SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai, Accredited by NBA,
'A' Grade Accreditation by NAAC & ISO 9001:2015 Certified Institution

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

III SEMESTER

EI3363 – TRANSDUCERS ENGINEERING

Regulation – 2023

Academic Year 2025-2026

Prepared by

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QUESTION BANK

SUBJECT : EI3363 – TRANSDUCERS ENGINEERING

SEM / YEAR : III / II

UNIT I - SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS

Units and standards, Functional elements of measurement system – Static calibration – Classification of errors, Limiting error and probable error– Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

PART – A

Q.No.	Questions	BT Level	CO	Competence
1.	Mention the purpose of measurement.	BTL-1	CO1	Remember
2.	Compare direct and indirect comparison methods in measurement.	BTL-2	CO1	Understand
3.	Classify the methods of measurement.	BTL-2	CO1	Understand
4.	Give the advantages of the MKS system of units.	BTL-2	CO1	Understand
5.	Summarize the drawbacks of CGS system of units.	BTL-2	CO1	Understand
6.	Define standards and classify their types.	BTL-1	CO1	Remember
7.	Define calibration of an instrument.	BTL-1	CO1	Remember
8.	What do you mean by static calibration?	BTL-1	CO1	Remember
9.	What is dynamic calibration? Give an example.	BTL-2	CO1	Understand
10.	List any four calibration methods.	BTL-1	CO1	Remember
11.	Point out the types of instrumental errors.	BTL-1	CO1	Remember
12.	Compare limiting errors & component errors.	BTL-2	CO1	Understand
13.	What are the two different means adopted to avoid gross error?	BTL-1	CO1	Remember
14.	Show the relation between the probability of occurrence and odds.	BTL-1	CO1	Remember
15.	What is the significance of Odds?	BTL-1	CO1	Remember

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16.	Differentiate passive and active transducers. Give an example of each.	BTL-2	CO1	Understand
17.	Define an inverse transducer. Give an example.	BTL-1	CO1	Remember
18.	Classify the types of transducers.	BTL-2	CO1	Understand
19.	Classify the types of analog transducers.	BTL2	CO1	Understand
20.	List the factors to be considered for the selection of a transducer for a particular application.	BTL-1	CO1	Remember
21.	Define transducer.	BTL-1	CO1	Remember
22.	Assess the desirable features of a transducer.	BTL-1	CO1	Remember
23.	Give any four measures of transducers.	BTL-2	CO1	Understand
24.	How the transducer is differ from the sensor?	BTL-1	CO1	Remember
	PART-B			
1.	Identify the elements of a generalized measurement system and describe them with an example. **(16)**	BTL-4	CO1	Analyze
2.	Briefly describe the type of Units. **(16)**	BTL-3	CO1	Apply
3.	Categorize standards and give examples for each level of standard. **(16)**	BTL-4	CO1	Analyze
4.	What are the calibration methods? Describe static calibration in detail. **(16)**	BTL-4	CO1	Analyze
5.	Explain the types of errors in the measurement system and explain how they are corrected? **(16)**	BTL-3	CO1	Apply
6.	What is error analysis? Describe different statistical methods for error analysis. **(16)**	BTL-3	CO1	Apply
7.	The following values were obtained from the measurement of current: 12.35A, 12.71 A, 12.48 A, 10.24 A, 12.63 A and 12.58 A. Estimate (a) The arithmetic mean (b) The average deviation (c) The standard deviation and (d) Variance. **(16)**	BTL-3	CO1	Apply
8.	Batches of resistors of value 100 KΩ were measured and were found to have the following values: 100.35, 100.20, 100.15, 100.10, 100.25, 100.20, 100.05, and 100.30 KΩ. Determine the mean, standard deviation and probable error. Can any resistor be discarded on the basis of ± σ limits? If so, deduce the resistor values. **(16)**	BTL-3	CO1	Apply
9.	The following 10 observations were recorded when measuring a voltage. 41.7, 42.0, 41.8, 42.0, 42.1, 41.9, 42.5, 42.0, 41.9, 41.8. Formulate (a) Mean (b) Standard Deviation (c) Probable error (d) Mode. **(16)**	BTL-3	CO1	Apply
10.	One hundred temperature readings were taken at small intervals of time and recorded to the nearest 0.5 ^{0}C. The frequency of occurrences of the readings is given below:	BTL-3	CO1	Apply

