Code No: R05220205 **Set No. 1**

II B.Tech II Semester Regular Examinations, Apr/May 2008
CONTROL SYSTEMS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering, Electronics & Telematics and Electronics & Computer Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the traffic control system concepts using open loop as well as closed loop system.
   (b) Why is negative feedback invariably preferred in closed loop systems? [8+8]

2. (a) Reduce the given block diagram (figure 2a)and hence obtain the transfer function $\frac{C(s)}{R(s)}$.

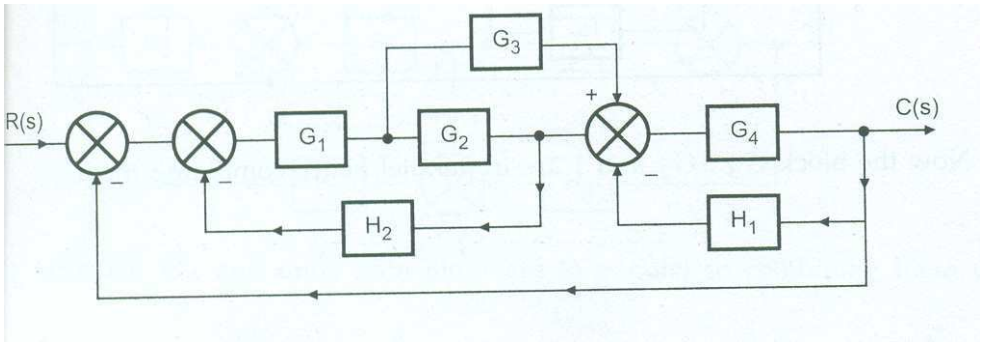

Figure 2a

   (b) Explain the need of signal flow graph representation for any system. [10+6]

3. (a) What is meant by time response? Explain about
      i. Steady- state response
      ii. Transient response
   (b) A unity feed-back system is characterized by an open loop T.F $G(s) = \frac{K}{s(s+10)}$ Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K , determine T_s, T_p and M_p for a unit step input. [6+10]

4. (a) Define the term root locus and state the rule for finding out the root locus on the real axis?
   (b) Calculate the angle of asymptotes and the centroid for the system having $G(s)H(s) = \frac{K(s+3)}{s(s+2)(s+4)(s+5)}$
   (c) For $G(s)H(s) = \frac{K}{s(s+1)(s+3)}$, find the intersection point of the root locus with the jω - axis? [4+6+6]

5. Sketch the Bode plots for a system
   $G(s) = \frac{15(s+5)}{s(s^2+16s+100)}$
   Hence determine the stability of the system. [16]

6. Write short notes:
   (a) Comparision of polar & Nyquist plots
   (b) Applications of Nyquist criterion. [8+8]

7. (a) What is compensation? what are the different types of compensators?
   (b) What is a lag compensator, obtain the transfer function of lag compensator and draw pole-zero plot?
   (c) Explain the different steps to be followed for the design of compensator using Bode plot? [3+3+10]

8. Obtain the two differential state representation for the system with transfer function.
   $\frac{y(s)}{u(s)} = \frac{2}{S^3+6S^2+11S+6}$. [16]

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Code No: R05220205 **Set No. 2**

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

Answer any FIVE Questions
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1. (a) Define transfer function and what are its limitations? [6+10]
   (b) Find the transfer function of the following system: Shown in figure 1b.

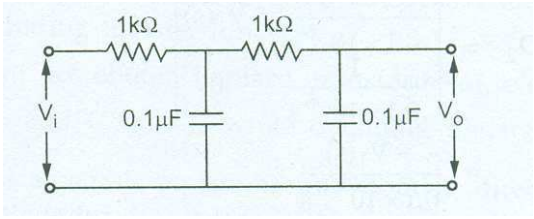

Figure 1b

2. (a) Reduce the given block diagram (figure 2a) and hence obtain the transfer function $\frac{C(s)}{R(s)}$

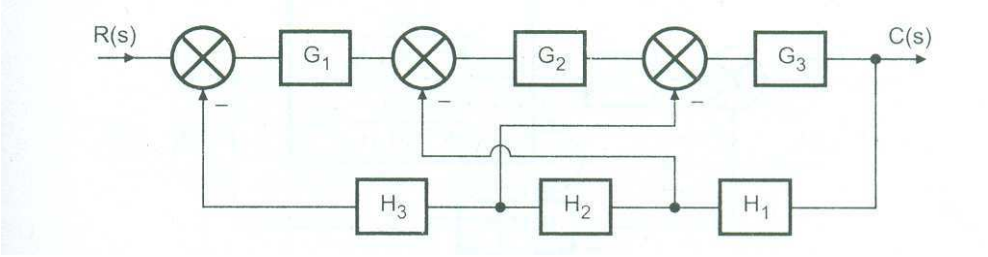

Figure 2a

   (b) Explain the working principle of synchro receiver with neat sketch. [10+6]

3. (a) What are generalized error constants? State the advantages of generalized error coefficients?
   (b) For a first order system, find out the output of the system when the input applied to the system is unit ramp input? Sketch the r(t) and c(t) and show the steady state error. [8+8]

4. (a) What are the necessary conditions to have all the roots of the characteristic Equation in the left half of s-plane?
   (b) What are the difficulties in RH stability crititerion? Explain ,how you can over come them? [4+12]

5. (a) State the advantages & limitations of frequency domain analysis

(b) Sketch the Bode plot s of
$G(s) = \frac{28.5e^{-0.1s}}{s(1+s)(1+0.1s)}$
Hence find gain cross over frequency. [6+10]

6. (a) What is "Nyquist Contour"?

