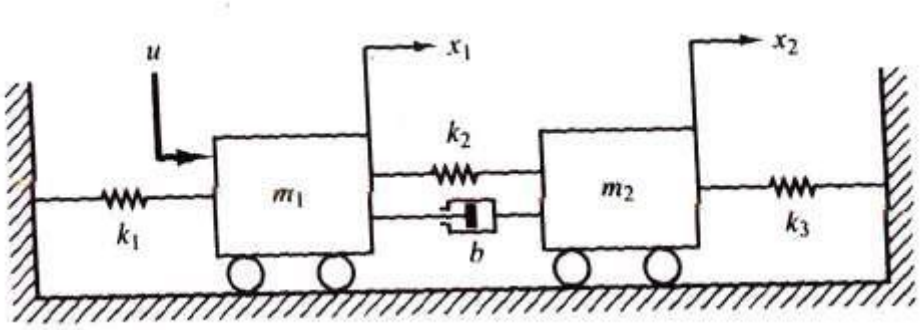
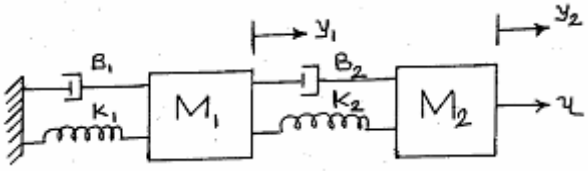
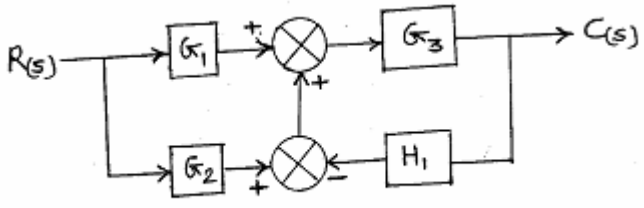
GUJARAT UNIVERSITY

BE Semester-IV (IC) Question Bank-2013
Control Theory (IC 404)
All questions carry equal marks (10 marks)

Q.1	Give the names of the analogous quantities in thermal and liquid level Systems analogous to charge, current, voltage and resistance in electrical systems.
Q.2	Explain the difference between Open loop and Close loop control system with examples. Compare their merits and demerits
Q.3	Obtain the transfer function X2(s)/U(s) of the mechanical system shown in figure. 
Q.4	Describe Correlation between transfer function and state-space equations with suitable examples
Q.5	Obtain state space representation of system shown in Figure 
Q.6	Explain about state space modeling and obtain state variable model for dc motor
Q.7	Give one example of an open loop stable system and open loop unstable system. Explain about stability of the system.
Q.8	Write state equation and output equation for a generalized control system using matrices A, B, C and D. Write two different state equations for a mass-spring and damper system. Find eigenvalues of system matrix A in both cases. Comment on your result. Assume suitable symbols for constants of all three elements.
Q.9	Write definitions of state and state variables. Explain the fact that for any system, the set of state variables are non-unique. Discuss the limitations of transfer functions and advantages of analysis of control systems using state space.
Q.10	Obtain mathematical model for one electrical system and one mechanical system. Obtain their transfer functions.
Q.11	Explain about time constant of first order and second order system
Q.12	Draw sketches of three time responses of a second order system for a unit step Input for under damped, critically damped and over damped systems. Give

	definitions of five performance indices with the help of sketch drawn for under Damped system.
Q.13	Explain about thermal system giving suitable example. Obtain its transfer function.
Q.14	Explain about liquid level system giving suitable example. Obtain its transfer function.
Q.15	System 1 has transfer Function G1(s) =30 / 4S2+3 S+6 and system 2 has transfer Function G2(s) =2 / S+4 .Find cascade and parallel transfer Function for system 1 and system 2. Write MATLAB program to find cascade, and parallel transfer Function from given transfer Function.
Q.16	Explain types of the system and steady state error constants for the same. Explain with example the first order system.
Q.17	For the unity feedback control system with G(s)=k(s+15)/s(s+2)(s+3) Determine the range of *K* for stability using R-H criteria
Q.18	For a unity feedback control systems shown below, obtain steady state error for step input. $G_1(s)=10/s^2+14s+50$ $G_2(s)= 10/s\ (s^2+14s+50)$
Q.19	The characteristic equation of the system is given by $S^4 + 2S^3 + (4+k)\,S^2 + 9S + 25 = 0$. Determine the range of k for the system to be stable.
Q.20	Explain : (I) Gain Margin (II) Phase Margin (III) Gain crossover frequency (IV) Phase crossover frequency
Q.21	For a RLC circuit, derive the state model of the system.
Q.22	State and Explain Nyquist Stability criteria. Explain about phase margin and gain margin using Nyquist plot
Q.23	Obtain root-locus plot for the unity feedback system with transfer function G(s)=k/s (s+2)
Q.24	Obtain gain crossover frequency and phase crossover frequency for the system having transfer function as shown below using Bode Plots. G(s)=10/s(1+0.4s)(1+0.1s)
Q.25	Draw the Nyquist Plot for G(s) =1/S(S-1) and also Write MATLAB program for it.
Q.26	Explain Root Locus Technique Rules.
Q.27	Explain following terms with necessary diagrams. 1) Delay Time 2) Rise Time 3) Peak Time 4) Steady state error 5) Settling Time
Q.28	Sketch the direct and reverse polar plots for unity feedback system with an open loop transfer function, $G(s) = \frac{1}{S\,(1+S)^2}$.
Q.29	From block diagram shown in Figure, Draw the corresponding signal flow graph and evaluate closed-loop transfer Function using Mason's gain Formula. 
Q.30	Define the following terms with respect to root locus (I) Centroid (II) Asymptote (III) Angle of departure (IV) Angle of arrival (V) Break away point

Q.31	Write two notions of stability and a brief note on stability of control systems. Draw sketches of impulse response of control system having different locations of poles to explain the concept of stability.
Q.32	Compare root locus technique and Bode plots for control system analysis Purpose. Explain how root locus technique is more difficult than the Bode plots.
Q.33	Explain constant-M circles and constant-N circles by deriving related expressions.Explain how resonant peak can be obtained.
Q.34	Draw and explain Nyquist contour. Write definition and discuss the Nyquist Stability criterion.
Q.35	Determine the value of k for a unity feedback control system having open loop transfer function G(s) H(s)= $\frac{K}{S(S+2)(S+4)}$ Such that (I) Gain margin 20 db (II) Phase margin 60 db
Q.36	A feedback control system has an open loop transfer function $G(S)H(S) = \frac{K}{S(S+3)(S^2+2S+2)}$ sketch the root locus as K is varied from 0 to ∞.
Q.37	The open loop transfer function of a unity feedback system is given by $G(S) = \frac{K}{S(TS+1)}$ Where k and T are constants. By what factor should the amplifier gain be reduced so that the peak overshoot of the system is reduced from 75% to 25%?
Q.38	A unity feedback system is characterized by open loop transfer function $G(S) = \frac{K}{S(S+10)}$. Determine gain k so that the system will have a damping ratio of 0.5
Q.39	Define Following Terms (1) Transfer Function (2) State (3) Peak Overshoot (4) Delay Time (5) Rise Time (6) Settling Time (7) Peak Time
Q.40	Draw the Nyquist Plot for G(s)=1/S(S-1) and also Write MATLAB program for It.