Total No. of Questions : 8]

SEAT No. :

P3236

[Total No. of Pages : 3

[4859] - 1027

B.E. (Electrical)

CONTROL SYSTEMS - II

(2012 Pattern) (End Sem.)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Design a lag compensator for unity feedback system with

$G(s) = \dfrac{20K}{s(s+1)(s+4)}$ to meet following specifications. **[10]**

i) K_v = 8/sec ii) Phase Margin = 42°.

b) Obtain the state model representation from system differential equation by using phase variables. **[6]**

$$\frac{d^3y(t)}{dt^3} + 5\frac{d^2y(t)}{dt^2} + 10\frac{dy(t)}{dt} + 20y(t) = 2u(t)$$

c) Explain the effect of pole zero cancellation on the controllability of system with suitable example. **[4]**

OR

Q2) a) A system is given by $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

It is desired to place close loop poles at –2, 1 ± *j*2. Obtain state feedback gain matrix. **[10]**

P.T.O.

b) For a given system, $\dot{x} = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u, \quad y = \begin{bmatrix} 1 & 0 \end{bmatrix} x, \quad x(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$

Obtain $x(t)$ for unit step input. **[6]**

c) Draw circuit diagram of op-amp based lead/lag compensator, write transfer function and draw pole zero plot. **[4]**

Q3) a) In a unity feedback system an ideal relay with output equal to ± 1 unit is connected in cascade with $G(s) = \dfrac{20}{s(s+1)(s+3)}$ Determine amplitude and frequency of limit cycle if it exists by describing function method. **[10]**

b) Explain any one peculiar behavior of nonlinear system : **[6]**

i) Jump resonance

ii) Limit cycle

iii) Sub-harmonic oscillations

OR

Q4) a) A linear second order system is described by equation. **[10]**

$$\ddot{e} + 2\xi\omega_n \dot{e} + \omega_n^2 e = 0$$

where, $\xi = 0.3, \omega_n = 1$ rad/sec, $e(0) = 2, \dot{e}(0) = 0$.

Construct the phase trajectory using method of isoclines.

b) Explain different types of singular points of the phase trajectories. **[6]**

Q5) a) Draw the block diagram of digital control system & explain the function of each block in short. **[10]**

b) Determine inverse Z transform of **[6]**

i) $\dfrac{z^2 + 3z}{z^2 + 3z + 2}$

ii) $\dfrac{(1 - e^{-3T})z}{(z-1)(z - e^{-3T})}$

OR

Q6) a) Explain the sampling and reconstruction process, State the sampling theorem and give its importance. **[10]**

b) Solve the following equation by using z-transform method. **[6]**

$x(k + 2) + 5x(k + 1) + 6x(k) = 0$ where $x(0)$; $x(1) = 1$

Q7) a) Define Pulse Transfer Function and obtain the pulse transfer function of two systems in cascade with sampler in between. **[8]**

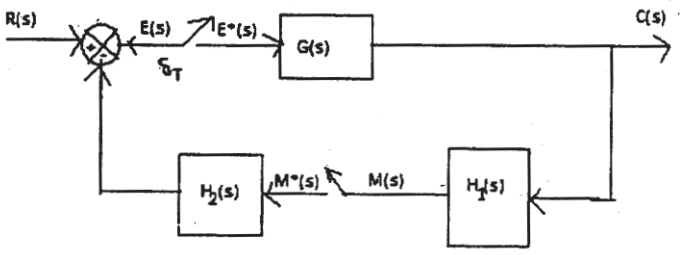
b) Obtain the direct and cascade realization of **[10]**

$$D(z) = \frac{z^2 + 5z + 2}{z^3 + 6z^2 + 4z + 1}$$

OR

Q8) a) Write a short note on Digital PID Controller. **[8]**

b) Obtain the closed loop pulse transfer function of the following system. **[10]**



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