GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - VI EXAMINATION - WINTER 2025

Subject Code: 3160620   **Date: 19-11-2025**

Subject Name: Instrumentation and Sensors

Time: 02:30 PM TO 05:00 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 measurement and instrumentation. List different types of sensors used in engineering applications.	03
	(b)	Explain the characteristics of an ideal transducer.	04
	(c)	Explain the working principle of strain gauge and its application.	07
Q.2	(a)	What is calibration of sensors? Explain its importance.	03
	(b)	Explain the procedure for sensor installation and configuration.	04
	(c)	Draw and explain the block diagram of a data acquisition system (DAQ).	07
		OR	
	(c)	Explain in detail the various sources of measurement errors and their minimization.	07
Q.3	(a)	Define mean, median, and mode with examples.	03
	(b)	Explain the concept of frequency domain signal analysis.	04
	(c)	Explain the working and applications of piezometer and inclinometer.	07
		OR	
	(a)	Discuss the process of data reduction and interpretation using statistical tools.	03
	(b)	Explain the need for sensor selection in instrumentation systems.	04
	(c)	Explain measurement uncertainty with an example.	07
Q.4	(a)	Explain the role of FFT in noise reduction with a suitable example.	03
	(b)	Explain the concept of measurement uncertainty propagation in instrumentation.	04
	(c)	Describe the importance of data filtering techniques in signal conditioning.	07
		OR	
	(a)	Explain the need for frequency domain analysis.	03
	(b)	Write a short note on leakage and frequency resolution.	04

	(c)	List any two light sensors and explain them.	**07**
Q.5	**(a)**	Differentiate between analog and digital signal processing.	**03**
	(b)	Write short note on case study: use of sensors in structural health monitoring.	**04**
	(c)	Design a conceptual instrumentation system for monitoring vibrations in a tall building.	**07**

OR

	(a)	Define signal conditioning. Why is it needed?	**03**
	(b)	Write a note on measurement system design considerations.	**04**
	(c)	Explain time-domain and frequency-domain signal processing comparison.	**07**

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160620   **Date:28-11-2024**

Subject Name:Instrumentation and Sensors

Time:02:30 PM TO 05:00 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)**	List various physical variable.	03
	(b)	Explain types of instrumentation.	04
	(c)	Compare with necessary examples: Permanent installation and Temporary installation.	07
Q.2	**(a)**	Define: i) Transducer ii) Sensor.	03
	(b)	Explain Measurement uncertainty.	04
	(c)	Write a short note on Predict the response of sensors to various inputs	07
		OR	
	(c)	Construct a conceptual instrumentation and monitoring program.	07
Q.3	**(a)**	Decide the order and methodology for sensor installation.	03
	(b)	List Criteria for Sensor selection.	04
	(c)	Explain the Working Principle of Strain Gauge with its application and derive the expression of Gauge Factor.	07
		OR	
Q.3	**(a)**	Explain the types of sensors	03
	(b)	List Criteria for Sensor siting.	04
	(c)	Explain in brief about data reduction and interpretation with necessary example	07
Q.4	**(a)**	Define: Signal and Noise.	03
	(b)	Explain Time domain signal processing.	04
	(c)	You are a civil engineer analyzing the compressive strength of concrete samples (in MPa) from three suppliers. Given the following data: Supplier A: 34, 36, 35, 33, 34, 36, 34, 37, 36, 35 Supplier B: 38, 39, 37, 40, 36, 39, 38, 37, 38, 40 Supplier C: 32, 31, 33, 31, 34, 33, 32, 35, 34, 31 Based on your analysis of statistical measures (average, standard deviation, mode, and range), provide recommendations for selecting a concrete supplier for this project	07
		OR	
Q.4	**(a)**	Define following term 1. Mode 2. Range	03

(b)	Show the use of following given sensor, 1. Piezometer 2. Inclinometer		**04**
(c)	Justify the following terms in the context of normal frequency distribution of data (a) Mean Value, (b) Deviation, (c) Average deviation, (d) Variance, (e) standard deviation		**07**

Q.5	**(a)**	Discuss Noise reduction with filters.	**03**
	(b)	Explain Fourier Transform & its application.	**04**
	(c)	Explain the need for frequency domain analysis and its principles.	**07**

