Code No: OR320252 **OR**

III B.Tech II Semester Supplementary Examinations, April/May 2005
CONTROL SYSTEMS
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the transfer function of a D.C. servomotor with armature voltage control.
   (b) Draw the connection diagram of a Synchro pair used as a position indicator.

2. (a) Derive the transfer function of a field controlled d.c. Servomotor and develop the block diagram. Clearly state the assumptions made in the derivation.
   (b) What are the effects of feedback on the performance of a system? Briefly explain.

3. (a) What are the different time domain specification of a dynamical system. Explain important specifications of a second ordered system to unit step input.
   (b) The open loop transfer function of a unity feedback system is given by G(s) = K/s(Ts+1), where K and T are positive constants. By what factor should the amplifier gain be reduced so that the peak overshoot of unit-step response of the system is reduced from 75%to25%?

4. (a) A unity feedback system has forward transfer function: $G(s) = \frac{\mathrm{K(s+13)}}{\mathrm{s(s+3)(s+7)}}$ Using R-H criterion, find the range of K for which the closed loop system is stable.
   (b) The characteristic equation of a servo system is given by $a_0s^4+a_1s^2+a_3s + a_4= 0$. Determine the conditions, which must be satisfied by the coefficients of the characteristic equation for the system to be stable.

5. (a) Show that for a point on the real axis to lie on the root locus, the total number of poles and zeros on the real axis to the right of that point must be an odd number.
   (b) For a unity negative feedback control system, the open-loop transfer function is $G(s) = \frac{K(s+2)}{s^2}$. Find the value of damping ratio for K=4. Determine all the closed loop poles at this value of K. Use root locus technique.

6. (a) Explain the frequency response specifications.
   (b) Draw the Bode Plot for the system having
   $G(s)H(s) = \frac{100(0.02s+1)}{(s+1)(0.1s+1)(0.01s+1)}$. Find gain and phase cross over frequency.

7. (a) Construct the complete Nyquist plot for a unity feed back control system whose open loop transfer function is $G(s)H(s) = \frac{K}{s(s^2+2s+2)}$ Find maximum value of K for which the system is stable.

(b) The open loop transfer function of a unity feed back system is $G(s) = \frac{1}{s(1+0.5s)(1+0.1s)}$. Find gain and phase margin. If a phase lag element with transfer function of $\left(\frac{1+2s}{1+5s}\right)$ is added in the forward path, find how much the gain must be changed to keep the margin same.

8. (a) Obtain the stat variable model in phase variable form for the following system: $\dddot{y} + 2\ddot{y} + 3\dot{y} = u(t)$

(b) The closed loop transfer function is given by $\frac{Y(s)}{U(s)} = \frac{160(s+4)}{s^3+8s^2+192s+640}$
Obtain the state variable model using signal flow graph.

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