Total number of printed pages: **Programme(D/UG/PG)/Semester/ DIE611**

2024

INDUSTRIAL AUTOMATION

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. a) Write the definition of 'Industrial Process'? Write different examples of industrial processes with their types. 2+3

   b) Explain the process signals with respect to a water heating system. 5

   c) Write the steps and explain briefly for making a process into an automated process. 5

   d) With the help of examples define distributed and localized processes. 5

2. a) Briefly discuss the procedure of Data Acquisition System (DAS) in an industry with neat sketch. 10

   b) Find the digital word that results from a 3.127 V input to a 5-bit ADC with a 5 V reference. 5

   c) Draw the physical diagram of a process-control loop related to flow measurement and control. Explain the different components associated with it. 5

3. a) What is PLC? Draw the basic structure of PLC with brief explanation. 5

   b) Write the differences between Relay logic and PLC. 5

   c) What is a timer in PLC? Explain with the help of example. 5

   d) Write the objectives of a PLC controlled automatic bottle filling station. 5

4. a) What is scan time of a PLC? A complex manufacturing operation results in a 30-ms PLC scan time. The PLC must detect individual 2-cm object moving on a high –speed conveyor. Draw the setup for the moving object. 1+4

What is the highest speed of the conveyor to be sure the object is detected?

b) Write the parameters and procedures of instrumentation documentation. 5

c) Define and explain the operation of the three process management system: Unattended, Attended and Automated. 10

5. a) Discuss the following protocols. 2.5 × 4

i) RS-232

ii) HART

iii) Device Net

iv) Modbus

b) What is Ethernet? How does Ethernet work? 1+4

c) Why wireless communication is preferred? Provide some possible application areas of wireless communication technology. 2+3

6. Write short notes on any four of the following 4×5

a) SCADA

b) SAMA diagrams

c) Hierarchical concept of automation

d) DCS

e) OSI model

7. a) Define the Robotic arm terminology: 5 × 2

Link, Joint, Degrees of freedom, Tool centre point, workspace.

b) Write the major application areas of robotic system. 4

c) The links of a 3R robotic arm are $L_1 = 350$ mm, $L_2 = 250$ mm and $L_3 = 50$ mm. The gripper is at world coordinates given as $x = 300$ mm, $z = 400$ mm and $\alpha = 30^\circ$. Determine the angles θ_1, θ_2 and θ_3, which the motor controlling the shoulder, elbow and wrist to be rotated. 6