

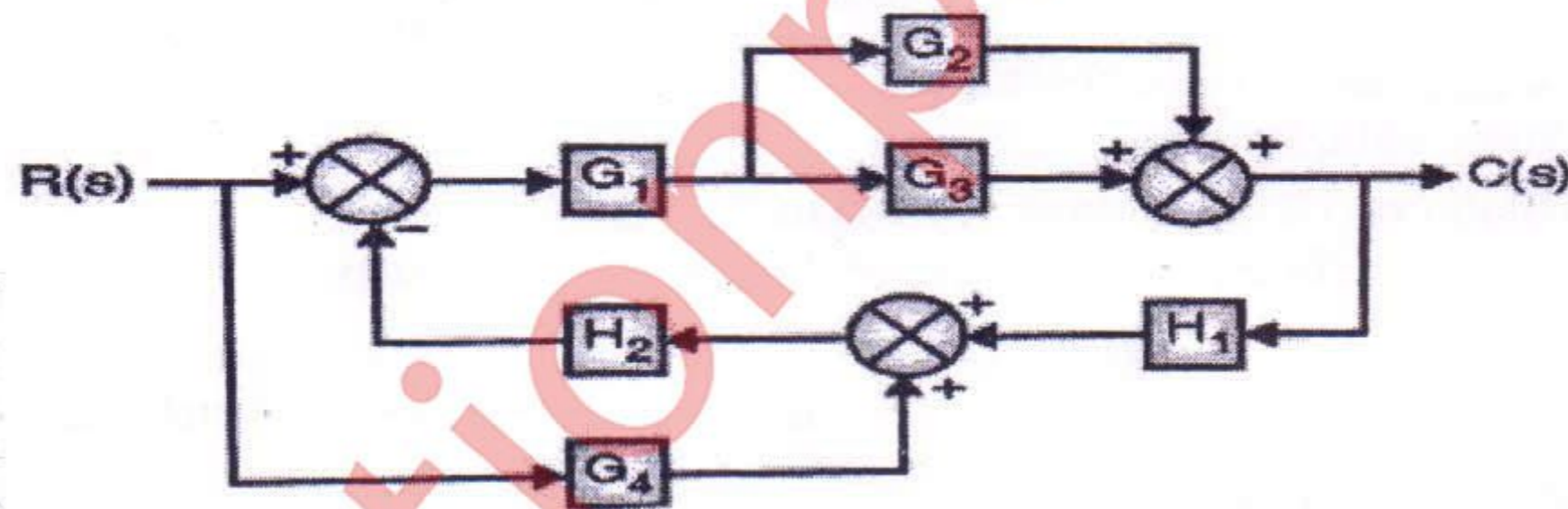
Q.P. Code: 25142

(3 hours)

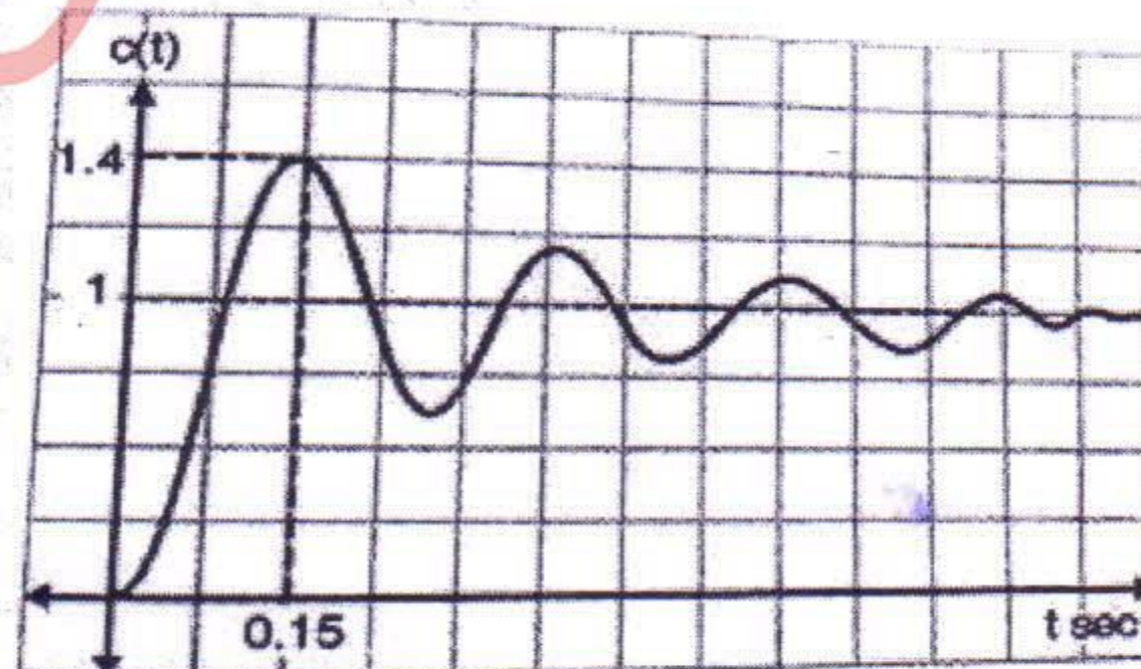
Total Marks: 80

- N.B.: (1) Question No. 1 is compulsory.  
 (2) Solve any three questions from remaining five questions.  
 (3) Draw neat diagrams and assume suitable data wherever necessary. Justify your assumptions.