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	<table><tr><td>Temperature in ^{0}C</td><td>98.5</td><td>99</td><td>99.5</td><td>100</td><td>100.5</td><td>101.0</td><td>101.5</td></tr><tr><td>Frequency</td><td>4</td><td>13</td><td>19</td><td>35</td><td>17</td><td>10</td><td>2</td></tr></table> Estimate (i) arithmetic mean, (ii) average deviation, (iii) standard deviation, (iv) variance and (v) probable error. **(16)**			
11.	In a test, temperature is measured 100 times with variations in apparatus and procedures. After applying the corrections, the results are: <table><tr><td>Temperature in ^{0}C</td><td>397</td><td>398</td><td>399</td><td>400</td><td>401</td><td>402</td><td>403</td><td>404</td><td>405</td></tr><tr><td>Frequency</td><td>1</td><td>3</td><td>12</td><td>23</td><td>37</td><td>16</td><td>4</td><td>2</td><td>2</td></tr></table> Calculate the arithmetic mean, the average deviation, the standard deviation and the probable error. **(16)**	BTL-3	CO1	Apply
12.	A batch of colour resistors of value 5.6kΩ were measured and were found to have the following values. 5.75, 5.60, 5.65, 5.50, 5.70, 5.55, 5.80 and 5.55kΩ. Determine the mean and standard deviation. Can any resistor be discarded on the basis of 3σ limits. **(16)**	BTL-3	CO1	Apply
13.	A circuit was tuned for resonance by eight different students and the values of resonant frequency in kHz were recorded as 532, 548, 543, 535, 546, 531, 543 and 536. Estimate (a) the arithmetic mean, (b) deviations from mean, (c) the average deviation, (d) the standard deviation and (e) variance. **(16)**	BTL-3	CO1	Apply
14.	Discuss about the classifications of transducers based on the physical effect employed. **(16)**	BTL-4	CO1	Analyze
15.	Discuss about the classification of electrical transducers in detail. **(16)**	BTL-4	CO1	Analyze
16.	With neat diagram, explain Digital displacement transducers in detail. **(16)**	BTL-3	CO1	Apply
17.	Analyze the factors that are to be considered in the selection of a transducer. **(16)**	BTL-4	CO1	Analyze

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UNIT II - CHARACTERISTICS OF TRANSDUCERS

Static characteristics: accuracy, precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effect, range and span. Dynamic characteristics: Mathematical model of transducer - zero, first and second order instruments - impulse, step, ramp and frequency response of the above instruments

Q.No.	Questions	BT Level	CO	Competence
1.	Compare the static and dynamic characteristics of an instrument.	BTL-2	CO2	Understand
2.	Define Sensitivity and Linearity of an instrument.	BTL-1	CO2	Remember
3.	Distinguish between threshold and resolution of a transducer.	BTL-2	CO2	Understand
4.	Differentiate accuracy and precision.	BTL-2	CO2	Understand
5.	State the importance of resolution for a measuring instrument.	BTL-1	CO2	Remember
6.	Distinguish Range and Span of an instrument.	BTL-2	CO2	Understand
7.	Define hysteresis of an instrument.	BTL-1	CO2	Remember
8.	Evaluate measuring lag and give its types.	BTL-1	CO2	Remember
9.	Examine speed of response.	BTL-1	CO2	Remember
10.	Analyze different test input signals.	BTL-1	CO2	Remember
11.	What is damping ratio of an instrument?	BTL-1	CO2	Remember
12.	Give an example of zero-order transducer.	BTL-2	CO2	Understand
13.	Define transfer function.	BTL-1	CO2	Remember
14.	Give an example of first-order transducer.	BTL-2	CO2	Understand
15.	Label the step response of a first-order system.	BTL-1	CO2	Remember
16.	A thermometer has a time constant of 3.5 s. it is quickly taken from a temperature of 0 ^{0}C to a water bath having a temperature of 100 ^{0}C. what temperature will be indicated after 1.5 s?	BTL-1	CO2	Remember
17.	Sketch impulse response of I and II order transducers.	BTL-1	CO2	Remember
18.	A temperature-sensitive transducer is subjected to a sudden temperature change. It takes 10 s for the transducer to reach the equilibrium condition (5 time constant). How long will it take for the transducer to read half of the temperature difference?	BTL-2	CO2	Understand
19.	Generalize the importance of zero-order transducer.	BTL-2	CO2	Understand
20.	Analyze the need for a mathematical model of a transducer in the field of control engineering.	BTL-2	CO2	Understand
21.	Analyze the typical ramp response of I and II order transducers.	BTL-2	CO2	Understand
22.	An instrument transfer function is given by	BTL-1	CO2	Remember

