

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh semester B.Tech examinations (S), September 2020

Course Code: ME407**Course Name: MECHATRONICS**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer any three full questions, each carries 10 marks.*

Marks

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|---|---|-----|
| 1 | a) Define the following sensor characteristics (i) Time constant (ii) Hysteresis | (4) |
| | b) Explain the principle of Hall effect. How a proximity sensor works on the basis of Hall effect? | (6) |
| 2 | a) Illustrate the working principle of incremental and absolute rotary encoders. | (7) |
| | b) Compare binary and grey code encoders | (3) |
| 3 | a) With a neat sketch explain the working of diaphragm operated process control valve | (5) |
| | b) Explain the working of any one type of rotary actuator with a neat sketch | (5) |
| 4 | a) Distinguish between pilot operated and direct operated DCVs | (3) |
| | b) A double acting cylinder is to be advanced either by operating a push button or by a foot pedal. Once the cylinder is fully advanced, it is to be retracted to its initial position. A 3/2-way roller lever valve is to be used to detect the full extension of the cylinder. Design a pneumatic circuit for this application. | (7) |

PART B*Answer any three full questions, each carries 10 marks.*

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| 5 | a) Distinguish between bulk micromachining and surface micromachining with sketches | (5) |
| | b) Illustrate the sequence of operations in LIGA process with neat sketches | (5) |
| 6 | a) Distinguish between wet chemical etching and dry plasma etching. What are the advantages of dry plasma etching over wet chemical etching | (5) |
| | b) Explain the fabrication of MEMS based pressure sensor | (5) |
| 7 | a) Explain the mechanism of recirculating ball screw with neat sketch. How backlash can be avoided? What are the advantages of recirculating ball screw? | (10) |
| 8 | a) What is latching? Draw a simple latched circuit | (2) |

- b) Consider a pneumatic system with single-solenoid controlled valves and involving two cylinders A and B, with limit switches a-, a+, b-, b+ detecting the limits of the piston rod movements. Design a ladder programme with the requirement being when the start switch is triggered, the sequence A+, B+, A-, 10s time delay, B- occurs and stop at that point until the start switch is triggered again. (8)

PART C

Answer any four full questions, each carries 10 marks.

- 9 a) Write down the describing equations of basic mechanical building blocks. (3)
b) Derive the mathematical model for a quarter car suspension system (7)
- 10 a) Illustrate the working of harmonic drive with neat sketches. List out its applications (8)
b) What are the advantages of harmonic drive? (2)
- 11 a) Explain the working of piezoelectric type tactile sensor (4)
b) Explain the constructional features and working of brushless DC motor (6)
- 12 Illustrate the working of Vidicon camera and CCD with neat sketches (10)
- 13 a) Explain how thresholding is used for segmentation in industrial vision applications? (7)
b) Illustrate the histogram processing technique for enhancing the image contrast (3)
- 14 With the help of a neat sketch explain the different mechatronics modules used in automatic car park barrier system (10)
