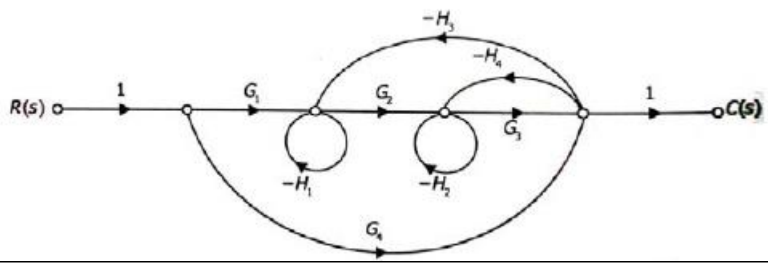
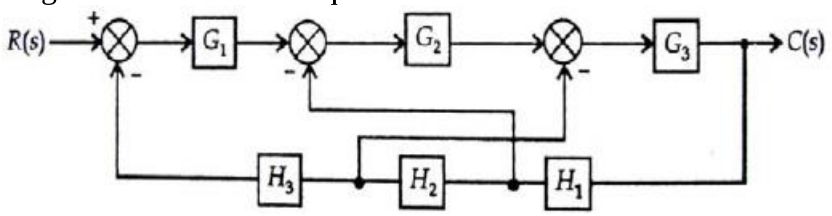
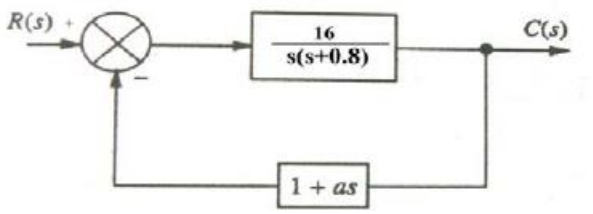
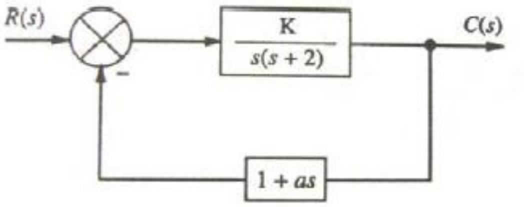
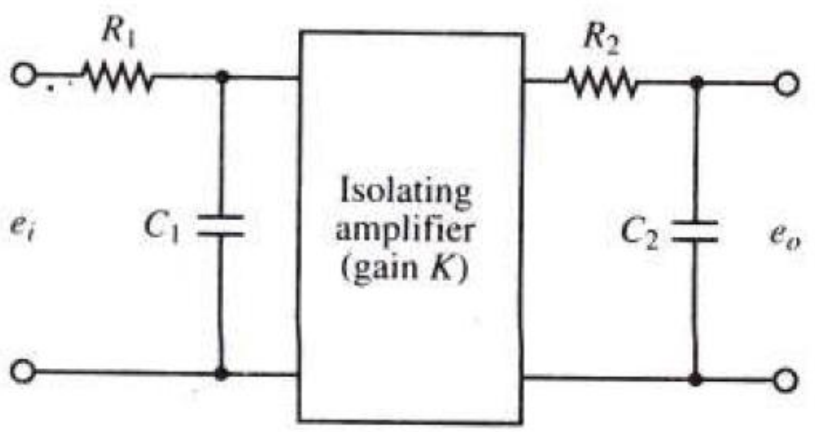
BE Semester-IV (Electrical) Question Bank

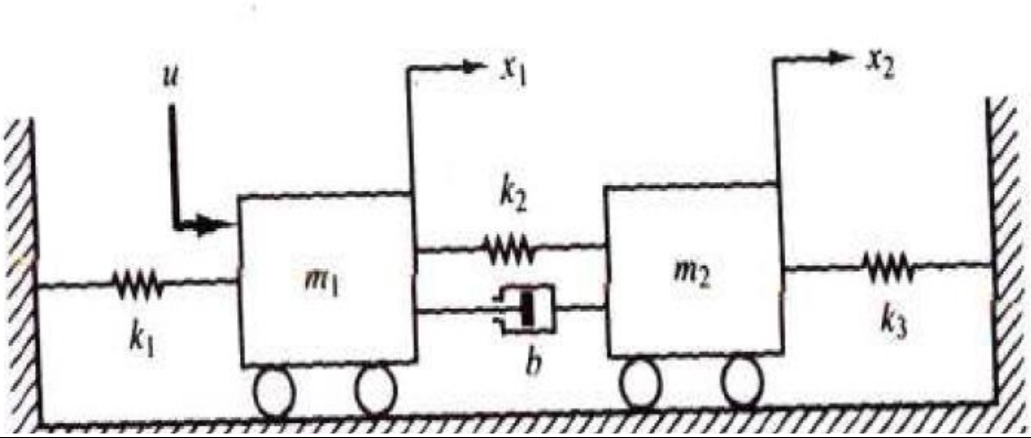
Control Theory

All questions carry equal marks (10 marks)