(b) A system is given by
$G(s) = \frac{4s+1}{s^2(s+1)(2s+1)}$ Sketch the Nyquist plot & hence determine the stability of the system. [2+14]

7. (a) What is compensation? what are the different types of compensators?

(b) What is a lag compensator, obtain the transfer function of lag compensator and draw pole-zero plot?

(c) Explain the different steps to be followed for the design of compensator using Bode plot? [3+3+10]

8. Obtain the two differential state representation for the system with transfer function.
$\frac{y(s)}{u(s)} = \frac{2}{S^3+6S^2+11S+6}$. [16]

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Code No: R05220205 **Set No. 3**

II B.Tech II Semester Regular Examinations, Apr/May 2008
CONTROL SYSTEMS
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write the important differences between open loop and closed loop systems with suitable examples.
   (b) Obtain the transfer function $\frac{X_0(s)}{X_1(s)}$ of the following system. Shown in figure 1b. [8+8]

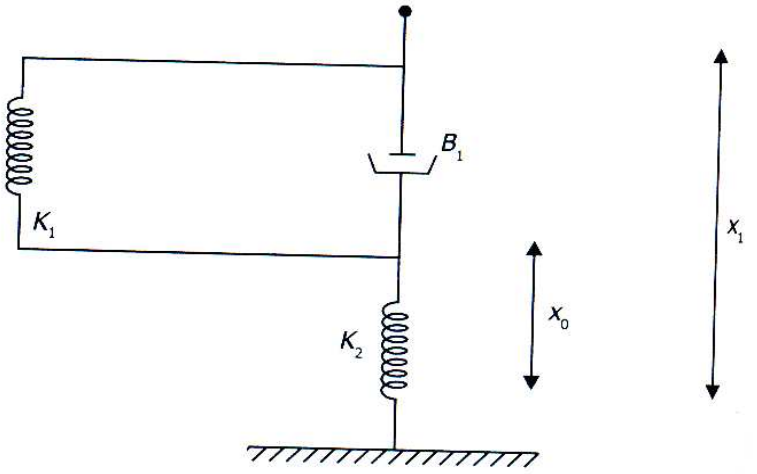

Figure 1b

2. (a) State and explain mason's gain formula for the signal flow graph.
   (b) What are differences between block diagram reduction and signal flow graph reduction? [8+8]

3. (a) How steady ?state error of a control system is determined? How it can be reduced?
   (b) Determine the error coefficients and static error for $G(s) = \frac{1}{s(s+1)(s+10)}$, $H(s) = s + 2$. [8+8]

4. (a) What are the necessary conditions to have all the roots of the characteristic Equation in the left half of s-plane?
   (b) What are the difficulties in RH stability crititerion? Explain ,how you can over come them? [4+12]

5. (a) Define frequency response.

(b) Discuss the advantages & disadvantages of frequency response analysis.

(c) Bring out the correlation between time response & frequency response and hence show that the correlation exists for the range of damping ratio $0 < \zeta < 0.707$. [2+6+8]

6. (a) What is "Nyquist Contour"?

(b) A system is given by
$G(s) = \frac{4s+1}{s^2(s+1)(2s+1)}$ Sketch the Nyquist plot & hence determine the stability of the system. [2+14]

7. Design a lead compensator for unity feed back system whose open loop transfer function G(S) = $\frac{K}{S(S+1)(S+5)}$ to satisfy the following specifications.

(a) velocity error constant $K_V \geq 50$

(b) Phase margin $\geq 20^0$. [16]

8. (a) Obtain the state model of the system whose transfer function is given as.
$\frac{Y(s)}{V(s)} = \frac{10}{S^3+4S^2+2S+1}$

(b) Consider the matrix A compute e^{At}? [8+8]

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

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Code No: R05220205 **Set No. 4**

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the basic components of control systems?
   (b) Find the transfer function for the system given figure 1b:

