Reg No.:_____ Name:_____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S8 (R, S) / S6 (PT) (R, S) Examination May 2024 (2019 scheme)

Course Code: MET402

Course Name: MECHATRONICS

Duration: 3 Hours

Max. Marks: 100

PART A

Answer all questions, each carries 3 marks. Marks

1		Identify and explain the working of a type of sensor that can be used for determining the angular movement of a shaft.	(3)
2		Describe the terms hysteresis error and non-linearity error.	(3)
3		Explain how cushioning is achieved in pneumatic actuators.	(3)
4		Illustrate the use of sacrificial layer in MEMS fabrication.	(3)
5		Distinguish between positive and negative photoresist. Include sketches.	(3)
6		Describe the stick-slip phenomenon associated with friction guide ways.	(3)
7		Differentiate between an open loop and closed loop control system.	(3)
8		Explain the use of timers in PLC programming with an example.	(3)
9		List any two requirements of an ideal range finder.	(3)
10		List any four applications of robotic vision systems.	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	Explain the working of incremental and absolute optical encoders and why Gray-code is used in coding absolute encoders.	(8)
	b)	Explain the working principle and applications of thermistor.	(6)

OR

12	a)	List and explain any seven static characteristics of sensors.	(14)

Module II

13 a) Develop a pneumatic circuit with standard symbols to operate two cylinders (A&B) in sequence A+B+A-B-. Explain its working. (8)

b) Explain the configuration of a hydraulic actuation system with block diagram. (6)

OR

14 a) Illustrate the sequence of operations in a LIGA process with neat sketches. (8)

b) Explain the configuration of a pneumatic actuation system with block diagram. (6)

Module III

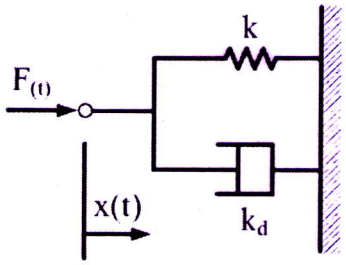
15 a) What is the purpose of preloading in ball screws? Using neat sketches explain any two preloading techniques for ball screws. (8)

b) Explain the salient features of hydrostatic and hydrodynamic bearing. (6)

OR

16 a) What are the basic building blocks of an Electrical system? Obtain their describing equations. (8)

b) Explain the mathematical modelling for the mechanical system shown. (6)



Module IV

17 a) 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 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. (8)

b) Construct a simple electrical system consisting of all the basic building blocks and obtain the differential equation of the system. (6)

OR

18 a) In a car park system, a horizontal bar barrier is to be lifted to vertical position when a vehicle reaches nearby and pay the parking fees. The barrier remains in vertical position for 10 seconds to allow the vehicle to pass and comes back to horizontal position. This sequence is to be repeated for every vehicle. The (8)

position of barrier is to be sensed by proximity sensor and its movement is controlled by a pneumatic circuit. Develop a PLC ladder program for the sequence and pneumatic circuit for the actuation

b) Explain the physical system and working of a pick and place robot with neat sketch. (6)

Module V

19 a) Bring out the working principles of Triangulation method and elapsed time method used in range finders. (8)

b) Explain the constructional features and working of brushless DC motor. (6)

OR

20 a) Explain the working of (i) ultrasonic range finders and (ii) light-based range finders (8)

b) Explain the different histogram processing techniques in image processing. (6)

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