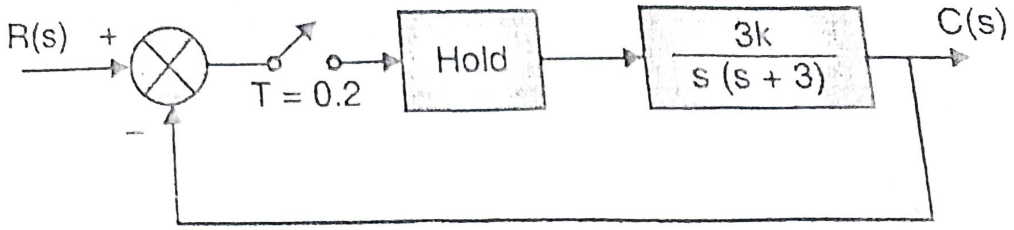
1. Question no. 1 is compulsory
2. Attempt any three questions out of remaining five questions
3. Assume suitable data whenever necessary
4. Figures to the right indicate full marks

TE - ELEC - R- 19 C-Scheme Winter 2025 Sem VI - KT

			Marks
Q. 1		Attempt All	
	a	Compare lag and lead compensators along with electrical equivalent circuit and pole-zero plot in S-plane.	05
	b	Define controllability and observability of a system.	05
	c	Develop a flowchart for the digital compensator defined by $Gc(z)=\frac{X(z)}{E(z)}=\frac{z-0.8}{z^2-0.4z+0.8}$	05
	d	Convert given transfer function into cascade form of state space $\frac{Y(s)}{U(s)}=\frac{(s+3)}{(s+2)(s+4)(s+6)}$	05
Q.2	a)	Design a lead compensator by root locus technique for the unity feedback system which has the forward system given by G(S)=K/s(s+4)(s+6) which will reduce the settling time by a factor of 2 while maintaing 30% overshoot.	15
	b)	Explain how to improve the steady state error by cascade compensation	05
Q 3	a)	The open loop transfer function of a uncompensated system is G(s)=5/s(s+2). Design a suitable lag compensator for the system so that static error constant Kv=20, phase margin is at least 55^0 and the gain margin is at least 12 dB. Use Bode plot.	15
	b)	Explain the steps in lag-lead compensator design using frequency domain analysis.	05
Q 4	a)	Design a state variable feedback controller to yeild 5% overshoot and peak time of 0.3 sec for a plant G(s)= 100(S+10)/s(s+3)(s+12) which is represented phase variable form.	15
	b)	Given T(z) = N(Z)/D(Z) where D(Z)= $z^4 + z^3$ -2z+0.5. Use Routh-Hurwitz criterion to find the number of z plane poles of T(z) inside, outside and on the unit circle. Is the system stable.	05
Q 5	a)	Consider a unity feedback system with open loop transfer function G(S)=K/s(s+1)(s+2). Design a suitable lag-lead compensator to acquire Kv=10, phase margin=50^0 and gain margin >=10 dB. Use frequency response analysis.	10
	b)	Design a lag compensator using root locus technique with open loop transfer function G(S)=k/s(s+2)(s+8) to meet damping ratio =0.174. Steady state error to be improved by the factor of 10.	10

Q 6 a) Find the range of gain K to make the system shown in the given figure is stable 10



b) Design the observer of the plant G(S)=(S+4)/(S+1)(S+2)(S+5) which is represented in observer canonical form that will respond 10 times faster. Design specifications are 20.8 % overshoot, 4 sec settling time. 10

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