Q. Code:514533

Reg. No. | | | | | | | | | | | | | |

M.E / M.TECH. DEGREE EXAMINATIONS, MAY 2024

Second Semester

IR22201 – SENSORS, ELECTRICAL ACTUATORS AND DRIVES

(Mechanical Engineering)

(Regulation 2022)

TIME: 2 HOURS **MAX. MARKS: 60**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students will be able to identify proximity and displacement sensors and apply the same for automation.	**3**
CO 2	To understand and practice on different sensors and apply them for measuring parameters like pressure, force and temperature.	**1**
CO 3	Acquire the knowledge of signal conditioning and data acquisition.	**2**
CO 4	Graduates will able to select the suitable electrical actuators for the industrial automation.	**3**
CO 5	Acquire knowledge on selection of electrical drives for the specific actuators.	**2**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Enumerate the static and dynamic characteristics which describes the system performance.	**1**	**2**
2.	Identify a sensor which can be used as a fan speed regulator.	**1**	**2**
3.	Interpret the significance of NTC and PTC materials in temperature measurement.	**2**	**2**
4.	Differentiate between tactile and proximity sensors. Give few examples for each type.	**2**	**4**
5.	Compare the characteristics and performance specifications of different operational amplifiers commonly used in signal conditioning circuits.	**3**	**4**
6.	Design a flowchart showing the conversion of physical phenomena into digital data for processing in data acquisition process.	**3**	**3**
7.	Describe the basic working principle of a stepper motor and provide an example of a situation where stepper motors are preferred over other types.	**4**	**3**
8.	Establish the relationship between speed and torque in an AC motor and its significance in various applications.	**4**	**4**
9.	Interpret the concept of speed control in DC motors using an H-bridge under PWM mode.	**5**	**2**
10.	Outline the basic operation of brushless DC (BLDC) motors and the role of controllers	**5**	**2**

in their operation.

PART- B (3 x 10 = 30 Marks)

		Marks	CO	RBT LEVEL
11. (a)	In a robotic assembly line that employs the use of Inductive Proximity Sensors, an error has been identified that causes mispositioning of the robotic arm. One hypothesis suggests this could be due to inappropriate sensor alignment. Discuss a structured approach through which you would assess this hypothesis.	**(10)**	**1`**	**3**
	(OR)			
(b)	If you have been appointed to implement an Ultrasonic sensor in a self-driving automobile, what are the key specifications you would focus on and why?	**(10)**	**1**	**3**
12. (a)	A bellows pressure transducer is being used in a fluid processing plant. The recorded readings appear inconsistent, despite the unchanged fluid pressure conditions. What logical steps would you propose to detect the source of error?	**(10)**	**2**	**4**
	(OR)			
(b)	An industrial plant is set with different types of temperature sensors. Explain the working principles of any two types of temperature sensors used for industrial purposes with their corresponding applications.	**(10)**	**2**	**4**
13. (a)	Evaluate the design and optimization strategies for implementing a high-precision instrumentation amplifier in mechanical signal processing applications.	**(10)**	**3**	**5**
	(OR)			
(b)	Analyze the factors influencing the selection of an operational amplifier for a specific signal conditioning application, considering parameters such as bandwidth, slew rate, and noise performance.	**(10)**	**3**	**5**

PART- C (1 x 10 = 10 Marks)

(Q.No.14 is compulsory)

		Marks	CO	RBT LEVEL
14.	Evaluate the optimal selection strategy for motors (DC, AC, stepper) and actuators (piezoelectric, linear, hybrid) in industrial applications, considering performance metrics such as speed control, torque requirements, precision positioning, and energy efficiency.	**(10)**	4	**5**

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