Code No: NR/RR220206 **NR/RR** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
CONTROL SYSTEMS
Common to Electronics And Telematics, Electronics And Control Engineering, Electronics And Instrumentation Engineering, Electronics And Communication Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain how Routh Hurwitz criterion can be used to determine the absolute stability of a system.

   (b) For the feedback control system shown in Figure 5b. it is required that :

      i. the steady-state error due to a unit-ramp function input be equal to 1.5.

      ii. the dominant roots of the characteristic equation of the third-order system are at -1+j1 and -1-j1. Find the third-order open-loop transfer function G(s) so that the foregoing two conditions are satisfied. [6+10]

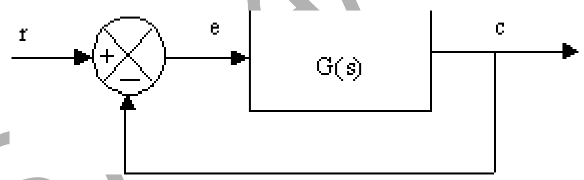

Figure 5b

2. (a) Show that the breakaway and break-in points, if any, on the real axis for the root locus for G(s)H(s)= $\frac{KN(s)}{D(s)}$, where N(s) and D(s) are rational polynomials in s, can be obtained by solving the equation $\frac{dK}{ds}$ =0.

   (b) By a step by step procedure draw the root locus diagram for a unity negative feedback system with open loop transfer function G(s)=$\frac{K(s+1)}{s^2(s+9)}$. Mark all the salient points on the diagram. Is the system stable for all the values of K? [8+8]

3. (a) Define sensitivity and explain mathematically.

   (b) What is a PID controller and derive its transfer function. [8+8]

4. (a) Define phase margin and gain margin.

   (b) Sketch the Nyquist plot and find the stability of the following system. [6+10]

$$G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}.$$

5. (a) Explain the important time - response specification of a standard second ordered system to a unit step input.

   (b) Derive expressions for time domain specifications of a standard second ordered system to a step input. [8+8]

6. (a) For the given system X = Ax + Bu
where
$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$
Find the characteristic equation of the system and its roots.

(b) Given $\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 & (t) \\ x_2 & (t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$
Find the unit step response when,
X(0)=$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ [8+8]

7. (a) Derive an expression for peak resonance and band width for standard second order system.

(b) Sketch the Bode Plot for a unity feedback control system with forward path transfer function G(s) = $\frac{24}{(s+2)(s+6)}$ Determine the gain margin and phase margin. [4+12]

8. Write the differential equations to represent the following system shown in fig 7 and draw its electrical equivalent circuit and also find transfer function for both cases. [6+5+5]

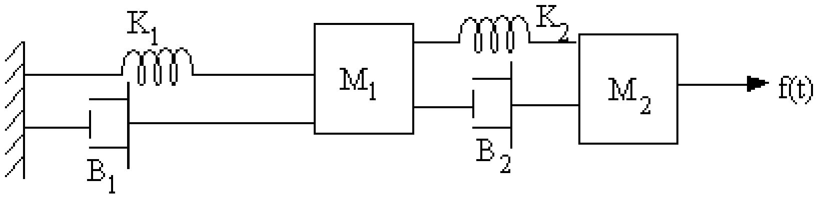

Figure 7

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Code No: NR/RR220206 **NR/RR** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
CONTROL SYSTEMS
Common to Electronics And Telematics, Electronics And Control Engineering, Electronics And Instrumentation Engineering, Electronics And Communication Engineering

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

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) For the given system X = Ax + Bu
where
$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$
Find the characteristic equation of the system and its roots.

   (b) Given $\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 & (t) \\ x_2 & (t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$
Find the unit step response when,
X(0)= $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ [8+8]

2. (a) Explain the important time - response specification of a standard second ordered system to a unit step input.

   (b) Derive expressions for time domain specifications of a standard second ordered system to a step input. [8+8]

3. (a) Explain how Routh Hurwitz criterion can be used to determine the absolute stability of a system.

