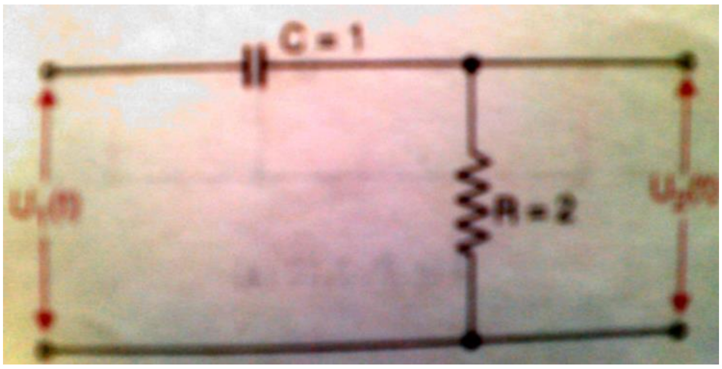
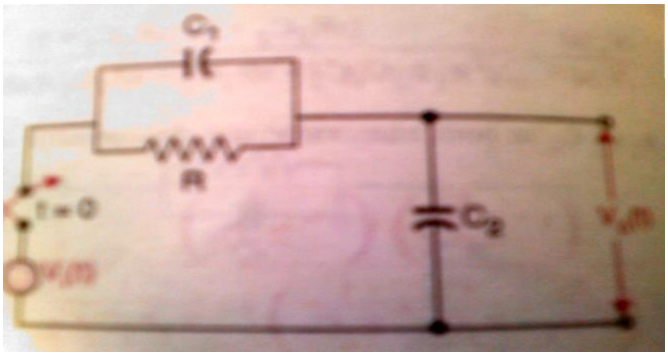
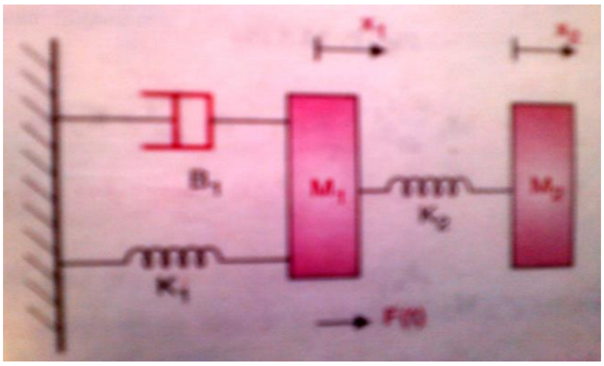
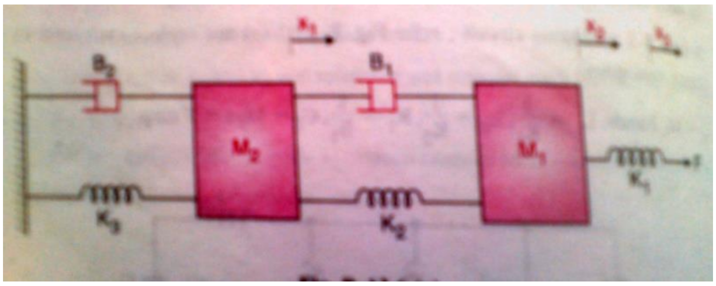
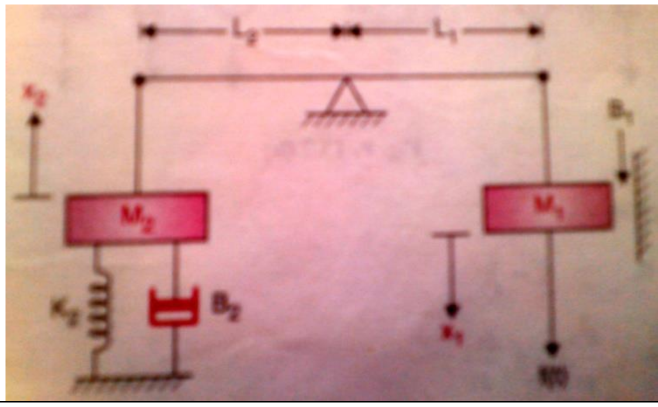
