2005 ANNA NIVERSITY

B.E/B.TECH V SEMESTER DEGREE EXAMINATION

ELECTRONICS AND COMMUNICATION ENGINEERING

CONTROL SYSTEM

TIME 3 HOUR
MARK 80

ANSWER ANY ALL QUESTION

PART - A (10 X 2 = 20 Marks)

1. Derive the transfer function of the network shown in fig 1.

2. Write the differential equations of the mechanical system shown in fig 2.

3. Calculate the time response of the following system if the input r(t) is an unit impulse

4. Plot the time response of the first order system to a unit step and unit ramp input.

5. Write the transfer function of a PID controller.

6. Write the Hurwitz determinant for the system given by the characteristic equation 4s3 + 2s2 + 5s + 7 = 0

7. State the magnitude criterion with reference to a root locus plot.

8. Draw the frequency magnitude plot for an under damped and over damped second order system.

9. Mention any two functions of a compensator in a control system.

10. Draw the circuit of a lead compensator.

Part - B (5 X 16 = 80 Marks)

11. The polarized solenoids shown in fig 3 produces a force proportional to the current in the coil. The coil has resistance R and inductance L. Write the differential equations of the system

12.a)i) Derive an expression for the peak over shoot of a second order system for an unit step input.

ii) A mechanical vibratory system and its response when 2kg of force(step input) applied to the system is shown in fig 4. Determine the M, B and K of the system.

(OR)

12.b) For the control system shown in fig 5, find the steady state error without the proportional and derivative (PD) controller for a unit ramp input. Show that with the PD controller this error can be made to zero for a specific value of K.

13.a) For a feedback control system G(s) = K / (s+1) (s+3) (s+4) Calculate the value of K at which the system would become oscillatory in the closed loop [H(s) = 1], and obtain the frequency of such oscillations. Also, find the value of K so that the real parts of all the roots will be less than -1.

(OR)

13.b) Sketch the root locus plot of a unity feedback system with an open loop transfer function G(s) = K / s (s+2) (s+4) Determine the value of K so that the dominant pair of complex poles of the system has a damping ratio of 0.5.

14.a)i) Show that the constant M locus in G- plane is a circle for all values of M except M=1
ii) The open loop transfer function of a unity feedback control system is G(s) = K / s (1+0.1s) (1+s)

Draw the Bode diagram and analyze the stability of the system for K =10.

(OR)

14.b) The open loop transfer function of a feedback system is given by G(s) = K / s (T1s+1) (T2s+1)Draw the Nyquist plot. Derive an expression for gain K in terms of T1, T2 and specific gain margin Gm.

15.a) A Unity feedback system has an open loop transfer function of G(s) = K / s (s+1) (s+5) Draw the root locus plot and determine the value of K to give a damping ratio of 0.3 A network having a transfer function of 10(1 +10s) /(1 +100s) is now introduced in tandem. Find the new value of K, which gives the same damping ratio for the closed -loop response. Compare the velocity error constant and settling time of the original and the compensated systems

15.b) A servomechanism has an open loop transfer function of G(s) = 10 / s (1+0.5s) (1+0.1s) Draw the Bode plot and determine the phase and gain margin. A networks having the transfer function (1+0.23s)/(1+0.023s) is now introduced in tandem. Determine the new gain and phase margins. Comment upon the improvement in system response caused by the network