Government Polytechnic Chapra

**Sub- Industrial Automation (2000505F)**

1. What is Industry 4.0, and how does it differ from previous industrial revolutions?

2. Explain the concept of the Internet of Things (IoT) in the context of Industry 4.0.

3. How does Industry 4.0 impact traditional manufacturing processes and supply chain management?

4. What role does artificial intelligence play in the evolution of Industry 4.0?

5. Discuss the significance of data analytics and big data in the context of Industry 4.0.

6. Differentiate between industrial automation and Industry 4.0-driven smart manufacturing.

7. How do cyber-physical systems contribute to the implementation of Industry 4.0?

8. Explore the concept of a digital twin and its applications in Industry 4.0.

9. Compare and contrast centralized and decentralized automation architectures.

10. Explain the role of robotics in the context of Industry 4.0 and smart factories.

11. What are the key components of a Supervisory Control and Data Acquisition (SCADA) system in industrial automation?

12. Describe the principles of Programmable Logic Controllers (PLCs) and their use in automation.

13. Discuss the advantages and challenges of implementing cloud computing in industrial automation.

14. Explore the concept of Human-Machine Collaboration (HMC) in the context of Industry 4.0.

15. What is a Programmable Logic Controller (PLC), and what role does it play in industrial automation?

16. Explain the basic components and architecture of a PLC system.

17. How do PLCs differ from traditional relay control systems in industrial applications?

18. Discuss the programming languages commonly used in PLC programming and their respective applications.

19. What are the key advantages of using PLCs in industrial automation processes?

20. Describe the importance of input and output modules in a PLC system.

21. How does ladder logic programming contribute to the ease of use and understanding of PLC programs?

22. Explore the concept of scan cycle in PLC operation and its significance in real-time control.

23. Discuss the role of PLCs in process control and how they are utilized in different industries.

24. What is the primary function of a sensor in the context of electronic systems?

25. Differentiate between analog and digital sensors, providing examples of each.

26. Explain the concept of sensitivity in relation to sensors and its importance in accurate measurements.

27. How do proximity sensors work, and what are their applications in industrial settings?

28. Discuss the role of temperature sensors in various industries and their different types.

29. What are the key features and applications of photoelectric sensors?

30. Explain the working mechanism of a pressure sensor and its use in industrial and automotive applications.

31. How do ultrasonic sensors function, and what are their advantages in distance measurement?

32. Describe the function of a strain gauge and its applications in load and force measurements.

33. What role do humidity sensors play in controlling environmental conditions in industries and homes?

34. What is the primary purpose of an actuator in the context of automation systems?

35. Differentiate between linear and rotary actuators, providing examples of each.

36. Explain the role of electric actuators in industrial applications and robotics.

37. How do hydraulic actuators work, and what are their advantages in heavy-duty applications?

38. Discuss the working principle of pneumatic actuators and their common uses in automation.

39. What are the key considerations in selecting an actuator for a specific application?

40. Describe the function of a piezoelectric actuator and its applications in precision positioning.

41. How do electromechanical actuators contribute to the development of mechatronic systems?

42. Discuss the advantages and disadvantages of using solenoid actuators in various devices.

43. Explain the importance of feedback systems in closed-loop control of actuators.

44. What role do thermal actuators play in temperature control and regulation?

45. Explore the applications of electroactive polymers as soft actuators in robotics.

46. Discuss the challenges and advancements in the field of microactuators and nanotechnology.

47. How are magnetic actuators utilized in the design of miniature and efficient systems?

48. What is a control system, and how does it differ from an open-loop system?

49. Explain the basic components of a feedback control system.

50. What is the role of a sensor in a control system, and how does it contribute to feedback?

51. Define PID control and describe how it combines proportional, integral, and derivative actions.

52. How does a proportional controller contribute to the overall response of a system in PID control?

53. Explain the concept of integral action in PID control and its significance in system stability.

54. What role does the derivative action play in a PID controller, and how does it affect system performance?

55. Describe the advantages and disadvantages of using a PID controller in a control system.

56. How is the steady-state error in a control system defined, and how can a PID controller help minimize it?

57. What is the significance of tuning a PID controller, and what factors influence the tuning process?

58. Explain the difference between open-loop and closed-loop transfer functions in control systems.

59. How does the concept of stability relate to control systems, and what methods are used to analyze stability?

60. Discuss the impact of a disturbance on a control system and how PID control helps mitigate disturbances.