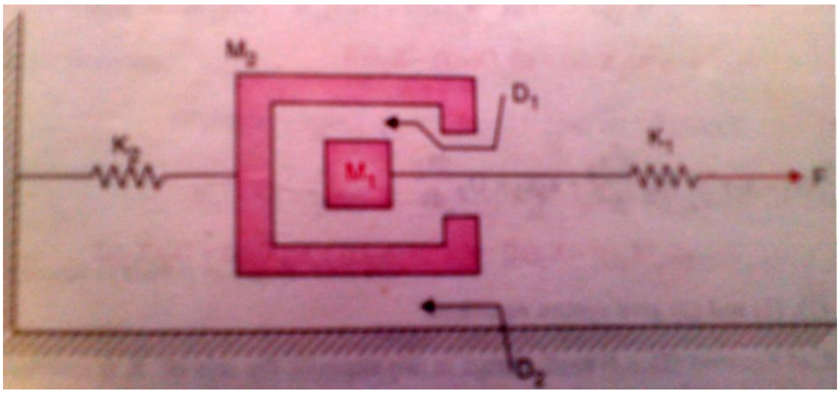
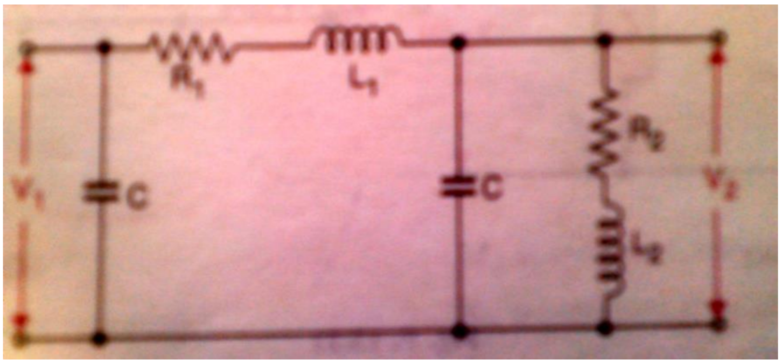
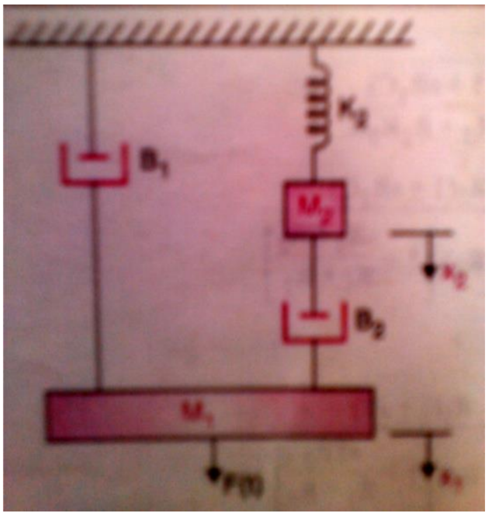
BE Semester-__IV__ (BIOMEDICAL ENGINEERING) Question Bank

