how an analog signal can be reconstructed from the sampled data using extrapolation? Derive the transfer function of first order hold. 10

Q3. (a) Check if all the roots of the following characteristic equations lie within the unit circle in the plane: 10

$$z^4 - 1.368z^3 + 0.4z^2 + 0.08z + 0.002 = 0$$

(b) Consider the discrete time LTI system

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+1) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -0.24 & -1 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix}$$

i. Obtain the state transition matrix 7

ii. Find the solution to the state equation for initial condition $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ 2

iii. From the nature of the solution, comment whether the unforced system is stable or unstable.

Q4. (a) A discrete time regulator system has the plant 10

$$x(k+1) = \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix} x(k) + \begin{bmatrix} 4 \\ 3 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 1 & 1 \end{bmatrix} x(k) + 7u(k)$$

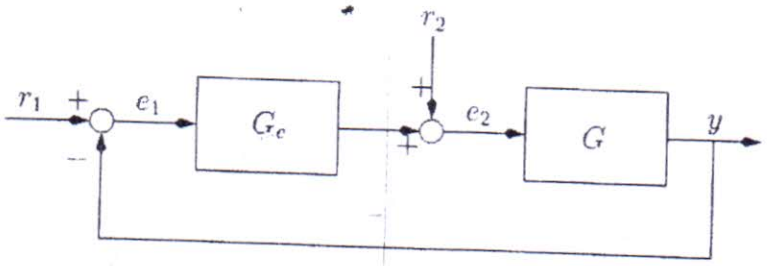
Design a state feedback control algorithm $u(k) = -Kx(k)$ which places the closed loop characteristics roots at $\pm j\frac{1}{2}$

(b) Define static position, velocity and acceleration error coefficient for a discrete time LTI system and find the steady state error for step, ramp and parabolic input for a unity feedback system characterized by the open loop transfer function

$$G_{h0}G(z) = \frac{0.2385(z+0.8760)}{(z-1)(z-0.2644)}$$

The sampling period is T=0.2 sec. 10

Q5. (a) What do you mean by internal stability? How is it different from bounded input bounded output (BIBO) stability? For the system shown in the block diagram:



Determine the internal stability if $G = \frac{1}{z-1}$ and $G_c = \frac{1.5z-1}{z-1}$. 10

Turn Over

(b) A PID controller is described by the following relation between input e(t) and output u(t): 10

$$u(t) = k_p \left(e(t) + \frac{1}{T_I} \int_0^t e(t)dt + T_D \frac{de(t)}{dt} \right)$$

Using the trapezoidal rule for integration and backward-difference approximation for the derivative, obtain the difference equation model of the PID algorithm. . Also obtain the transfer function U (z)/ E (z)

Q6. (a) Consider system defined by continuous time state and output equations

$$\dot{x}(t) = Ax(t) + Bu(t)$$

$$y(t) = Cx(t) + Du(t)$$

If this system is sampled at T sec, derive its discrete time equivalent. Assume hold to be zero order. 10

(b) Design a full order state observer so that observer poles are located at - 0.2 and - 0.4 for the system 10

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

$$y(k) = [0 \quad 1]\, x(k)$$

E/INST/Sem-VIII (CBSGS)/Instrumentation Project Doc. & Execution/ May-17

Q. P. Code: 16110

Duration: 03 Hours. Total marks assigned to the paper: 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. No.		Marks
Q. 1	Explain any **Four**	**20**
	a) Define project and types of Project.	
	b) Explain the role of Designer.	
	c) Describe Junction box scheduling.	
	d) Explain types of Tenders.	
	e) Electronic loop diagram.	
Q2	a) Explain the project Planning in detail	**10**
	b) Explain the importance of specification sheet. Explain the specification sheet For Temperature transmitter.	**10**
Q3	a) Explain project scheduling technique.	**10**
	b) Draw and explain instrument location plan with example.	**10**
Q4	a) Explain DCS or SCADA graphics in detail.	**10**
	b) Draw and explain hook-up diagram for pressure and temperature measurement.	**10**
Q5	a) Explain different standard used in Instrumentation projects.	**10**
	b) Checkout procedure for Pressure transmitter and control valve.	**10**
Q6	write a short note on **(ANY TWO)**	**20**
	a) Discuss in detail advantages of using software packages for documentation.	
	b) Explain testing, commissioning and calibration in general.	
	c) What is HMI? Explain the importance of graphics in process control industry. Prepare graphical user interface template.	