   (b) For the feedback control system shown in Figure 5b. it is required that :

      i. the steady-state error due to a unit-ramp function input be equal to 1.5.
      ii. the dominant roots of the characteristic equation of the third-order system are at -1+j1 and -1-j1. Find the third-order open-loop transfer function G(s) so that the foregoing two conditions are satisfied. [6+10]

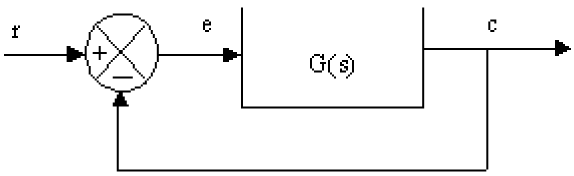

Figure 5b

4. (a) Show that the breakaway and break-in points, if any, on the real axis for the root locus for G(s)H(s)= $\frac{KN(s)}{D(s)}$, where N(s) and D(s) are rational polynomials in s, can be obtained by solving the equation $\frac{dK}{ds}$ =0.

(b) By a step by step procedure draw the root locus diagram for a unity negative feedback system with open loop transfer function G(s)=$\frac{K(s+1)}{s^2(s+9)}$. Mark all the salient points on the diagram. Is the system stable for all the values of K? [8+8]

5. (a) Define phase margin and gain margin.

   (b) Sketch the Nyquist plot and find the stability of the following system. [6+10]

$$G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}.$$

6. (a) Define sensitivity and explain mathematically.

   (b) What is a PID controller and derive its transfer function. [8+8]

7. (a) Derive an expression for peak resonance and band width for standard second order system.

   (b) Sketch the Bode Plot for a unity feedback control system with forward path transfer function G(s) = $\frac{24}{(s+2)(s+6)}$ Determine the gain margin and phase margin. [4+12]

8. Write the differential equations to represent the following system shown in fig 7 and draw its electrical equivalent circuit and also find transfer function for both cases. [6+5+5]

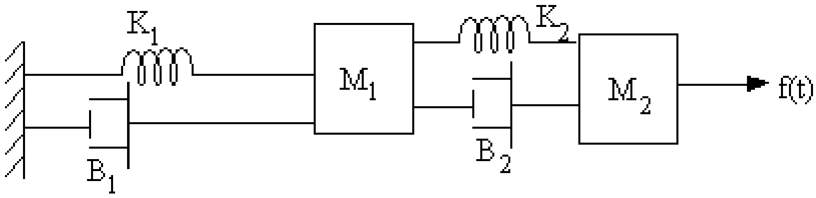

Figure 7

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Code No: NR/RR220206

NR/RR

Set No. 1

II B.Tech II Semester Examinations,December 2010
CONTROL SYSTEMS
Common to Electronics And Telematics, Electronics And Control Engineering, Electronics And Instrumentation Engineering, Electronics And Communication Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define phase margin and gain margin.

   (b) Sketch the Nyquist plot and find the stability of the following system. [6+10]

$$G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}.$$

2. (a) For the given system X = Ax + Bu
   where

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

   Find the characteristic equation of the system and its roots.

   (b) Given $\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 & (t) \\ x_2 & (t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$

   Find the unit step response when,

   $X(0)=\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ [8+8]

3. Write the differential equations to represent the following system shown in fig 7 and draw its electrical equivalent circuit and also find transfer function for both cases. [6+5+5]

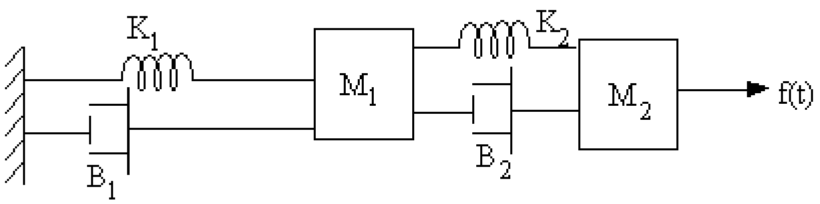

Figure 7

4. (a) Define sensitivity and explain mathematically.

   (b) What is a PID controller and derive its transfer function. [8+8]

5. (a) Explain the important time - response specification of a standard second ordered system to a unit step input.

   (b) Derive expressions for time domain specifications of a standard second ordered system to a step input. [8+8]

6. (a) Derive an expression for peak resonance and band width for standard second order system.
   (b) Sketch the Bode Plot for a unity feedback control system with forward path transfer function $G(s) = \frac{24}{(s+2)(s+6)}$ Determine the gain margin and phase margin. [4+12]

7. (a) Explain how Routh Hurwitz criterion can be used to determine the absolute stability of a system.
   (b) For the feedback control system shown in Figure 5b. it is required that :
      i. the steady-state error due to a unit-ramp function input be equal to 1.5.
      ii. the dominant roots of the characteristic equation of the third-order system are at -1+j1 and -1-j1. Find the third-order open-loop transfer function G(s) so that the foregoing two conditions are satisfied. [6+10]

