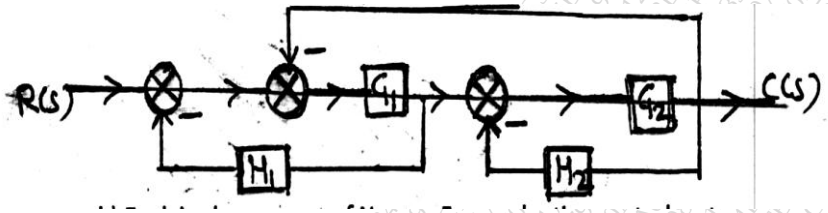
Time: 3 Hours **Marks: 80**

NB: 1Question no.1 is compulsory.
2 Attempt any 3 question from remaining questions.
3 Assume suitable data if necessary.
4 Figures to the right indicates full marks.

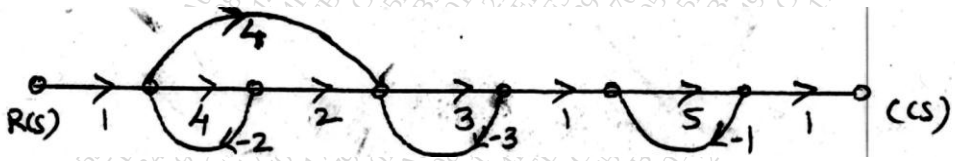
1) a) Explain Masons gain formula. 5
b) Define gain margin and phase margin. 5
c) Compare lead compensator and lag compensator. 5
d) Differentiate open loop and closed loop control system. 5

2) a) Obtain transfer function using block diagram reduction rule. 10



b) Explain the concept of Neuro –Fuzzy adaptive control system Explain one method of adaptive control. 10

3) a) Determine the C(s)/R(s) of the signal flow graph 10



b) Sketch the root locus for the given system 10
G(s) H(s) =k/s(s+3) (s+5)

4) a) Explain controllability and observability analysis of LTI system using suitable examples. 10
b) Examine the observability of the system 10

$$A=\begin{bmatrix}0 & 0 & 0\\ 1 & 0 & -3\\ 0 & 1 & -4\end{bmatrix} \quad B=\begin{bmatrix}40\\ 10\\ 0\end{bmatrix} \quad C=\begin{bmatrix}0 & 0 & 1\end{bmatrix}$$

5) a) unity feedback system has 10

$$G(s) = \frac{40\,(s+2)}{s(s+1)\,(s+4)}$$

Determine the type of the system, all error coefficients and error for ramp input with magnitude 4

b) For 10

$$G(s)\,H(s) = \frac{k}{s(s+1)\,(s+2)\,(s+5)}$$

using Routh- Hurwitz criterion determine range of k for stability and value of k for marginally stable system.

6 a) Sketch Bode plot for 10

$G(s) = k/s(s+0.5)\,(s+0.1)$

Determine value of k to obtain phase margin 30^0 and gain margin12dB.

b) Explain correlation between time and frequency domain specification. 10

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