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Q4.

a) Explain the general selection criteria for transducers. [10marks]

b) Check if the given actuator works satisfactorily [10marks]

Type: FTO

Packing: Teflon V-ring

K_h = -0.16 for opening

= -1.0 for closing

Seat diameter: 0.5"

Fluid pressure: 40 – 20 psig for opening

i. 50 – 10 psig for closing

Diagram area: 69" square

Spring rate available: 275 / 370 / 460

Air pressure: 3 – 15 psig

Q5. Write short note on

a) Phases of Electronic product design [10marks]

b) System engineering. [10marks]

Q6.

a) Explain the concept of Reliability with the terms MTTF, MTTR and MTBF [10marks]

b) Explain with methods of reducing control valve noise. [10marks]

INST / Sem-VIII / [CBSGS] T5228 / T1798 2) POWER PLANT INSTRUMENTATION / MAY-2017

Q.P. Code :09995

(3 Hours) [Total Marks: 80]

N.B: (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]
   (a) What are the most favorable sites for installing of wind turbines?
   (b) Explain depletion region and barrier voltage w.r.t. PV Cell.
   (c) Differentiate between forced and induced draught fans.
   (d) Discuss why?
      i) The nuclear reactor has to be of critical size.
      ii) Kaplan turbines are used for low heads.

2. (a) Explain the following terms:-
      1) Shell, 2) Grate, 3) Furnace, 4) Mounting, 5) Accessories. [10]
   (b) Explain the Water tube and Fire tube boiler with neat sketch and mention the applications. [10]

3. (a) With help of schematic diagram, explain active and passive solar heating system. [10]
   (b) With a neat diagram, explain pumped storage and storage reservoir Hydro power plants. [10]

4. (a) Draw the schematic of a Nuclear power station and explain. [10]
   (b) Using Betz's model of wind turbine, derive the expression for power extracted from wind. What is the maximum theoretical power that can be extracted and under what condition? [10]

5. (a) Compare the various power plants on the basis of operating cost, initial cost, efficiency, maintenance cost and availability of source of power. [10]
   (b) Explain the working of Gas turbine power plant with neat sketch. [10]

6. Write Short note on:- (Any Four) [20]
   (a) Geothermal energy.
   (b) Hydrology.
   (c) Energy Scenario in India.
   (d) Importance of Moderator and Control rods in Nuclear reactor.
   (e) Role of DCS in Thermal Power Plant.

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Q.P. Code :13027

(3 Hours) [Total Marks: 80]

N.B.: (1) Question **No.1** is **compulsory**.
(2) Attempt any **three** from the remaining questions.
(3) Assume suitable data wherever required and state the assumptions.

1. Answer the following (any four):- [20]
   a. What are different types of mechanical misalignments?
   b. Explain the term splice and what are the different losses occurred due to it?
   c. Write the concept of optical amplifier.
   d. What are the reliability considerations of optical detectors?
   e. Differentiate between single mode and multimode.

2. a) Explain in detail Outside vapour phase deposition method of fiber fabrication. [10]
   b) What is population inversion? Describe fabry perot laser diode. [10]

3. a) Explain the method of measuring pressure and temperature using fiber optic. [10]
   b) What is fiber Bragg gratings? Describe the distributed optical fiber sensing technique with neat diagram. [10]

4. a) Explain the Beam Splitter. [10]
   b) How the Measurement of attenuation using cut-back method is achieved in optical fiber? [10]

5. a) Write down the various laser applications in industry and explain any one. [10]
   b) Give the classification of transmission characteristics of fiber in detail [10]

6. Write short notes on : [20]
   a. Controlled fracture technique
   b. Electromagnetic Radiation
   c. Active and passive remote sensing
   d. Holography technique and its applications