Code No: RR412201 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER AIDED DESIGN OF CONTROL SYSTEMS
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the concept of observability both in SISO and MIMO system.
   (b) Determine the state observability of the system described by the state equation.
   $$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$
   $$y = [1 \quad 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$
   [8+8]
2. (a) Determine the transfer function from the state space.
   (b) Show that state model is not unique. [8+8]
3. Sketch the nyquist plot for G(c) = $\frac{(1-s)}{(1+s)\ (2+s)^3}$ [16]
4. (a) Examine the effect of a phase advance compensetor on a plant having g(s) = e^{-s}
   (b) How the oscillatory response can be improved. [8+8]
5. (a) Explain Multivariable system with an example.
   (b) Explain the concept of stability in multivariable systems. [8+8]
6. Sketch the Gershgorin row bands for Q(s) = $\begin{bmatrix} \frac{s+4}{(s+1)\,(s+5)} & \frac{1}{s+5} \\ \frac{s+3}{(s+1)\,(2s+5)} & \frac{2}{2s+5} \end{bmatrix}$ and investigate the closed loop stability. [16]
7. (a) Using MATLAB check the given number is prime number or not.
   (b) Perfect number or not. [8+8]
8. Explain compensation through Bodeplot using MATLAB. [16]

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Code No: RR412201 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER AIDED DESIGN OF CONTROL SYSTEMS
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Determine the definiteness for the quadratic equation
   $Q = x_1^2 + 4x_2^2 + x_3^2 + 2x_1 x_2 - 6x_2 x_3 - 2x_1 x_3$
   (b) Determine the stability of the origin of the following system
   $$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -1 & 1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$ [6+10]

2. Prove two system matrices P(s) and P1(s) in state space form one system similar if and only if they are strictly system equivalent. [16]

3. (a) What is the importance of compensation.
   (b) Explain the phase lead and phase lag compensation. [6+10]

4. Sketch the inverse Nyquist plot for g(c) = $\frac{1-s}{(1+s)(2+s)^3}$ [16]

5. (a) Explain Multivariable system with an example.
   (b) Explain the concept of stability in multivariable systems. [8+8]

6. Sketch the Gershgorin row bands for Q(s) = $\begin{bmatrix} \frac{s+4}{(s+1)(s+5)} & \frac{1}{s+5} \\ \frac{s+3}{(s+1)(2s+5)} & \frac{2}{2s+5} \end{bmatrix}$
   and investigate the closed loop stability. [16]

7. Describe the following functions with simple example
   (a) bode
   (b) r locus
   (c) nyquist
   (d) step [16]

8. Write a MATLAB programs for the following:
   (a) to plot two steps response curves on one diagram take suitable transfer functions
   (b) To plot the root locus from state space
   (c) To plot the root locus for the transfer function G(s) = $\frac{10}{s(s+1)(s+2)}$ [16]

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Code No: RR412201 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER AIDED DESIGN OF CONTROL SYSTEMS
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Determine the stability of the system described by

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \textit{ by using liapunov stability.}$$

[16]

2. Find the McMillan form for the matrix G(s)= $\begin{pmatrix} \frac{1}{(s+1)^2} & \frac{1}{(s+1)(s+2)} \\ \frac{1}{(s+1)(s+2)} & \frac{s+3}{(s+2)^2} \end{pmatrix}$ and check the matrix G and M are proper or not. [16]

3. What are the different types of compensation and explain any two techniques. [16]

4. Write short notes on
   (a) non-minimum phase response
   (b) Irrational transfer functions. [8+8]

5. Write short note on
   (a) Multi variable circle criteria.
   (b) sensitivity. [16]

6. Sketch the Gershgorin bands and show that if Q(s) arises from a least - order system if Q(s) $= \begin{bmatrix} \frac{s+4}{2s+5} & \frac{s+1}{2s+5} \\ \frac{s+3}{2s+5} & \frac{s+2}{2s+5} \end{bmatrix}$ [16]

7. What is control system tool box? Discuss various functions. [16]

8. (a) Write a procedure to analyse the frequency response and stability analysis.
   (b) Write a MATLAB program and comment on the results. [8+8]

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Code No: RR412201 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
COMPUTER AIDED DESIGN OF CONTROL SYSTEMS
(Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Calculate the i.d. zeros and o.d. zeros of the system matrix

$$\mathrm{P(S)} = \begin{bmatrix} I_2 & 0 & 0 & 0 \\ 0 & s^2(s+1) & s(s+2) & -s \\ 0 & 0 & s+2 & 1 \\ 0 & 0 & -1 & 0 \end{bmatrix} \quad [16]$$

2. Find the McMillan form for the matrix G(s)= $\begin{pmatrix} \frac{1}{s+1} & \frac{s+2}{(s+3)^2} \end{pmatrix}$ [16]

3. (a) What are the measurable quantities using step response.
   (b) What are the measurable quantities using frequency response. [8+8]

4. Derive a generalized inverse Nyqnst criteria. [16]

5. Explain frequency response criteria for stability with an example. [16]

6. Sketch the Gershgarin row bands for $\hat{Q(S)}$
   when Q(s) = $\begin{bmatrix} \frac{s+4}{(s+1)(s+5)} & \frac{1}{s+5} \\ \frac{s+3}{(s+1)(s+5)} & \frac{2}{s+5} \end{bmatrix}$
   and investigate the closed-loop stabililty. [16]

7. (a) Using MATLAB check the given number is prime number or not.
   (b) Perfect number or not. [8+8]

8. A regular system has a plant $\frac{Y(s)}{U(s)} = \frac{10}{(s+1)\ (s+2)\ (s+3)}$ Define state variables as
   x1= y, x2 = X_1 ; $x3 = X_2\, x2$
   by use of the state-feedback control u = - Kx, it is desired to place the closed-loop poles at
   S = -2 + $j2\sqrt{3}$, s = - 2 ? $j2\sqrt{3}$, s = -10
   Determine the necessary state-feedback gain matrix K. [16]

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