

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

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

Max. Marks: 100

Duration: 3 Hours

**PART A**

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

- |   |                                                                                                                                                                                  | Marks |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1 | a) Compare the working of resolver and synchro.                                                                                                                                  | (6)   |
|   | b) Suggest two applications of Hall effect sensor in mechatronic systems.                                                                                                        | (2)   |
|   | c) Describe the terms hysteresis error and non-linearity error.                                                                                                                  | (2)   |
| 2 | a) Differentiate between absolute and incremental encoders                                                                                                                       | (2)   |
|   | b) Explain the working of an optical absolute encoder. How the number of tracks and sectors of absolute encoder is related to the resolution of the encoder?                     | (5)   |
|   | c) Draw the encoder wheel layout of a grey coded absolute encoder with 45degree resolution                                                                                       | (3)   |
| 3 | a) Explain the working of a double acting hydraulic actuator                                                                                                                     | (4)   |
|   | b) Why cushioning is necessary for pneumatic actuators                                                                                                                           | (2)   |
|   | c) Explain how cushioning is achieved in pneumatic actuators with a sketch.                                                                                                      | (4)   |
| 4 | a) What is a 4/3 way valve? When is it used in place of 4/2 way valves                                                                                                           | (4)   |
|   | b) Design a hydraulic circuit to operate a winch fitted with a hydraulic motor. The motor should be run clockwise, counter clockwise and stopped. Use a manually operated valve. | (6)   |

**PART B**

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

- |   |                                                                                                                                                         |      |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 5 | a) List any 2 controlling factors in wet etching.                                                                                                       | (2)  |
|   | b) Differentiate between immersion etching and spray etching.                                                                                           | (2)  |
|   | c) Describe the dry etching process in MEMS micromachining                                                                                              | (6)  |
| 6 | Explain the LIGA process in MEMS fabrication with neat sketches.                                                                                        | (10) |
| 7 | a) Mention any 2 functions of guide ways in machine tools.                                                                                              | (2)  |
|   | b) Comment on the stick-slip phenomenon associated with friction guide ways.                                                                            | (2)  |
|   | c) Explain the working of LM guide ways                                                                                                                 | (6)  |
| 8 | Develop a PLC ladder program for the following sequence: Start a motor with push switch, and then after a delay of 90s, start a pump. When the motor is | (10) |

switched off, the pump will get switched off after a delay of 5s. Mention the logic used for each rung in the program to substantiate your answer.

### PART C

*Answer any four full questions, each carries 10 marks.*

- 9 a) Draw a schematic of a magneto-resistive tactile sensor and list any *three* features of the sensor. (5)
- b) List any four techniques to measure an unknown force. (2)
- c) Draw the sketch of the basic configuration of a laser-based triangulation range finder. (3)
- 10 a) With a block diagram, illustrate the elements of a control system. (3)
- b) List three types of models and give an example each. (3)
- c) Draw a block diagram of a feedback control system. (4)
- 11 a) Draw a flowchart and discuss the steps in frequency domain analysis. (5)
- b) Draw the response curve for an under-damped system. (2)
- c) A stepper motor is to be used to drive a linear axis of a mechatronic system. The motor output shaft is connected to a screw thread with a 30 mm pitch. It is desired to control each axis at 0.5 mm. What is the corresponding step angle? (3)
- 12 a) Draw the schematic diagram of a machine vision system. (4)
- b) List the steps in thresholding technique in image processing. (4)
- c) Write a short note on the applications of vision sensors. (2)
- 13 a) With a neat sketch, explain the physical system and working of a pick and place robot. (6)
- b) List any *four* applications of robotic vision systems. (2)
- c) Draw sketches to discuss any *two* objectives of image segmentation. (2)
- 14 a) With a flowchart, explain the steps in building of a smart system for automatic car park barrier system. (6)
- b) List any *two* advantages of charge injection device camera for machine vision applications. (2)
- c) With a sketch, discuss 'equalization' method in histogram processing. (2)

\*\*\*\*