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, starta 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)

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