Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (R, S) Examination November 2024 (2019 Scheme)

Course Code: RAT 305

Course Name: INDUSTRIAL AUTOMATION

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		Differentiate between mechanization and automation.	(3)
2		Explain fixed automation stating two applications.	(3)
3		Explain the use of variation in capacitance in finding the position of an object.	(3)
4		Explain working principle of encoders.	(3)
5		Explain the importance of preloading in ball screw based linear drives.	(3)
6		State any three design considerations required for material handling.	(3)
7		Explain the three main types of control valves.	(3)
8		Define the role of solenoid in electro-pneumatics/electro-hydraulics.	(3)
9		State the role of PLC in automation with an application.	(3)
10		Illustrate the ladder diagram for the expression Y= AB+CD.	(3)

PART B

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

Module -1

11	a)	An automated transfer line has 20 stations and an ideal cycle time of 1.0 min. Probability of a station failure is p=0.01, and the average downtime when a breakdown occurs is 10 min. Determine (a) average production rate Rp and (b) line efficiency E.	(6)
	b)	With a neat sketch explain the automation pyramid and the architecture of elements.	(8)
12	a)	Explain production flow analysis and steps involved in a production flow analysis.	(8)
	b)	Explain group technology and the main benefits of group technology.	(6)

Module -2

13	a)	Explain the construction and working of impedance type gauging transducer.	(8)
	b)	Compare absolute encoder and incremental encoder.	(6)

14 a) With a neat figure explain the sensor systems for automated inspection. (6)

b) Compare the advantages and disadvantages of both hydraulic system and pneumatic system. (8)

Module -3

15 a) With neat figures compare the working of Brushed DC motor and Brushless DC motor. (8)

b) Describe the concept of ASRS storage systems. (6)

16 a) Explain the CNC machine system with suitable block diagram (8)

b) What is the function of material transport system and explain the role of industrial trucks used in material transport system (6)

Module -4

17 a) Illustrate the hydraulic circuit to operate a double-acting actuator such that the forward and backward motions can be controlled. (8)

b) Explain the need to use a pressure relief valve in hydraulic circuits. (6)

18 a) Explain the construction and working of a spool valve. (5)

b) A pneumatic circuit is to be designed for the following sequence: (9)

(i) Clamping a job and maintaining its position with clamping.

(ii) Moving the tool for machining

(iii) Returning the tool

(iv) Unclamping the job

Implement above using Karnaugh-Veitch method.

Module -5

19 a) (10)

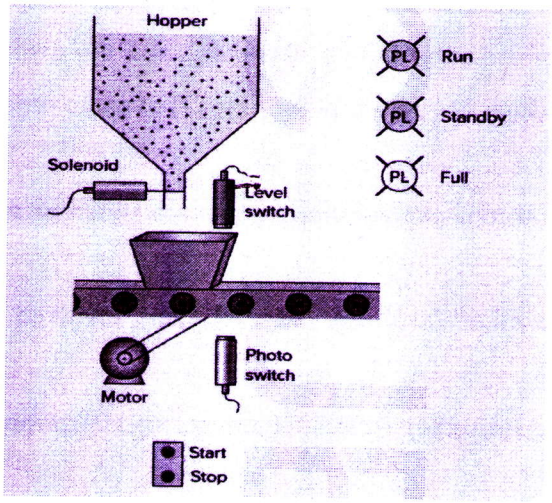

Figure above shows the sketch of a continuous filling operation. This process requires that boxes moving on a conveyor be automatically positioned and filled. The sequence of operation for the continuous filling operation is as follows:

- Start the conveyor when the start button is momentarily pressed.
- Stop the conveyor when the stop button is momentarily pressed.
- Energize the run status light when the process is operating.
- Energize the standby status light when the process is stopped.
- Stop the conveyor when the right edge of the box is first sensed by the photosensor.
- With the box in position and the conveyor stopped, open the solenoid valve, and allow the box to fill. Filling should stop when the level sensor goes true.
- Energize the full light when the box is full. The full light should remain energized until the box is moved clear of the photosensor.

Implement the above process using PLC ladder programming.

b) Differentiate between relays and contactors. (4)

20 a) Explain the working principle of VFD (Variable Frequency Drive) and its application in industrial automation. (8)

b) Explain different types of counters used in PLC. (6)

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