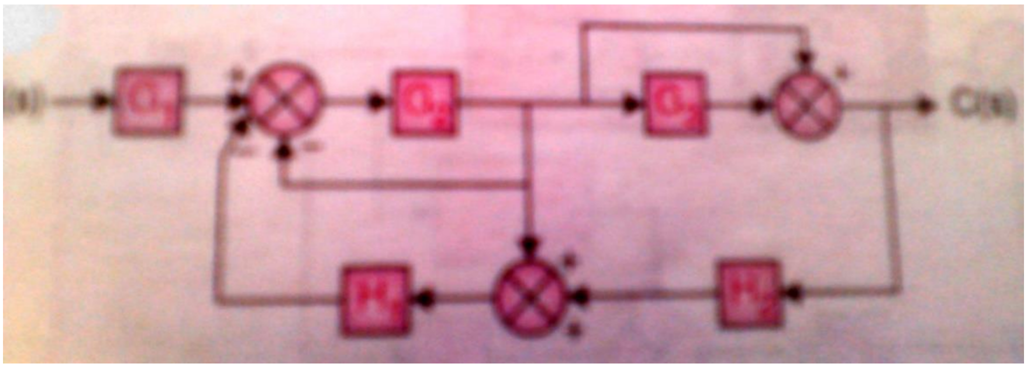
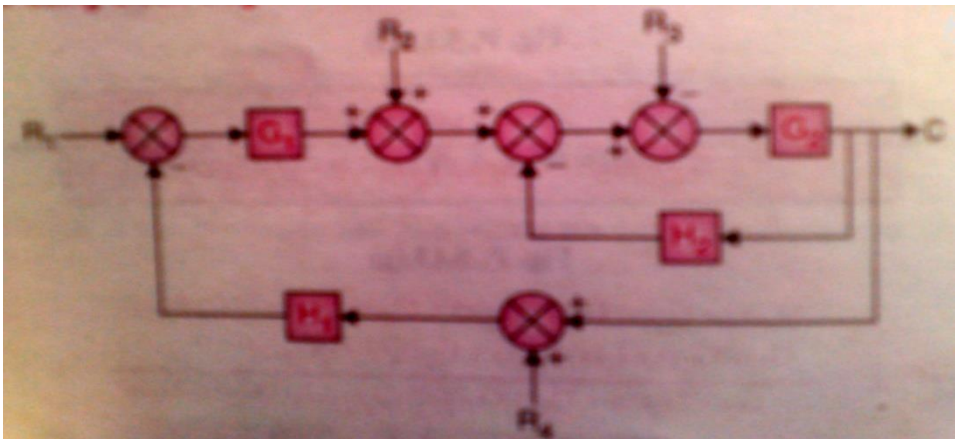
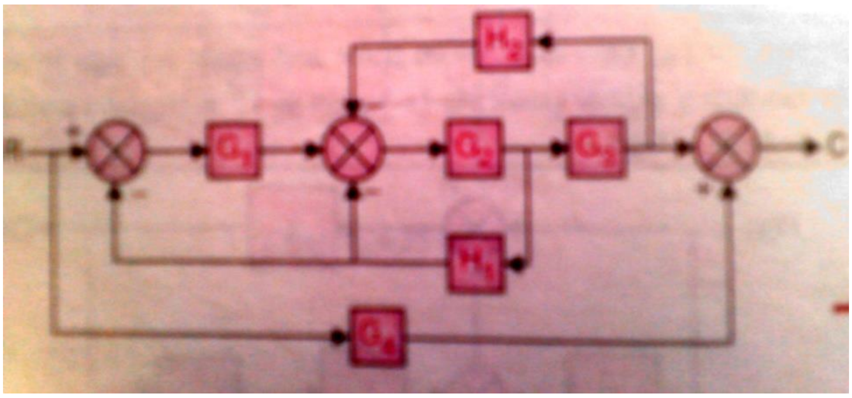
(Control Theory)