Q.1	Define terms: 1. State 2. State vector 3. Transfer function 4. Non touching loops 5. Sink node 6. Time response 7. Order of the system
Q.2	Derive transfer function for an armature controlled d.c.motor.
Q.3	Explain force voltage analogy with suitable example.
Q.4	Determine the transfer function of the system with signal flow graph shown below: 
Q.5	Determine close loop transfer function of the system shown below using block diagram reduction techniques. 
Q.6	Explain Block diagram reduction techniques.
Q.7	Give the advantage of signal flow graph method over block diagram reduction method.
Q.8	What is Stability? Define various terminologies of the same.
Q.9	What is mathematical modeling? What is the advantage and explain it with suitable example.
Q.10	Describe gear –train method with modeling idea.
Q.11	Derive the standard characteristics equation for second order system.
Q.12	Derive the all time performance specification characteristics.
Q.13	Consider the system as shown in figure. Determine the value of '*a*' such that the damping ratio is 0.5. Also obtain the values of rise time and maximum overshoot Mp in its step response. 

Q.14	Determine the value of 'K' and 'a' such that the system has a damping ratio of 0.7 and an undamped natural frequency of 4 rad/sec for the system shown below. 
Q.15	Write note on steady state error and error constants.
Q.16	Discuss Nyquist's stability criterion.
Q.17	Using Routh's criterion check the stability of a system whose characteristic equation is given by $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$
Q.18	An open loop transfer function of a system is given by $G(s)H(s) = \frac{K}{(s+1)(2s+1)}$ Prepare Nyquist plot for it.
Q.19	The open loop transfer function of a feedback control system is given by $G(s)H(s) = \frac{K}{s(s+3)(s^2+2s+2)}$ Draw complete root locus plot as K varies from 0 to ∞. Also calculate the value of K for which the system becomes oscillatory.
Q.20	Sketch Bode plot for the transfer function $G(s) = \frac{200(s+2)}{s(s^2+10s+100)}$ Determine there from gain margin and phase margin.
Q.21	Explain about time constant of first order and second order system.
Q.22	Explain about state space modeling and obtain state variable model for dc motor.
Q.23	Give one example of an open loop stable system and open loop unstable system. Explain about stability of the system.
Q.24	Explain about thermal system giving suitable example. Obtain its transfer function.
Q.25	Explain about liquid level system giving suitable example. Obtain its transfer function.
Q.26	Explain about integral action and derivative action on system performance. Can integral action be used alone ?
Q.27	Obtain gain crossover frequency and phase crossover frequency for the system having transfer function as shown below using Bode Plots.

	$$G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$$
Q.28	Explain with suitable example, one method for linearization of nonlinear mathematical model.
Q.29	Explain constant-M circles and constant-N circles by deriving related expressions. Explain how resonant peak can be obtained.
Q.30	(i) State whether the root locus tool is a frequency response or a time response tool. (ii) 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.31	Comment on the stability of a closed loop system whose open-loop transfer function is, as given below, using Nyquist stability criterion. Draw Nyquist contour and corresponding G(s)H(s) contour. $$\frac{10}{(1+0.1S)(1+0.5S)}$$
Q.32	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.33	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.34	Explain the concept of linearity and time invariance in the context of control systems. Give definition of transfer function and explain the same. State any three advantages of closed loop systems over open loop control systems.
Q.35	Find the transfer function of the given network 

Q.36	Obtain the transfer function $X_2(s)/U(s)$ of the mechanical system shown in figure. 
Q.37	The open loop transfer function of a unity feed back 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	Give the names of the analogous quantities in thermal and liquid level systems analogous to charge, current, voltage and resistance in electrical systems?
Q.39	Write notes on “Phase Lag – Lead compensation”
Q.40	Explain : (I) Gain Margin (II) Phase Margin (III) Gain crossover frequency (IV) Phase crossover frequency