

(3 Hours)

Total Marks - 80

N.B.

- i) Question No. 1 is compulsory.
- ii) Attempt any three questions from remaining.
- iii) Assume suitable data (mention the same) and use semi log paper wherever necessary.
- iv) Figures to the right indicate full marks.

Q.1 Attempt any **Four**

- A) What is compensator? Compare lag and lead compensator. [05]
- B) Explain different forms of Industrial PID controllers. [05]
- C) What is an observer? Explain the different types of observer. [05]
- D) Explain the "Tustin transformation" method. [05]
- E) Explain the PLC scan cycle. [05]
- F) Explain the working principle of "Down Counter" of PLC. [05]

Q.2

- A) Find the value of gain "K" for a unity feedback system with a forward transfer function

$$G(s) = \frac{K}{s(s+36)(s+100)}, \text{ for 20\% overshoot} \quad [10]$$

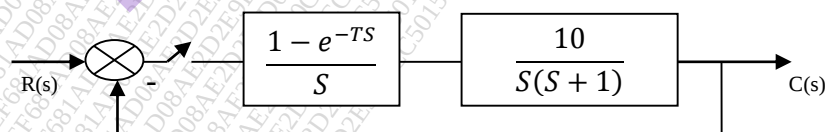
- B) Explain different type of addressing modes used in PLC. [10]

Q.3

- A) Design a controller for "controller canonical form" to yield 15% overshoot & a settling time of 0.5 second. The open loop transfer function of a plant is given by, $G(s) = \frac{10}{s(s+5)(s+10)}$. [10]
- B) Consider a plant $G(s) = \frac{1}{s(s+3)(s+7)}$, whose state variables are not available. Design an observer for "observer canonical form" to yield transient response described by $\xi = 0.4$ and $W_n = 75$ rad/sec. [10]

Q.4

- A) For a unit step, ramp and parabolic input. Find the steady state error for the system shown below, [10]



- B) Given $T(z) = N(z) / D(z)$, where $D(z) = z^3 - z^2 - 0.2z + 0.1$, use the 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? [10]

Q.5

- A) Explain the timer instruction of PLC. And also explain the working principle of “OFF delay timer “ T_{OFF} ” with timing diagram. [10]
- B) Explain the AC input module of PLC. [10]

Q.6

- A) Explain integral windup and anti-windup circuits. [10]
- B) Develop and explain a PLC ladder diagram for direction control of DC motor. [10]
