Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code:3161008 Date:28-05-2025

Subject Name:Sensors and Transducers

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	How the performance of any sensor is measured?	**03**
	(b)	Define following: 1 .Settling time 2.Fidelity 3. Hysteresis 4.Linerarity	**04**
	(c)	List down different types calibration techniques for sensors. Explain any one of them.	**07**
Q.2	**(a)**	Write advantages and disadvantages of Thermocouple.	**03**
	(b)	What is thermistor and how it works?	**04**
	(c)	Explain the principle of operations of RVDT with the help of neat sketch and characteristics.	**07**
		OR	
	(c)	Potentiometer can be used as motion sensor – Justify the statement.	**07**
Q.3	**(a)**	List out applications of the RF beacons.	**03**
	(b)	Define Hall effect and justify the applications of it.	**04**
	(c)	What are the different types of magnetic sensors? On what principles do they work? Outline briefly.	**07**
		OR	
Q.3	**(a)**	State the basic concept of an electrical resistance strain gauge.	**03**
	(b)	Write down the advantages of magnetic sensors.	**04**
	(c)	Show the constructional and functional details of photo conductive cell with the relevant laws and diagrams.	**07**
Q.4	**(a)**	Explain the principle of ultrasonic Flow meter.	**03**
	(b)	List the properties of piezoelectric crystals.	**04**
	(c)	What is gyroscope? Explain the principle of operation and properties of it with relevant diagrams.	**07**
		OR	
Q.4	**(a)**	What is meant by signal conditioning and why it is required?	**03**
	(b)	List down the applications of attenuators, amplifiers and passive filters in signal conditioning.	**04**
	(c)	Elaborate an Instrumentation amplifier with neat diagram and estimate its gain.	**07**
Q.5	**(a)**	Compare MEMS sensors and Nano Sensors.	**03**
	(b)	Explain the working principle of LASER sensor.	**04**
	(c)	Draw and explain sample and hold circuit	**07**
		OR	
Q.5	**(a)**	List down the features and applications of inclinometers.	**03**
	(b)	Describe the operation of Weighted Resistor DAC.	**04**
	(c)	Explain any one type of ADC with neat diagram.	**07**

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3161008 Date:22-05-2024

Subject Name:Sensors and Transducers

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define: (1) Precision (2) Drift (3) Range/Span.	**03**
	(b)	Define: (1) Speed of Response (2) Fidelity (3) Lag (4) Dynamic Error.	**04**
	(c)	Write down types of Errors and explain any two errors in detail.	**07**
Q.2	**(a)**	Write any three applications of LVDT.	**03**
	(b)	Write a short note on Thermocouple.	**04**
	(c)	Compare RTD and thermocouple in detail.	**07**
		OR	
	(c)	Describe the construction and working of LVDT.	**07**
Q.3	**(a)**	Write down limitations of Wheatstone bridge.	**03**
	(b)	Compare MEMS Sensors and Nano Sensors.	**04**
	(c)	Discuss working of Maxwell's bridge for measurement of inductance.	**07**
		OR	
Q.3	**(a)**	Write any three applications of sensors in drone.	**03**
	(b)	Write any two advantages and any two disadvantages of Hay's bridge.	**04**
	(c)	Explain the Kelvin double bridge method for measurement of low resistance.	**07**
Q.4	**(a)**	Compare Magnetic and Ultrasonic flow meter.	**03**
	(b)	Explain Photo Conductive cell.	**04**
	(c)	Explain strain gauge. Give classification and describe any one in detail.	**07**
		OR	
Q.4	**(a)**	Write any three applications of fiber optic sensor.	**03**
	(b)	Explain LDR.	**04**
	(c)	Explain any one capacitive transducers.	**07**
Q.5	**(a)**	Write down any three requirements of Instrumentation amplifier.	**03**
	(b)	Write short note on GPS.	**04**
	(c)	Provide a comprehensive explanation of Successive Approximation method for ADC.	**07**
		OR	
Q.5	**(a)**	Draw a Sample and Hold the circuit.	**03**
	(b)	Write a short note on Bluetooth.	**04**
	(c)	Compare weighted Resistor DAC and R-2R ladder DAC.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3161008 Date:12-07-2023

