

BTINC602: Industrial Automation & Control

Unit I

1. Describe the role of Industrial Automation in ensuring overall profitability of a industrial production system. Be specific and answer point wise. Give examples as appropriate.
2. State the main objectives of a modern industry (at least five) and explain the role of automation in helping achieve these.
3. Draw the automation pyramid, identify the Layers and explain levels of automation.
4. Explain major functions of Supervisory Control system.
5. Draw the block diagrammatic structure of an industrial sensor. Explain the function of each block.
6. Draw and explain the functional configuration of a typical actuator system.
7. State the major aspect in which sequence/logic control systems differ from analog control systems.
8. Explain major functions of a Production Control System.
9. Explain with neat sketches, the architecture of industrial automation system.
10. Explain the static characteristics of measurement systems.
11. Explain the dynamic characteristics of measurement systems.
12. State three major functions for each level of the automation pyramid.

Unit II

13. Name the materials commonly used for RTDs. Which one has the most linear characteristics?
14. What is the difference between a NTC thermistor and a PTC thermistor?
15. Define automatic control. Distinguish it from supervisory control. Give an example.
16. Explain temperature measurement system using RTD, thermistor and thermocouple.
17. Explain the flow measurement techniques.
18. Define gage factor of strain gage. What are the strain gage materials normally used? Which one of them is having maximum gage factor?
19. Explain the construction and principle of operation of a Bourdon tube pressure gage.
20. Explain speed measurement techniques. Enlist different methods for measuring level, humidity and pH.
21. Compare the advantages and disadvantages of an orifice meter and a venturimeter.
22. Discuss the main features of an instrumentation amplifier.
23. Define calibration. Explain the estimation of errors in a measurement system.
24. Explain the advantage of using push-pull arrangement in a bridge circuit.
25. Distinguish between gross error and systematic error. Write down two possible sources of systematic error.
26. Explain the term limiting error. In a multiple range instrument it is always advisable to take a reading where the indication is near the full scale: justify.
27. Explain the physical reason behind generation of time delay. Why time delay is not so prevalent in electrical systems? Justify.

Unit III

28. Explain P-I-D control. Explain controller tuning.
29. How does incorporation of derivative action in the controller improve the closed loop performance?
30. Explain the implementation of PID controllers.
31. Explain feed forward and ratio control with neat diagrams.
32. Draw the basic scheme of a Smith Predictor for controlling a process with a transportation lag and explain its principle of operation.
33. Draw and explain the operation of a compensator for compensating the inverse response of a process in a feedback control scheme.
34. Explain override and split range control with neat diagrams.
35. What do you mean by split range control? Show a schematic arrangement of this type of control.
36. Explain in detail selective control.
37. Discuss the advantages and disadvantages of using cascade control.

Unit IV

38. Explain the major elements of a PLC system.
39. Name and explain three of the most prominent advantages of the PLCs over hardwired Relay Contactor Logic.
40. Explain an architecture of PLC with neat block diagram.
41. Explain relay ladder logic sequence control.
42. Explain RLL syntax sequence control.
43. Explain the structured design approach sequence control.
44. Write a short note on hardware environment related to programming sequence control.
45. Describe the major steps in the design of a sequence control program for an industrial control problem.
46. Describe typical Function modules used in PLC systems.
47. Describe the physical organization of hardware in the PLC.
48. State typical components and functionality of the main types of modules in a PLC.
49. Explain construction of ladder diagram with symbols for PLC. Develop a ladder diagram using a simple example.

Unit V

50. What is computer numerical control? Enlist the advantages of a CNC machine.
51. Define Numerical Control and describe its advantages and disadvantages.
52. Name and describe the major components of a CNC system.
53. Explain the control of machine tools and also explain the analysis of a control loop.
54. Name three types of control valves and sketch their ideal flow characteristics.
55. Explain the basic principle of operation of a pneumatically actuated control valve with neat sketch.

56. Discuss the construction, advantages and disadvantages of a double-seated control valve.
57. Sketch and explain the shapes of the plugs for three different types of control valves.
58. Define the term range ability of a control valve. Why is the property important?
59. Explain hydraulic actuator system with its principle. What are the advantages of hydraulic actuation systems? Enlist components of hydraulic actuation systems.
60. Draw the graphical symbols used to depict typical hydraulic system components.
61. Write a short note on the constructional and functional aspects of hydraulic pumps and motors.
62. Explain the various types of hydrostatic or positive displacement pumps used in hydraulic systems.
63. Write a short note on proportional and servo valves.

Unit VI

64. Explain with a neat sketch the principle of operation of a flapper nozzle amplifier.
 65. Explain the construction and working principle of a direct acting type pneumatic valve positioner. What are the limitations of this type of positioners?
 66. Sketch and explain the working principle of a pneumatic torque balance transducer.
 67. Sketch and explain the schematic arrangement of a pneumatic proportional controller and draw the closed loop block diagram.
 68. Explain with neat sketches, any four components of hydraulic actuation systems.
 69. Explain with neat schematic arrangement, a pneumatic proportional controller. Define the fieldbus. What is the fieldbus communication protocol?
 70. Write a short note on controllers and integrated pneumatic control systems.
 71. Explain production control systems.
 72. Explain the networking of sensors, actuators and controllers for pneumatic control systems.
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