**R07** 

## II B.Tech II Semester Examinations, APRIL 2011 CONTROL SYSTEMS

Common to E.COMP.E, ETM, E.CONT.E, ECE, EEE

Time: 3 hours

Code No: 07A4EC03

Max Marks: 80

### Answer any FIVE Questions All Questions carry equal marks \*\*\*\*

- 1. For the unity feed back control system forward path transfer function G(S) = K/S (S+4) (S+20). Design a lag-lead compensator so that PM  $\geq$  40 and steady state error for unit ramp input  $\leq$  0.04 rad. [16]
- 2. (a) State how the type of a control system is determined? How it effects the steady-state error of the system?
  - (b) A unity feed-back system has  $G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$ . Determine
    - i. Type of the system?
    - ii. All the error coefficients?
    - iii. Error for ramp input with magnitude. [6+10]
- 3. (a) Define the the following terms
  - i. absolute stability
  - ii. marginal stability
  - iii. conditional stability
  - (b) By means of RH criterion determine the stability of the system represented by the characteristic equation  $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$
  - (c) State the advantages of RH Stability criterion? [6+6+4]
- 4. (a) Determine the transfer function  $\frac{C(s)}{R(s)}$  for the following block diagram (figure 4a). [9+7]



### Figure 4a

- (b) Explain the properties of signal flow graphs.
- 5. (a) Explain the selection criteria of Nyquist contour in stability analysis of linear control systems.
  - (b) Discuss the effect of adding poles& zeros on the stability of a system with the help of Nyquist plots. [8+8]

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# Set No. 2

- 6. (a) Explain the significance of Bandwidth in the design of linear control systems.
  - (b) Show that the error contributed by a simple pole in the Bode magnitude plot is -3 dB at corner frequency.
  - (c) The asymptotic plot of a system is shown in figure 3c



Figure 3c Find the loop transfer function of the system.

[4+4+8]

- 7. (a) Explain the effect of feedback on stability.
  - (b) Explain the temperature control system concepts using open loop as well as closed loop system. [8+8]
- 8. (a) Consider the network shown in figure 7a and obtain the state variable form ?



Figure 7a

(b) A linear time in variant system is characterized by homogenous state equation  $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ 

Compute the solution of homogenous equation , assuming the initial state vector. [8+8]

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[6+10]

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Figure 7a

### Code No: 07A4EC03

(b) A linear time in variant system is characterized by homogenous state equation  $\begin{bmatrix} x_1 \end{bmatrix} \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \end{bmatrix}$ 

Set No. 4

[6+6+4]

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- $\begin{bmatrix} x_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_2 \end{bmatrix}$ Compute the solution of homogenous equation, assuming the initial state vector. [8+8]
- 5. (a) Define the the following terms
  - i. absolute stability
  - ii. marginal stability
  - iii. conditional stability
  - (b) By means of RH criterion determine the stability of the system represented by the characteristic equation  $S^4 + 2S^3 + 8S^2 + 4S + 3 \neq 0$
  - (c) State the advantages of RH Stability criterion?
- 6. (a) Explain the selection criteria of Nyquist contour in stability analysis of linear control systems.
  - (b) Discuss the effect of adding poles& zeros on the stability of a system with the help of Nyquist plots. [8+8]
- 7. For the unity feed back control system forward path transfer function G(S) = K/S (S+4) (S+20). Design a lag-lead compensator so that  $PM \ge 40$  and steady state error for unit ramp input  $\le 0.04$  rad. [16]
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  - (c) The asymptotic plot of a system is shown in figure 3c



Figure 3c

Find the loop transfer function of the system.

[4+4+8]

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Figure 3c

[4+4+8]

- Find the loop transfer function of the system.
- 4. (a) Explain the effect of feedback on stability.

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# Set No. 1

- (b) Explain the temperature control system concepts using open loop as well as closed loop system. [8+8]
- 5. (a) State how the type of a control system is determined? How it effects the steady-state error of the system?
  - (b) A unity feed-back system has  $G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$ . Determine
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- 6. (a) Consider the network shown in figure 7a and obtain the state variable form ?



- (b) A linear time in variant system is characterized by homogenous state equation  $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ Compute the solution of homogenous equation , assuming the initial state vector.
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Figure 4a

- (b) Explain the properties of signal flow graphs.
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[6+6+4]

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Figure 3c

[4+4+8]

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# R07 Set No.





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[6+10]

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- 6. (a) Explain the effect of feedback on stability.
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