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	$G(s) = \frac{4}{s^2 + s + 4}$ Find the damping ratio and natural frequency of the system.			
23.	When a step input is given to a second-order system, the measurements revealed that the system had an overshoot of 12%.Determine the damping ratio.	BTL-1	CO2	Remember
24.	Calculate the settling time for 5% error in the step response of a first-order instrument with a time constant of 12 sec.	BTL-1	CO2	Remember
	PART-B			
1.	Discuss the following static characteristics of a transducer: Accuracy, Precision, Resolution, Hysteresis, Range and Span, Input impedance and loading effect. **(16)**	BTL-4	CO2	Apply
2.	Analyze the desirable dynamic characteristics of a measuring system. **(16)**	BTL-4	CO2	Apply
3.	Determine the mathematical model of a zero-order transducer. **(16)**	BTL-5	CO2	Evaluate
4.	Determine the mathematical model of a first-order transducer. **(16)**	BTL-5	CO2	Evaluate
5.	Infer the step response of I order system and explain the effect of different time constants on the response of the system. **(16)**	BTL-4	CO2	Analyze
6.	Derive the time response of a first order transducer for a impulse input. **(16)**	BTL-3	CO2	Apply
7.	Derive the time response of a first order transducer for a ramp input. **(16)**	BTL-3	CO2	Apply
8.	Illustrate the frequency response of a first order instrument. **(16)**	BTL-3	CO2	Apply
9.	Deterimine the mathematical model of a second-order transducer. **(16)**	BTL-3	CO2	Apply
10.	Derive expression for rise time and peak time of a second order transducer. **(16)**	BTL-4	CO2	Analyze
11.	Derive expression for maximum peak overshoot and settling time of a second order transducer. **(16)**	BTL-4	CO2	Analyze
12.	A first order thermometer with a time constant of 5 sec is used to measure the temperature of a furnace fluctuating between 540° C and 580° C in a sinusoidal manner. The frequency of fluctuation is 0.04 Hz. Find the maximum and minimum readings of the thermometer. **(16)**	BTL-3	CO2	Apply
13.	Derive mathematical expression for output of the undamped second order transducer for a step input. **(16)**	BTL-4	CO2	Analyze
14.	Derive the equations for time response of a second order critically damped transducer for a step input. **(16)**	BTL-4	CO2	Analyze
15.	Deduce the mathematical expression for output of the under damped second order transducer for a impulse input. **(16)**	BTL-5	CO2	Evaluate

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16.	Derive the equations for time response of under damped second order transducer when subjected to a step input. **(16)**	BTL-4	CO2	Analyze
17.	Evaluate ramp response of a second order transducer for a step input. **(16)**	BTL-5	CO2	Evaluate

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UNIT III - RESISTIVE TRANSDUCERS

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, thermistor, photo resistor (LDR), hot-wire anemometer, piezo-resistive sensor and humidity sensor.

PART – A

Q.No.	Questions	BT Level	CO	Competence
1.	List the advantages and disadvantages of potentiometer.	BTL-2	CO3	Understand
2.	Define sensitivity in potentiometer.	BTL-1	CO3	Remember
3.	What is resolution of a potentiometer?	BTL-2	CO3	Understand
4.	Give any four materials used in Strain gauge with their types.	BTL-1	CO3	Remember
5.	List the types of strain gauge.	BTL-1	CO3	Remember
6.	Define gauge factor.	BTL-1	CO3	Remember
7.	Why dummy strain gauges are used in measurement application which uses strain gauges? What will happen if it is not used?	BTL-1	CO3	Remember
8.	Classify the factors to be considered for bonded strain gauge.	BTL-2	CO3	Understand
9.	Give the advantages and disadvantages of resistance thermometer.	BTL-2	CO3	Understand
10.	List some applications of RTD.	BTL-1	CO3	Remember
11.	Generalize the requirements needed for the materials to be used in RTDs.	BTL-1	CO3	Remember
12.	How is resistance of metals related with temperature? Write the equation for the relation.	BTL-2	CO3	Understand
13.	Point out the important merits and limitations of thermistor.	BTL-1	CO3	Remember
14.	Write the principle of operation of thermistor.	BTL-2	CO3	Understand
15.	Distinguish between RTD and thermistor.	BTL-2	CO3	Understand
16.	What is principle of LDR?	BTL-1	CO3	Remember
17.	Point out any four applications of strain gauge in measurements.	BTL-1	CO3	Remember
18.	What is strain of an instrument?	BTL-1	CO3	Remember
19.	Point out the use of LDR.	BTL-1	CO3	Remember
20.	Illustrate the principle of hotwire anemometer.	BTL-2	CO3	Understand
21.	What is piezoresistive effect?	BTL-1	CO3	Remember
22.	Compare absolute humidity and relative humidity.	BTL-2	CO3	Understand
23.	What is the basic principle used in humidity sensors?	BTL-1	CO3	Remember

