Name______________________ Entry No______________________ Group No.__________

Major Test MCL 212 : Max Marks 48: Time 2 hours

1.(a) Enlist the rules for plotting root locus (without proofs) with diagrams wherever needed.

(b) Plot the root locus pattern for a system whose forward path function is

$$\frac{K(s+5)}{s(s+1)(s^2+5s+12)}$$

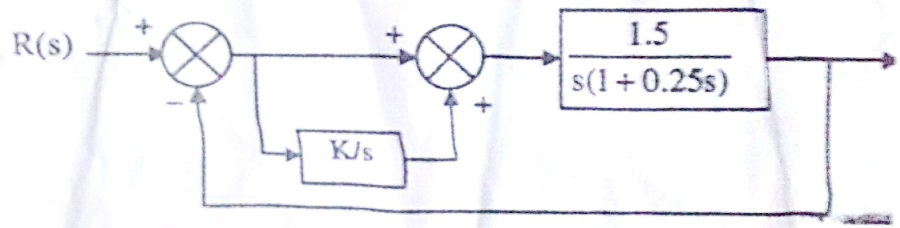
For K=1.2 Estimate the approximate damping ratio offered by the closed loop system

(3+5)

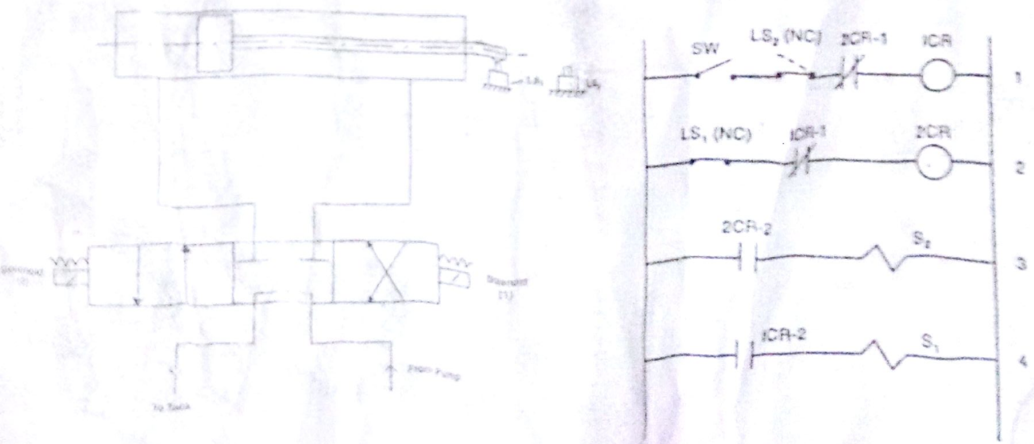
2 (a) The system as shown in figure below is being controlled by a PI controller. Prove that the PI controller behaves as a phase lag network. How is the steady state error characteristics improved by adding this network when used for a unit ramp input

(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

(3+5)



3



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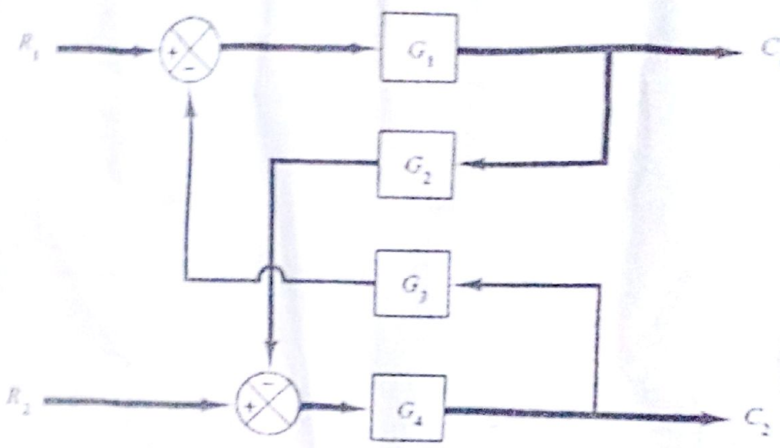
Name ____________ Entry No ____________ Group No. ________

(a) In a potato chip making assembly line, at one inspection stage the, weight and label on the packet is checked. If the packet is underweight, a plunger type of actuator A1 pushes such packets on another conveyor line where they would go for repacking. If the label is not there, then another actuator A2 pushes such packets to another line L2 where they would be relabeled. However, such packets must be of appropriate weight. Make the logic diagram and write suitable logic equations For these diagrams Define all the senor and actuator events and their active and inactive states.

(b) Write the logic equations for the relay circuit and the corresponding pneumatic system shown above and make the logic diagram using Pneumatic symbols. Also explain the system of operation. Write the equivalent PLC program for the ladder. (3+5)

4 For the system given below. $G_1=1/(1+s)$; $G_2=1/(2+s)$ $G_3=1/(3+s)$ $G_4=1/(4+s)$ Write the state space equations for the diagram. Use any method, do clearly define the states used.



5 .Obtain a state-space representation of

$$\frac{Y(s)}{U(s)}=\frac{12(1-s)}{(s+2)(s+3)}$$

From the state equations, demonstrate that you get back the transfer function.

Also, find expression for output $y(t)$ for a unit step input $u(t)$. Take initial conditions as zero. (8)

6 (a) How is an aircraft stabilized in space? Explain schematically the working of any one stabilization indicating all the elements involved in it.

(b) What is the importance of Nichols chart and how it is drawn.

For a feedback control system, with feedback gain = 2, the open loop transfer function is an approximate straight line with the two experimentally known values.

ω = 1 Hz OLTF = 16 dB phase lag = 90°

ω = 30 Hz OLTF = - 16 dB phase lag = 210° (8)

Show the Nichols plot for this function on the Nichols chart. What is the peak value of closed loop gain and at what phase angle it would occur.? Also find the gain margin and phase margin of the closed loop system. (8)