Registration No.:

6th Semester Regular/Back Examination: 2024-25
SUBJECT: Industrial Automation and Control
BRANCH(S): AEIE, EIE
Time: 3 Hours
Max Marks: 100
Q.Code: S123
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
**The figures in the right hand margin indicate marks.**

Part-I

Q1   Answer the following questions: (2 x 10)

a)   Define open loop and closed loop control system. Give one example from each.

b)   Write the mathematical expression for direct acting proportional controller. What is off-set error in proportional controller?

c)   What is two-position controller? Write one application of it.

d)   What happens to the closed loop stability of a feedback control system when feedforward loop is added?

e)   Why boiler drum level control is critical? What is three element control?

f)   "Ratio control is a special type of feedforward control", Justify the statement.

g)   Draw the diagram of direct acting and reverse acting pneumatic actuator.

h)   Write down one application of control valve. What is the relation between flow rate and pressure drop across control valve?

i)   What is SCAN in PLC operation? Identify different steps in operation of PLC.

j)   What should be the values (high or low) of MTBF and MTTR? Justify your answer.

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 x 8)

a)   Differentiate between open-loop and closed-loop system, taking the example of level control of a tank. Mention control variable, manipulated variable and load variable for the same process.

b)   What do you mean by tuning of a controller? Explain the process reaction curve method of tuning.

c)   Explain multivariable control with one example.

d)   Design and explain a control scheme to control the composition of overhead or bottom product of distillation column.

e)   The temperature of a furnace is to be controlled. The rate of flow of fuel to the furnace is the manipulated variable. Pressure of the fuel is the secondary variable. Draw a cascade control scheme for the system.

f) State the importance of adaptive control. Write the types of adaptive control. Explain any one of them.

g) Explain the operation of tandem cylinders with neat diagram.

h) Describe the communication options in distributed control systems.

i) Develop the ladder diagram for the logic circuit given below and write its corresponding Boolean program.
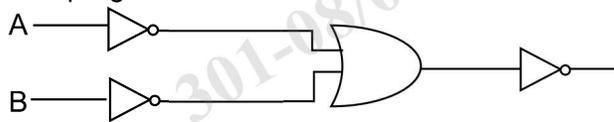

j) Explain in brief the programmable controller architecture that is similar to that of computer architecture.

k) What are the advantages and disadvantages of centralized systems? How the disadvantages are overcome by distributed system?

l) Explain inter task communication in real-time programming briefly.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)   (16 x 2)

Q3   Write down the characteristics of proportional, integral, and derivative controller. A PID   **(16)**
controller has K_P = 2.0, K_I = 2.2 s^{-1}, K_D = 2 s and $p(0)$ = 40%. Plot the controller output for an error given by below figure.
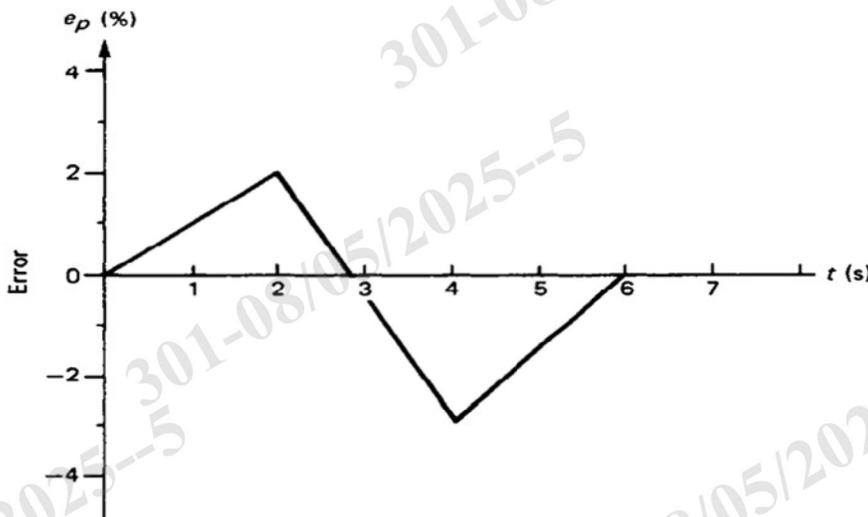
Q4   Compare feedback control with feedforward control. In which situation feedforward   **(16)**
control is preferred over feedback control. Design steady state and dynamic feedforward control for CSTH system.

Q5   Describe different configurations of ratio control. Explain how pH is controlled using End-   **(16)**
point control.

Q6   Compare distributed control system (DCS) with PLC. Explain the architecture and   **(16)**
functional requirements of distributed control system.