Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2022 (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	Explain about computer-integrated manufacturing	3
2	Write a short note on flexible assembly automation.	3
3	Explain the construction and working of encoders	3
4	Describe the use of electrical actuators in industrial automation	3
5	Differentiate between storage capacity and storage density with reference to performance of storage systems.	3
6	Describe the need for automated tool changers	3
7	Explain the different actuation mechanisms in DCVs	3
8	Draw the ISO symbols of the shuttle valve and pressure relief valve	3
9	Draw the ladder diagram for the following logic functions.	3

         (i)   XOR gate

         (ii)   NAND gate

         (iii)   NOT gate

10	Explain the internal diagram of VFD	3

PART B

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

Module -1

11	a)	Explain different types of FMS layout	8
	b)	Describe the following types of automated flow lines	6

         (i)   Segmented in-line type

         (ii)   Carousel assembly

12	a)	An automated transfer line has 30 stations and an ideal cycle time of 2.0 min. The probability of a station failure is p=0.02, and the average downtime when a	6

breakdown occurs is 15 min. Determine (a) average production rate Rp and (b) line efficiency E.

b) Explain the different tests of flexibility applied to manufacturing systems. 8

Module -2

13 a) Compare the construction and working of linear potentiometer and rotary potentiometer with appropriate sketches. 8

b) Explain how variation in capacitance can be employed for finding the position of an object. 6

14 a) With neat sketches explain the working of 8

    (i)   Photoelectric sensors

    (ii)   Thermoelectric sensors

b) Explain the image processing and analysis in the operation of a machine vision system. 6

Module -3

15 a) Sketch and explain the working of a servomotor 7

b) Explain the effect of preloading and characteristics of ball screw based linear devices. 7

16 a) Describe the various technologies used in commercial AGV systems for automated material handling. 7

b) With neat sketches explain adaptive control of machine tools. 7

Module -4

17 a) In a press shop, a stamping operation is to be performed using a stamping machine. The workpiece has to be first clamped under the stamping station. Then the stamping tool gets into position and performs the stamping operation. The workpiece must be unclamped only after the operation is completed. Design the cylinder sequence for above application using cascade method. 8

b) Explain the different types of flow control valves with necessary diagrams. 6

18 a) Design an electropneumatic circuit for a double acting cylinder to perform continuous to and fro motion. The cylinder has to stop automatically after performing 50 cycles operation. 8

b) Compare the construction and working of a single acting cylinder and a double acting cylinder. 6

Module -5

19 a) A pump is to be used to fill two storage tanks. The pump is manually started by   8
the operator from a start/stop station. When the first tank is full, the control logic
must be able to automatically stop flow to the first tank and direct flow to the
second tank through the use of sensors and electric solenoid valves. When the
second tank is full, the pump must shut down automatically. Develop a ladder
diagram to process the sequence.

   b) With the help of a neat block diagram explain PLC architecture.   6

20 a) Design a ladder logic for a box wrapping system with the following sequence of   8
operations:

      (i) Start and Stop pushbutton is used to start and stop the system

      (ii) The presence of a box is determined by the optical sensor (P). After
this, the conveyor (C) stops and the box is clamped in place (H).

      (iii) A wrapping machine (W) is turned ON for 20seconds.

      (iv) A sticker cylinder (S) is turned ON for 7 seconds to put the sticker on
the box.

      (v) The clamp (H) is turned OFF and the conveyor C is turned ON.

And the process repeats

   b) Describe in detail about timers and counters in PLC   6

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