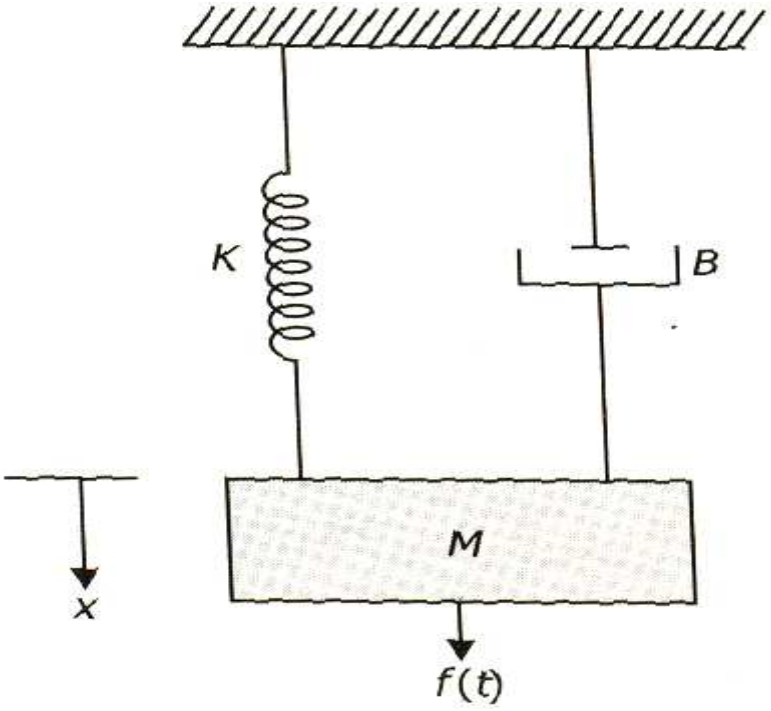

Figure 1b

where, M is the mass of the system. [6+10]
K is the spring deflection
B is the coefficient of viscous damping.

2. (a) Reduce the given block diagram (figure 2a) and hence obtain the transfer function $\frac{C(s)}{R(s)}$

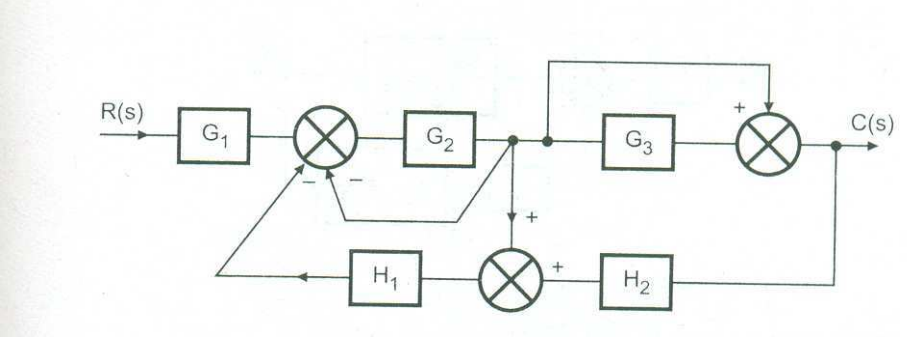

Figure 2a

(b) Explain the need of Mason's gain formula for any system reduction. [10+6]

3. (a) Define type and order of a control system and hence find the type and order of the following systems?
   i. $G(s)H(s) = \frac{100}{s(s^2+4s+200)}$
   ii. $G(s)H(s) = \frac{200}{s^2(s^2+10s+200)}$
   iii. $G(s)H(s) = \frac{4(s^2+10s+100)}{s(s+3)(s^2+2s+10)}$
   iv. $G(s)H(s) = \frac{200}{(1+01s)(1+0.5s)}$

   (b) The unit step response of a second order linear system with zero initial state is given by $c(t) = 1 + 1.25e^{-6t}Sin(8t - \tan^{-1} 1.333)$. Determine the damping ratio, un damped natural frequency of oscillations and peak overshoot? [8+8]

4. (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]

5. (a) Derive the expressions for resonant peak & resonant frequency and hence establish the correlation between time response & frequency response.

   (b) Given $\zeta = 0.7$ & $\omega_n = 10$ r/s find resonant peak, resonant frequency & Bandwidth. [10+6]

6. (a) With respect to a function q(s) "Every s-plane contour which does not pass through any singular points of q(s) has a corresponding contour in q(s) plane" Elaborate.

   (b) What is the effect of adding a zero at origin to the to the open loop transfer function on polar plot? [8+8]

7. (a) What is compensation? what are the different types of compensators?

   (b) What is a lag compensator, obtain the transfer function of lag compensator and draw pole-zero plot?

(c) Explain the different steps to be followed for the design of compensator using Bode plot? [3+3+10]

8. (a) The system is represented by the differential equation
$\ddot{y} + 5\dot{y} + 6y = u$
Find the transfer from state variable representation.

(b) Consider the RLC network shown in figure 8b. Write the state variable representation. [16]

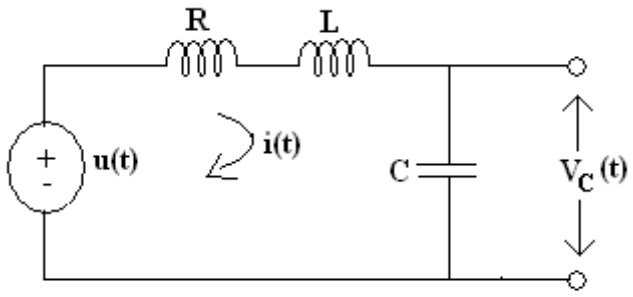

Figure 8b

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