

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH. DEGREE EXAMINATION (R,S), DECEMBER 2023

ROBOTICS AND AUTOMATION

(2020 SCHEME)

Course Code : 20RBT305

Course Name: Industrial Automation

Max. Marks : 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. What are the methods adopted to group parts into part families?
2. What are fixed, flexible and programmable types of automation?
3. Give any two situations when pneumatic actuators are preferred over its hydraulic counterpart.
4. Why is it required for sensors to be calibrated?
5. Briefly explain the carousel type of storage system.
6. What is meant by adaptive control systems?
7. List the different actuation mechanisms in DCVs.
8. Sketch the ISO symbols of
 - a. Double pilot operated 5/2 directional control valve
 - b. Regulator
 - c. Shuttle valve
9. Sketch the ladder diagram for the following logic functions
 - a. AND
 - b. OR
 - c. NOT
10. What is the significance of internal relays in PLC?

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Explain different types of FMS layouts. (6)
- b) With neat sketch, explain different types of automated transfer lines used in an industry. (8)

OR

12. a) A production line has 20-station transfer line to machine a certain component if the line takes 1.2 minutes to manufacture one piece at 100% efficiency and the average probability of station breakdowns (8)

per cycle per machine (assumed probability of breakdown is equal for all machines) is equal for all stations: $p = 0.005$ breakdowns/cycle. It is also estimated that the average downtime per line stop will be 8.0 min. Calculate

- (a) Average production rate R_p (pieces per hour) and
 (b) Line efficiency E .
- b) What are the different types of tests used for testing flexibility in FMS systems? (6)

MODULE II

13. a) Differentiate between incremental and absolute type optical encoder with neat diagrams. What is the advantage of using an absolute type encoder? (8)
 b) Explain the working of an inductive type proximity sensor. (6)

OR

14. a) Explain the operation of a hydraulic actuator system using a neat diagram. (6)
 b) With a neat sketch and mathematical equations explain the working of synchros and resolver. (8)

MODULE III

15. a) What are the differences between automated guided vehicles (AGV) and autonomous mobile robots (AMR) used in warehouses? (8)
 b) Explain the adaptive control technology used in automatic machine tool changer in a CNC machine. (6)

OR

16. a) Describe any three technologies used in automated guided vehicles systems used in industry. (7)
 b) With neat sketches explain any three types of conveyors used in industry. (7)

MODULE IV

17. a) Explain the design considerations of proportional control valve. (6)
 b) Design a pneumatic circuit for A+B+B-A- sequencing operation with relevant diagrams. (8)

OR

18. a) With a neat sketch explain any 3 types of pressure relief valves. (6)
 b) With neat sketches explain any two basic electrical devices used in electro pneumatic control. (8)

MODULE V

19. a) A simple lamp is required to be switched on if a pump is running and the tank is not full or if the lamp test switch is on. Draw the digital (7)

logic diagram using gates and the corresponding PLC ladder diagram.

- b) Draw a PLC ladder diagram to implement the sequence A+B+A-B-. (7)

OR

20. a) Two motors are to be operated in a sequence. The second motor starts 120 seconds after the first motor starts using a push switch. Also a stop push button switch needs to be used for stopping the motors. Draw a PLC ladder diagram for implementing the logic. (8)
- b) Describe On-delay timer and Off-delay timer with suitable figures. (6)
