M.E. First Semester (Electrical & Elect.) (New-CGS)

13281 : Advanced Control Systems : 1 EEEME 1

P. Pages : 2 | **AW - 3836**

Time : Three Hours | Max. Marks : 80

* 0 3 8 9 *

Notes : 1. Due credit will be given to neatness and adequate dimensions.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.

SECTION - A

1. Explain Basic Building Blocks of PLC in details. **13**

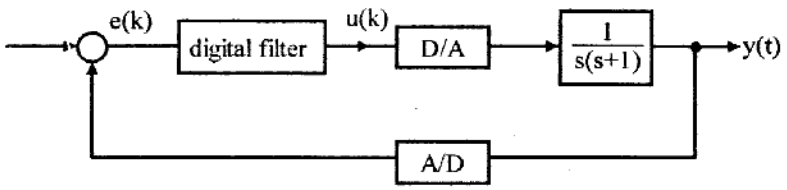
OR

2. If $\dot{y}(t) + ay(t) = r(t); y(0) = y^o$ derive difference equation models for numerical solution using **13**
i) backward rectangular rule for integration.
ii) forward rectangular rule for integration.

3. Explain Ziegler - Nichols tuning method based on process reaction curve. **13**

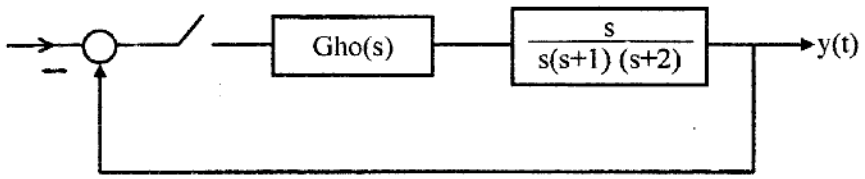
OR

4. Find $Y[z]/R[z]$ **13**



for $u(k) = u(k-1) + 0.5e(k)$
where; $f_s = 5Hz$
$e(k)$ & $u(k)$ are filter i/p & o/p resp.

5. a) Show that following discrete time control system is unstable. **5**



b) Explain Bode plot for lead and lag compensator. **8**

OR

6. Predict nature of transient response of discrete time system having chara, **13**

$$z^2 - 1.9z + 0.9307 = 0$$

where sampling interval is $T = 0.02\,sec$.

SECTION - B

7. 13

$$\dot{X} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} \dot{X} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

a) obtain SFG form

b) From (a) form $X(s) = G(s)X(0) + H(s)U(s)$

c) Use Inverse Laplace Transform for

i) $x(0) = \begin{bmatrix} x_1^0 & x_2^0 \end{bmatrix}^T$; Zero i/p response to initial condition.

ii) Zero state response to unit step input.

OR

8. 13

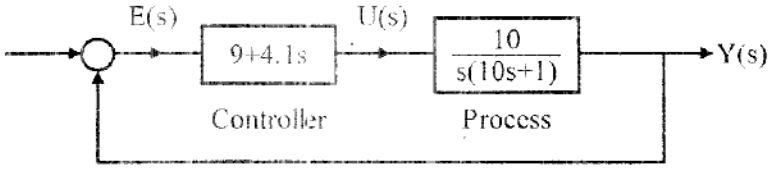
For $\frac{d^2\theta(t)}{dt^2} = u(t)$

i) develop state equation with u as input and θ and $\dot{\theta}$ as state variable of X_1 & X_3 resp.

ii) find state eq lin terms of $\bar{x}(t)$

$$x = P\bar{x} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \bar{x}$$

9. 14



Sample the process model with zero order hold & obtain state variable model of closed loop syst. for $T = 0.1$ sec sampling interval.

OR

10. 14

$$x(k+1) = Fx(k) + g\,r(k)$$

$$y(k) = Cx(k)$$

$$F = \begin{bmatrix} 0 & 1 \\ -1/8 & 3/4 \end{bmatrix} g = \begin{bmatrix} 0 \\ 1 \end{bmatrix} C = \begin{bmatrix} -\frac{1}{2} & 1 \end{bmatrix}$$

1. Find eigen values of F

2. Find $G(z) = \frac{Y(z)}{R(z)}$ & poles function.

11. Explain state feedback with integral control with neat sketch. 14

OR

12. Find observer gain matrix for 14

$$\dot{x} = Ax + by$$

$$A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \text{ i } b = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$x_1 = \theta;\ x_2 = \dot{\theta}$$

Assume

$$y = cx(t)$$

$$c = [1, 0]$$

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