**(3Hrs)** **Total Marks:-80**

NB
1. Question No.1 is compulsory.
2. Attempt any three questions from remaining.
3. Use semi log paper where necessary.
4. Assume suitable data wherever necessary.

Q.1 Attempt any four questions.
a. Draw bode plot of lag compensator, why it is called as lag compensator? [5]
b. Explain scan cycle of execution in PLC. [5]
c. Explain reverse acting controller. [5]
d. Explain how digital compensator can be designed from s-plane. [5]
e. Explain configuration of observer? [5]
f. How many words are occupied by counter instruction in the counter file? [5]

Q.2
a. Find value of gain K for unity feedback system for transfer function given by $G(s) = \frac{K}{s(s+36)(s+100)}$ for 20% Overshoot. [10]

b.Consider a plant G(s) = 1 /(s(s+3)(s+7) whose state variables are not defined. Design an observer for OCF to yield transient response described by $\zeta$=0.4 and $\omega_n$= 75 rad/sec. [10]

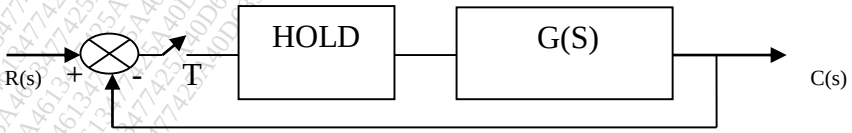
Q. 3
a.Design an integral controller to yield a 10% overshoot and settling time of 0.5 second and zero steady state error for step input for following plant

$$\dot{X} = Ax + Bu \text{ And } Y = Cx$$

$$A = \begin{bmatrix} -2 & 1 \\ 0 & -5 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, C = [1 \quad 1]$$ [10]

b.Prove that the transform of sampled output is the product of the transform of the sampled input and pulse transfer function of the system and thus derive transfer function of the system. [10]

Q.4
a. Explain the integral windup and anti-wind up circuit. [10]
b. For step and ramp input find the steady state error for unity feedback system shown in figure with sampling time interval "T=0.1 seconds" where for $G(S) = \frac{10}{S(S+1)}$. [10]



Q.5

a. Develop a flow chart for a digital compensator defined by

$$G_C(Z) = \frac{X(Z)}{E(Z)} = \frac{Z+0.5}{Z^2-0.5Z+0.7}$$ [10]

b. Explain different input and output field devices of PLC? [10]

Q.6

a. Explain what is three term PID controller. [10]

b. Write short note on any one. [10]

i) Memory unit of PLC.

ii) Arithmetic Instructions of PLC ladder programming.

iii) Counter instructions in PLC ladder programming.

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