END SEMESTER EXAMINATION

B.TECH ELECTRICAL ENGINEERING -IV SEMESTER

BASIC CONTROL SYSTEMS (EE1402)

Max marks: 60 Time: 3 hrs

Note: Answer all questions

1. Using block diagram reduction rules, obtain the input-output transfer function of the system given in Fig. 1. [6]

2. a) The system as shown in Fig. 2 is being controlled by a PI controller. Prove that the PI controller behaves as a phase lag network. How is the steady state error charecteristics improved by adding this network when used for a ramp input [5+10]

   b) Construct the root locus of the system with respect to variation of K. Determine the range of K for which the system is stable.

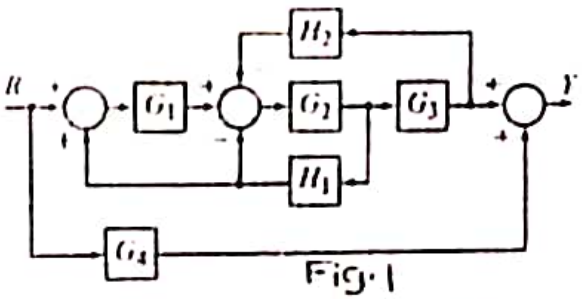


Fig. 1

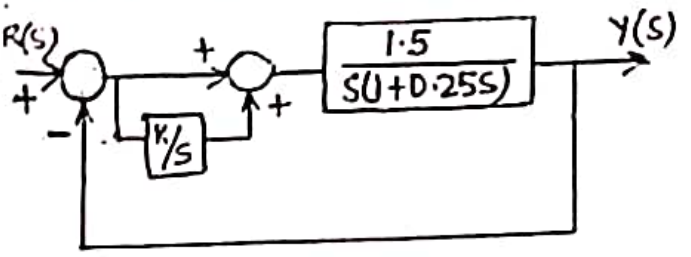


Fig. 2

3. a) Explain the terms gain margin and phase margin with reference to Nyquist plots. [3+5]

   b) A unity feedback system has open-loop transfer function

   $G(s) = \frac{6}{(s^2+2s+2)(s+2)}$. Find the gain margin and phase margin using Nyquist plot.

4. a) Discuss how the dB versus log ω can be sketched using straight line approximation for (i) pole at $s = -1/T$ and (ii) Complex zeros. [4+5]

   b) The bode plot of a system is asymptotically approximated as shown in Fig.3. Find the transfer function of the system.

5. a) For the system given in Fig. 4, write the state space equations. Clearly define the states used where $G_1=1/(s+1)$, $G_2=1/(s+2)$, $G_3=1/(s+3)$, $G_4=1/(s+4)$. [6+6]

   b) A linear time invariant system is given by $\dot{x}_1=x_2$ and $\dot{x}_2=-2x_2$. Find the solution of the state equation for initial conditions given by $x_1(0)=1$ and $x_2(0)=0$.

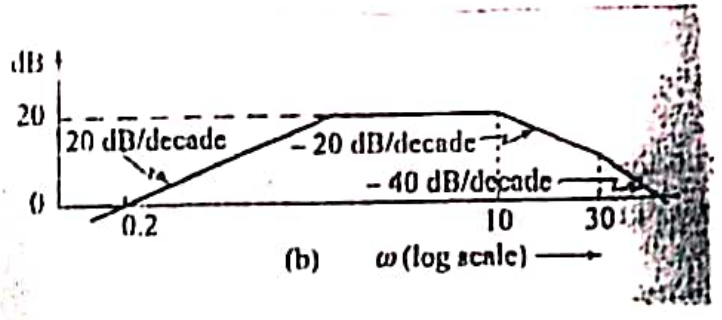
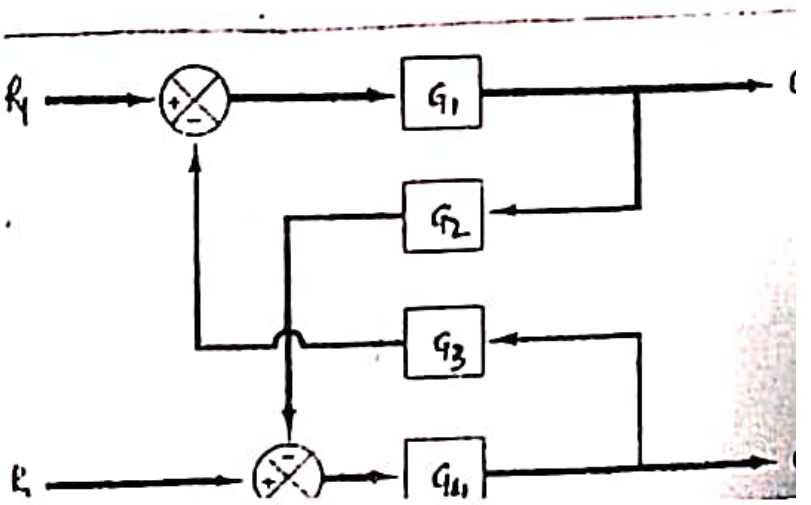


Fig.3



6 Derive the equation of the output position θ_o for the system shown in Fig 5 .

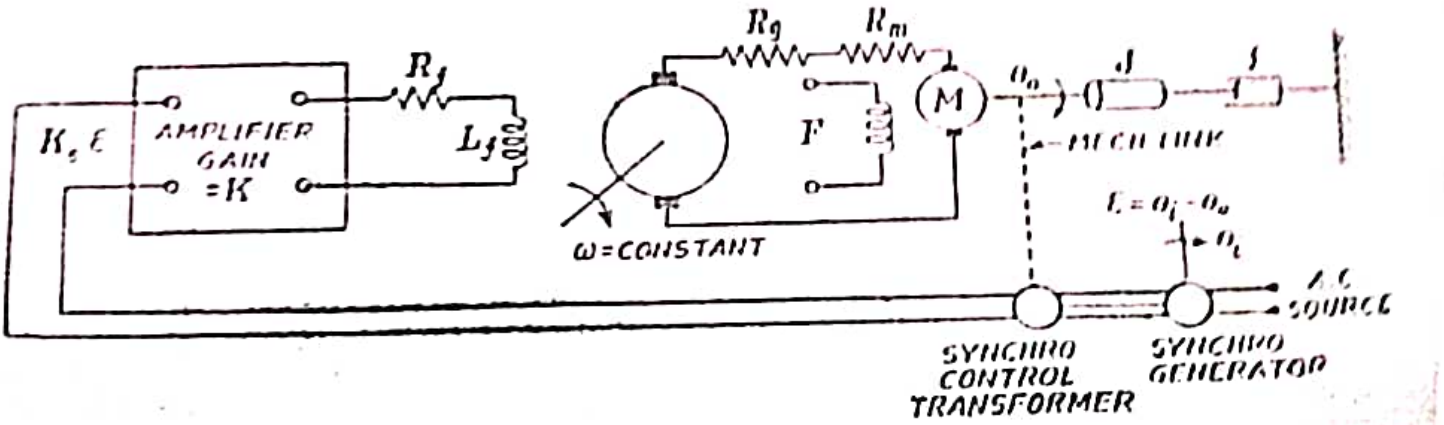


Fig. 5