All questions carry equal marks (10 marks)

Q.1	What is open loop system? Explain the term with its suitable examples.
Q.2	What is closed loop system? Explain the term with its suitable examples.
Q.3	How does a voltage stabilizers work as closed loop system? Explain with neat diagram.
Q.4	Give comparison of Open and Closed Loop systems.
Q.5	Define the following terms: (a) Accuracy, (b) Sensitivity, (c) Servomechanism, (d) Open loop, (e) Closed loop.
Q.6	What is Transfer Function? Discuss the properties of Transfer function.
Q.7	Explain State Model of Linear systems.
Q.8	Determine the transfer function of the network shown in fig. Hence Calculate the voltage $U_2(t)$ when the inputs are: (i) $U_1(t) = 5$, (ii) $U_1(t) = 5t$, (iii) $U_1(t) = 5t^2$. 
Q.9	Determine the value of $V_0(t)$ if $C_2 = 5\ C_1$ $V_i(t) = 40\ e^{-20t}$, $C_1 = 0.5\mu F$, $R = 100m\Omega$ Switch is closed at t=0. 

Q.10	What are the types of Mechanical Modelling? Explain any one in detail.
Q.11	Compare the translational and rotational counterparts of mechanical modelling.
Q.12	Explain in detail Force-Voltage analogy in terms of Translational, Electrical and Rotational mechanical systems.
Q.13	Explain in detail Force-Current analogy in terms of Translational, Electrical and Rotational mechanical systems.
Q.14	For the mechanical system shown in fig. (i) Draw the mechanical network, (ii) Write the differential equations of performance. (iii) Draw the force voltage and force current analogous networks. 
Q.15	Obtain differential equations describing the mechanical system shown in fig. and draw the electric network using force-voltage analogy. 
Q.16	For the mechanical system shown in fig, draw the force-voltage analogous network. Find the transfer function $X_2(s) / X_1(s)$. 

Q.17	Find the system equations and F-I and F-V analogous circuit. Refer fig. 
Q.18	Determine the transfer function of electrical network shown in fig. 
Q.19	Write the set of equilibrium equations for the system shown in fig., Draw the mechanical equivalent system for the given system and obtain only electrical equivalent / analogous circuit using: (i)F-V analogy, (ii)F-I analogy. 
Q.20	Refer fig. and find the single block equivalent by block diagram reduction.

	
Q.21	Find C using block diagram reduction techniques. Refer fig. 
Q.22	Using block diagram reduction techniques, find the closed loop transfer function of the system. Refer fig. 
Q.23	Define Time response of the system? Briefly discuss transient response with its graph.
Q.24	Discuss time response of second order system subjected to unit impulse input for $\xi < 1$ and $\xi > 1$ where ξ is Damping ratio.
Q.25	Explain the relation between steady state error and type of system.
Q.26	Discuss relation between ξ and Pole location.
Q.27	Derive unit step response of second order system.

Q.28	Derive performance indices in Transient response analysis.
Q.29	Explain in detail Routh's criterion. Find the stability F(s) = $s^6+2s^5+8s^4+12s^3+20s^2+16s+16$.
Q.30	Discuss relation between OLTF and CLTF Poles and Zeros.
Q.31	For G(s) = $\frac{k(s+1)}{(s)(s+2)(s+3)}$, H(s) = 1. Find the number of loci.
Q.32	Plot the root locus for the unity feedback system with G(s) = $\frac{K}{s(s+6)(s+9)}$.
Q.33	The open loop transfer function of the system is G(s)H(s) = $\frac{k}{s(s+2+2j)(s+2-2j)}$. Determine the complete root locus and comment on the stability of the closed loop system.
Q.34	Consider a unity feedback system with a forward path transfer function, G(s) = $\frac{k(s+4)}{(s+2)(s-1)}$ $k \geq 0$. Draw the root locus plot and find the value of k that results ξ = 0.707 and t_s<4sec. Determine the peak overshoot, settling time and the position error for this value of k.
Q.35	Given GH(s) = $\frac{12}{s(s+1)(s+2)}$. Draw the polar plot and hence determine if system is stable and its gain and phase margin.
Q.36	Sketch the Nyquist plot. G(s) = $\frac{1}{s(s-1)}$.
Q.37	Draw Nyquist plot for G(s) H(s) = $\frac{2500}{(s+300)}$ Determine phase crossover frequency, gain crossover frequency, gain margin and phase margin.
Q.38	For a unity feedback system, if the open loop transfer function is given by G(s) = $\frac{10k}{s(s+1)(s+5)}$. Sketch the Nyquist plot. Also determine the range of k (k>0) for stability.
Q.39	What is Polar plots? Give its properties, advantages and disadvantages.
Q.40	List out locations of poles and system's stability relationships.