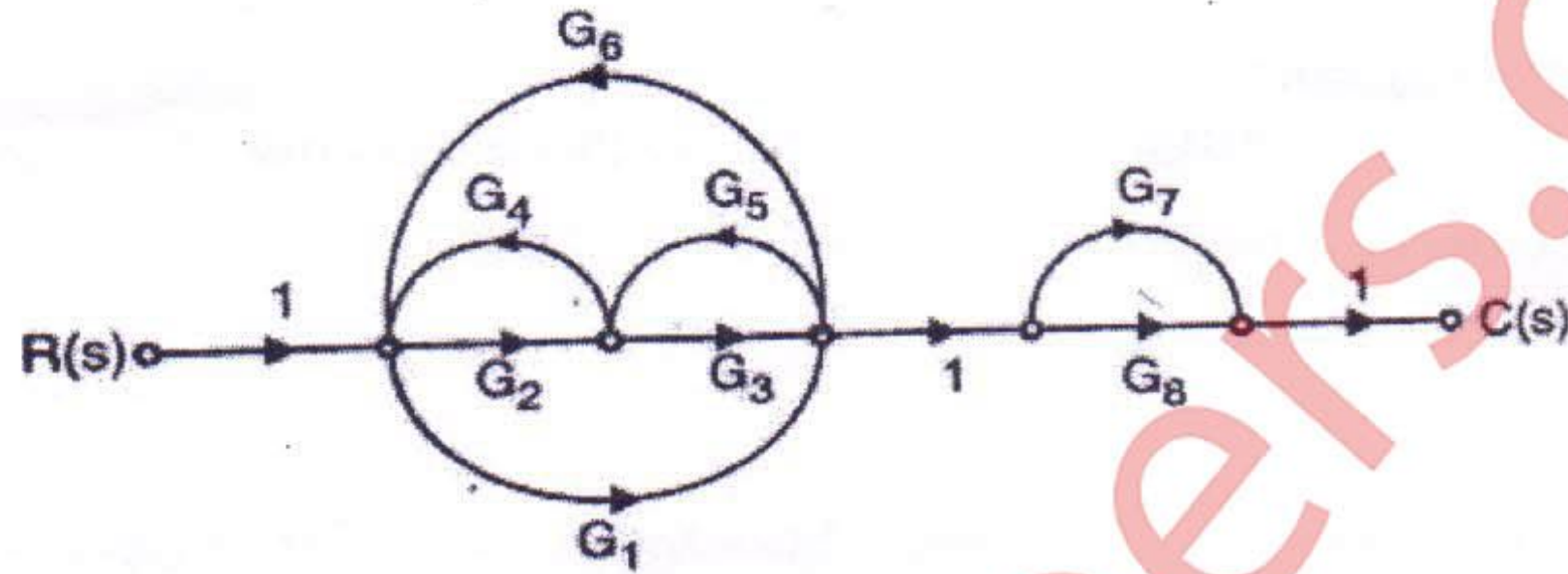
1. Attempt any **four**: 20
- (a) Define i) Phase margin ii) Gain margin iii) Phase cross over frequency ( $\omega_{pc}$ ) iv) Gain cross over frequency ( $\omega_{gc}$ ) and state the conditions for stable system.
  - (b) Differentiate analog and digital control system.
  - (c) State and explain rules for constructing a root locus.
  - (d) Explain the need of compensation. State and explain different types of compensation techniques.
  - (e) Compare open loop and closed loop control system.
2. (a) Find the transfer function  $\frac{C(s)}{R(s)}$  using Block Diagram Reduction Technique: 10



- (b) For second order system the time response of a unit step is as shown below. 10  
 Compute the resonant peak and resonant frequency.



3. (a) A feedback control system has open loop transfer function  $G(s)H(s) = \frac{k}{s(s+4)(s^2+4s+20)}$ . Plot the root locus for  $k=0$  to  $\infty$  indicate all the points on it. 12
- (b) Explain the realization of lag-lead compensator using electrical network. 8
4. (a) Obtain the overall transfer function from the signal flow graph: 10



- (b) Find the range of  $k$  so that the following system are stable using Routh's stability criteria: 10
- i)  $S^4 + 7s^3 + 10s^2 + 2ks + k = 0$
- ii)  $s^3 + 3ks^2 + (k+2)s + 4 = 0$
5. (a) For the transfer function given below  $G(s)H(s) = \frac{48(s+10)}{s(s+20)(s^2+2.4s+1)}$  Find: 10
- i) Static position error coefficient
- ii) Static velocity error coefficient
- iii) Static acceleration error coefficient
- iv) Steady state error if the input to the system is unit step
- (b) For the unity feedback control system  $G(s) = \frac{10}{s(s+1)(s+5)}$  sketch the Bode plot. 10
- Determine gain and phase margin.
6. (a) Explain Implementation of Digital controller in Temperature Control System. 10
- (b) Define i) Delay Time ii) Rise Time iii) Peak Time iv) Settling Time v) Peak overshoot 10