OR

Q.5	**(a)**	Discuss the below terms, 1. Leakage 2. Frequency Resolution	**03**
	(b)	Summarize on the data analysis and interpretation with reference to inclinometer.	**04**
	(c)	What is FFT and explain its application in civil engineering.	**07**

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3160620   **Date:07-12-2023**

Subject Name: Instrumentation and Sensors

Time:02:30 PM TO 05:00 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)**	Differentiate between sensor and transducer.	**03**
	(b)	Explain various specifications of sensor.	**04**
	(c)	What is sensor? Explain different types of sensors in detail.	**07**
Q.2	**(a)**	Explain sensor selection.	**03**
	(b)	Explain types of error in measurement.	**04**
	(c)	Write note on type of instruments.	**07**
		OR	
	(c)	Explain basic concepts in frequency domain signal processing and analysis.	**07**
Q.3	**(a)**	Define measurement and instrumentation.	**03**
	(b)	Explain sensor siting.	**04**
	(c)	Explain in brief sensor installations.	**07**
		OR	
Q.3	**(a)**	Explain Piezometer.	**03**
	(b)	Write a note on Inclinometer.	**04**
	(c)	Explain in brief sensor monitoring (or measurement).	**07**
Q.4	**(a)**	What is aliasing? How can it remove?	**03**
	(b)	Explain in brief sensor installations.	**04**
	(c)	Write a note on Strain Gauge sensor.	**07**
		OR	
Q.4	**(a)**	Explain the need for frequency domain analysis and its principles.	**03**
	(b)	Define: (i) Average value (mean) (ii) Standard deviation (iii) Median (iv) Mode.	**04**
	(c)	Explain types of filters used in frequency domain analysis.	**07**
Q.5	**(a)**	Define: (i) Discrete Signal (ii) Noise(iii) Signal to Noise ratio	**03**
	(b)	Explain Noise reduction with filters.	**04**
	(c)	Explain the principle of operations of LVDT with the help of neat sketch.	**07**
		OR	
Q.5	**(a)**	Explain in brief Load Cell.	**03**
	(b)	Explain Data Reduction and Interpretation.	**04**
	(c)	Explain Time domain signals processing.	**07**

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022

Subject Code:3160620   **Date:15-12-2022**
Subject Name:Instrumentation and Sensors
Time:02:30 PM TO 05:00 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: i) Transducer ii) Sensor.	03
	(b)	List various physical variables.	04
	(c)	Explain the principle and working of a strain gauge. Derive the expression of gauge factor.	07
Q.2	**(a)**	What are the different types of signal and differentiate it.	03
	(b)	Explain types of instrumentation	04
	(c)	Explain the working principle of different types of flow sensors. Differentiate between Ultra Sonic and Electromagnetic type flow sensors.	07

OR

	(c)	Explain the types of proximity sensors and describe their use as accelerometer and vibration sensor	07
Q.3	**(a)**	Define and explain the static characteristics of an instrument.	03
	(b)	List Criteria for Sensor siting.	04
	(c)	Discuss in detail various types of errors associated in measurement and how these errors can be minimized?	07

OR

Q.3	**(a)**	Explain Piezometer with proper diagram.	03
	(b)	List Criteria for Sensor selection.	04
	(c)	Define the following terms in the context of normal frequency distribution of data (a) Mean Value, (b) Deviation, (c) Average deviation, (d) Variance, (e) standard deviation	07
Q.4	**(a)**	List various pressure sensors and explain any one of them.	03
	(b)	Differentiate between types of sensors and their modes of operation.	04
	(c)	Draw the functional block diagram of measurement system. Mentions the purpose of measurement.What is the methods of measurement?	07

OR

Q.4	**(a)**	List any two light sensors.	03
	(b)	What is noise? & explain SNR.	04
	(c)	What are the main characteristics to choose Permanent installations and Temporary installations?	07
Q.5	**(a)**	What is the importance of frequency domain analysis?	03

	(b)	Explain Noise reduction with filters	**04**
	(c)	Explain the need for frequency domain analysis and its principles.	**07**

<div align="center">OR</div>

Q.5	**(a)**	Explain Fourier Transform?	**03**
	(b)	Explain Time domain signal processing.	**04**
	(c)	What is FFT and explain its application in civil engineering	**07**