Subject Name:Sensors and Transducers

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define: (1) Sensitivity (2) Precision (3) Accuracy.	**03**
	(b)	Write short note on Limiting Errors.	**04**
	(c)	A 0-150 V voltmeter has a guaranteed accuracy of 1% of full scale reading. The voltage measured by this instrument is 75 V. Calculate the limiting error in percent. Comment upon the result.	**07**
Q.2	**(a)**	How a thermistor differs from a thermocouple as a temperature sensor?	**03**
	(b)	Write advantages and disadvantages of Thermistor.	**04**
	(c)	Explain the construction and working principle of potentiometer. Evaluate its application as motion sensor.	**07**
		OR	
	(c)	Explain working of LVDT with advantages and disadvantages.	**07**
Q.3	**(a)**	Write down the characteristics of Strain Guage.	**03**
	(b)	State advantages of Fiber Optic Sensor and its applications.	**04**
	(c)	Explain the working of Piezoelectric Sensors. List the advantages and disadvantages of Piezoelectric Sensors.	**07**
		OR	
Q.3	**(a)**	Explain Magneto Resistive Effect.	**03**
	(b)	Define dark resistance and list out various materials used for the construction of LDR.	**04**
	(c)	State the working principle of Optic Fiber sensor. With example explain optic fiber sensor configuration.	**07**
Q.4	**(a)**	Draw an Inverting Amplifier using Op-Amp and derive formula for its gain.	**03**
	(b)	Write down any four requirements of an Instrumentation Amplifier.	**04**
	(c)	Explain the Kelvin Double bridge method for measurement of Low resistance.	**07**
		OR	
Q.4	**(a)**	Write down applications of attenuators.	**03**
	(b)	Suggest suitable detectors for AC bridges for the following frequency ranges. (1) 250 Hz to 4 KHz (2) Below 200 Hz (3) 10 Hz to 100 KHz.	**04**
	(c)	Discuss working of Maxwell's Bridge for measurement of Inductance. For what range of Q- factor of the coil, the bridge is suitable?	**07**
Q.5	**(a)**	Define Resolution and Quantization terms in context of A/D Converters.	**03**
	(b)	A control valve has a linear variation of opening as the input votage varies from 0 to 10 V. A microcomputer outputs an 8-bit output word to control valve opening using an 8 bit D/A converter to generate the valve voltage.	**04**

(1) find the reference voltage required to obtain full value opening (10 V)
(2) find percentage of valve opening for a 1 bit change in the input word.

(c) An analog transducer with a 0-10 V input is able to distinguish a change of 10 mV in its input signal. (1) calculate its resolution (2) Calculate the number of bits of an A/D converter so that the digital output has almost the same resolution as the transducer. The A/D converter uses a binary code. Calculate also (3) the quantization error and (4) the number of decision levels. **07**

OR

Q.5 **(a)** Give three comparisons between Weighted Resistor DAC and R-2R ladder DAC. **03**

(b) Draw a Sample and Hold Circuit. **04**

(c) Explain Successive Approximation Type A/D Converter with suitable block diagram. **07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3161008 Date:08/06/2022

Subject Name:Sensors and Transducers

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define: (1) Sensitivity (2) Repeatability (3) Hysteresis.	**03**
	(b)	What is meant by two wire and three wire sensors? Give example for each type.	**04**
	(c)	Discuss about types of errors in measurement system and explain how they are corrected?	**07**
Q.2	**(a)**	Discuss why thermocouples require a reference junction.	**03**
	(b)	Differentiate the characteristics of RTD and Thermistor.	**04**
	(c)	Explain construction and working principle of potentiometer. Evaluate its application as motion sensor.	**07**
		OR	
	(c)	Summarize the construction, principle, working of thermistor and its resistance temperature characteristic.	**07**
Q.3	**(a)**	Define Gauge Factor of Strain Gauge.	**03**
	(b)	Define Dark Resistance and list out some materials used for construction of LDR.	**04**
	(c)	Define Piezo Electric effect. Draw the equivalent circuit of a Piezoelectric crystal and derive the transfer function of Piezo Electric transducer.	**07**
		OR	
Q.3	**(a)**	How can optical fiber be used for stress sensing?	**03**
	(b)	What is meant by Tactile Sensor?	**04**
	(c)	Explain the principle, construction, working and applications of Ultrasonic Flow Meter with neat sketches.	**07**
Q.4	**(a)**	Write limitations of Wheatstone Bridge.	**03**
	(b)	Show the block diagram of Smart Sensor Architecture.	**04**
	(c)	Draw Maxwell's Bridge circuit and derive the expression for the unknown element at balance.	**07**
		OR	
Q.4	**(a)**	Write advantages of AC Bridges.	**03**
	(b)	Compare MEMS Sensors and Nano Sensors.	**04**
	(c)	Draw Wein's Bridge Circuit and derive expression for the unknown element at balance.	**07**
Q.5	**(a)**	A 10 bit ADC has a full scale of 10.230 V. When digital output is (11 1111 1111)$_2$, the quantization error of ADC in millivolts is _____ .	**03**
	(b)	Compare Weighted Resistor DAC and R-2R Ladder DAC.	**04**
	(c)	With a neat circuit diagram, explain construction and working of 3 bit R-2R ladder DAC.	**07**

OR

Q.5	**(a)**	An 8-bit Unipolar DAC has a full scale voltage range from 0V to 7.68 V. If the digital input code is $(10010110)_2$, then the analog output is _____ .	**03**
	(b)	Explain Single Channel Data Acquisition System with suitable block diagram.	**04**
	(c)	Explain operation of Successive Approximation ADC.	**07**

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