

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S5 (S,FE) Examinations June 2026 (2019 Scheme)



Course Code: RAT305

Course Name: INDUSTRIAL AUTOMATION

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

Marks

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| 1 | Explain the concept of Group technology and part family. | 3 |
| 2 | Write a short note on flexible assembly automation. | 3 |
| 3 | Compare the working of an electromechanical limit switch with a proximity sensor. | 3 |
| 4 | Define the following sensor performance parameters
(i) Accuracy
(ii) Resolution
(iii) Stability | 3 |
| 5 | Explain the construction and working principle of a servomotor. | 3 |
| 6 | State any three technologies used in commercial AGV systems for vehicle guidance. | 3 |
| 7 | Explain the construction and working of a spool valve. | 3 |
| 8 | Illustrate the electro-pneumatic circuit for the extension stroke in indirect control of a double acting cylinder using a 5/2-way solenoid operated DCV. | 3 |
| 9 | Explain the advantages of PLCs over electromechanical relays. | 3 |
| 10 | Differentiate between PLC on-delay timers and PLC off-delay timers. | 3 |

PART B

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

Module -1

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|----|---|---|
| 11 | a) Describe different types of FMS layouts with neat sketches. | 8 |
| | b) Explain the different tests of flexibility applied to manufacturing systems. | 6 |
| 12 | a) A 30 station Transfer line is being proposed to machine a certain component currently produced by conventional methods. The proposal received from the | 8 |

machine tool builder states that the line will operate at a production rate of 100 pc/hr at 100% efficiency. From a similar transfer line, it is estimated that breakdowns of all types will occur at a frequency of $F = 0.20$ breakdowns per cycle & that the average downtime per line stop will be 8.0 minutes. The starting blank that is machined on the line costs Rs. 5.00 per part. The line operates at a cost for 100 parts each & the average cost per tool = Rs. 20 per cutting edge.

Determine the following: 1. Production rate 2. Line efficiency 3. Cost per unit piece produced on the line

b) Describe the following types of automated flow lines

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| (i) | Segmented in-line type | 6 |
| (ii) | Carousel assembly | |

Module -2

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| 13 | a) | Compare the construction and working of linear potentiometer and rotary potentiometer with appropriate sketches. | 8 |
| | b) | Explain the basic components of a hydraulic system with the help of a block diagram. | 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

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|----|----|--|---|
| 15 | a) | Explain the effect of preloading and characteristics of ball screw based linear devices. | 7 |
| | b) | Describe the various parameters used to assess the performance of a storage system. | 7 |
| 16 | a) | Explain the different types of conveyors used for automated material handling. | 9 |
| | b) | Explain the different technologies used for automatic part identification. | 5 |

Module -4

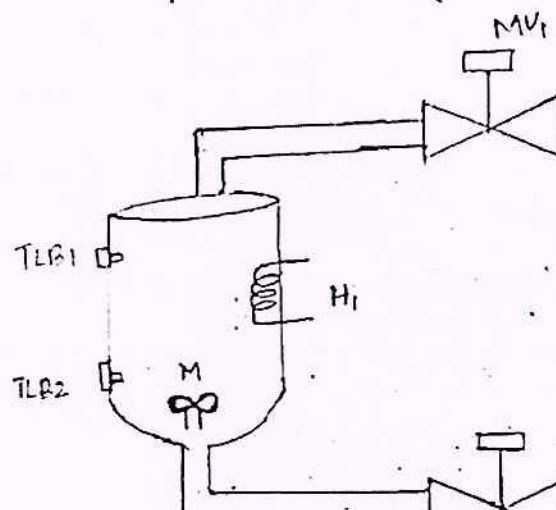
- | | | | |
|----|----|---|---|
| 17 | a) | In a press shop, a stamping operation is to be performed using a stamping machine. The workpiece has to be first clamped under the stamping station. Then the stamping tool gets into position and performs the stamping operation. The | 8 |
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workpiece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

- b) Explain the different actuation mechanisms used in directional control valves. 6
- 18 a) Explain the different types of flow control valves with necessary diagrams. 6
- b) Compare the construction and working of a single acting cylinder and a double acting cylinder. 8

Module -5

- 19 a) What is a counter? Explain the Up counter and Down counter with its symbols used in the ladder diagram. 6
- b) Design ladder logic for an automatic tank mixing system with following conditions: 8
- The tank circuit has one inlet and one outlet.
 - Allow the tank to fill by opening Mixing Valve1 (MV1), and as liquid reaches TLB1(level1 sensor), the MV1 has to be closed.
 - Heat the liquid and mix the liquid using Heater (H) and Mixer (M) for 10s.
 - After 10s the liquid has to be expelled from the tank by opening Mixing Valve2(MV2).
 - As liquid reaches TLB2(level2 sensor), MV2 has to be closed and again start to fill the tank using MV1 and the process continues.



- 20 a) Components are to be stamped using a stamping machine. A double acting cylinder is used to push the die attached down to a fixture one second after the push button is pressed. The die is to return to the initial position upon reaching sufficient stamping time of two seconds. This automatic cycle should stop after 7

5 cycles. Start button should reset the counter. Develop an electropneumatic control circuit to implement the control task for the stamping operation.

b) Design a ladder logic for a box wrapping system with the following sequence of 7 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.
- (vi) And the process repeats