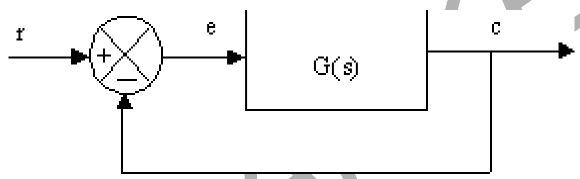

Figure 5b

8. (a) Show that the breakaway and break-in points, if any, on the real axis for the root locus for $G(s)H(s)= \frac{KN(s)}{D(s)}$, where N(s) and D(s) are rational polynomials in s, can be obtained by solving the equation $\frac{dK}{ds}$ =0.
   (b) By a step by step procedure draw the root locus diagram for a unity negative feedback system with open loop transfer function $G(s)=\frac{K(s+1)}{s^2(s+9)}$. Mark all the salient points on the diagram. Is the system stable for all the values of K? [8+8]

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Code No: NR/RR220206

NR/RR

Set No. 3

II B.Tech II Semester Examinations,December 2010

CONTROL SYSTEMS

Common to Electronics And Telematics, Electronics And Control Engineering, Electronics And Instrumentation Engineering, Electronics And Communication Engineering

Time: 3 hours Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Define phase margin and gain margin.
   (b) Sketch the Nyquist plot and find the stability of the following system. [6+10]
   $$G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}.$$
2. (a) Explain the important time - response specification of a standard second ordered system to a unit step input.
   (b) Derive expressions for time domain specifications of a standard second ordered system to a step input. [8+8]
3. (a) Show that the breakaway and break-in points, if any, on the real axis for the root locus for G(s)H(s)= $\frac{KN(s)}{D(s)}$, where N(s) and D(s) are rational polynomials in s, can be obtained by solving the equation $\frac{dK}{ds}$ =0.
   (b) By a step by step procedure draw the root locus diagram for a unity negative feedback system with open loop transfer function G(s)=$\frac{K(s+1)}{s^2(s+9)}$. Mark all the salient points on the diagram. Is the system stable for all the values of K? [8+8]
4. (a) Derive an expression for peak resonance and band width for standard second order system.
   (b) Sketch the Bode Plot for a unity feedback control system with forward path transfer function G(s) = $\frac{24}{(s+2)(s+6)}$ Determine the gain margin and phase margin. [4+12]
5. (a) Explain how Routh Hurwitz criterion can be used to determine the absolute stability of a system.
   (b) For the feedback control system shown in Figure 5b. it is required that :
      i. the steady-state error due to a unit-ramp function input be equal to 1.5.
      ii. the dominant roots of the characteristic equation of the third-order system are at -1+j1 and -1-j1. Find the third-order open-loop transfer function G(s) so that the foregoing two conditions are satisfied. [6+10]

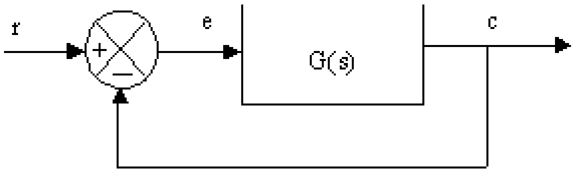

Figure 5b

6. (a) For the given system X = Ax + Bu
where
$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$
Find the characteristic equation of the system and its roots.

(b) Given $\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 & (t) \\ x_2 & (t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$
Find the unit step response when,
X(0)= $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ [8+8]

7. Write the differential equations to represent the following system shown in fig 7 and draw its electrical equivalent circuit and also find transfer function for both cases. [6+5+5]

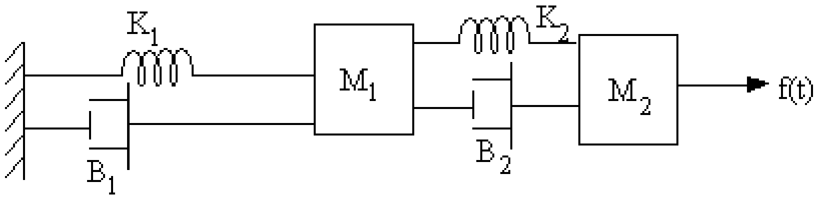

Figure 7

8. (a) Define sensitivity and explain mathematically.

(b) What is a PID controller and derive its transfer function. [8+8]

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