

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.

| | | |
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| 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)