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24.	Mention the types of humidity sensors.	BTL-2	CO3	Understand
	PART – B			
1.	Illustrate the construction and working principle of Translational potentiometers with its characteristics. **(16)**	BTL-3	CO3	Apply
2.	Illustrate the construction and working principle of rotational potentiometers with its characteristics. **(16)**	BTL-3	CO3	Apply
3.	Explain about the Loading effect on potentiometers in detail. **(16)**	BTL-3	CO3	Apply
4.	Analyze the characteristics of a Nonlinear potentiometer. **(16)**	BTL-4	CO3	Analyze
5.	Explain Unbonded type strain gauge with neat sketch. **(16)**	BTL-3	CO3	Apply
6.	Explain Bonded type strain gauge with neat sketch. **(16)**	BTL-3	CO3	Apply
7.	Evaluate Strain gauge circuit with temperature compensation with neat sketch. **(16)**	BTL-5	CO3	Evaluate
8.	Determine expression for gauge factor and express piezo-resistivity in terms of gauge factor. **(16)**	BTL-5	CO3	Evaluate
9.	Illustrate the principle of operation, constructional details of resistance thermometer. Also explain the characteristics of different metals for resistance thermometers. **(16)**	BTL-3	CO3	Apply
10.	Explain the RTD and explain how it can be used to measure temperature. **(16)**	BTL-3	CO3	Apply
11.	The resistance variation of a thermistor follows the equation $R_T = R_o e^{\beta\left(\frac{1}{T}-\frac{1}{T_0}\right)}$, Where $T\&T_0$ are temperature in °K. R_T and R_o are resistances. β is the characteristic constant of the thermistor material. It is given that β=3140, R_{27}=1050Ω. This thermistor is used for temperature measurement and at a particular temperature the resistance is 2330 Ω. Evaluate temperature. **(16)**	BTL-5	CO3	Evaluate
12.	Summarize the construction, principle, working of thermistor and its resistance temperature characteristics. **(16)**	BTL-5	CO3	Evaluate
13.	A thermistor is assumed to have a linear resistance variation with a constant temperature co-efficient of resistance of -0.05Ω/°C. The resistance of the thermistor at 20°C is 1000Ω. **(i)** Evaluate the value of its resistance at 25°C. **(8)** **(ii)** If this thermistor is connected in series with a copper coil. Evaluate the value of resistance of copper coil if resistance at 20°C and 25°C are the same. The temperature co-efficient of resistance of copper is 0.004°C. **(8)**	BTL-5	CO3	Evaluate
14.	Explain the construction and working of LDR with a neat diagram. Also give its advantages and disadvantages. **(16)**	BTL-4	CO3	Analyze
15.	Illustrate the construction and working of hot wire anemometer with a neat diagram. Also give its advantages and disadvantages. **(16)**	BTL-3	CO3	Apply

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16.	Explain the functioning and typical application for piezo-resistive type of sensor. **(16)**	BTL-4	CO3	Analyze
17.	Identify the procedure for measuring humidity using hair hygrometer. **(16)**	BTL-1	CO3	Remember

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UNIT IV - INDUCTIVE AND CAPACITIVE TRANSDUCERS

Inductive transducers: Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer – variable reluctance transducers – Synchros – Microsyn. Capacitive transducers: Principle of operation, construction details, characteristics, different types and applications - capacitor microphone, capacitive pressure sensor, proximity sensor.

PART - A

Q.No.	Questions	BT Level	CO	Competence
1.	Relate the differential output with reference to LVDT.	BTL-1	CO4	Remember
2.	Sketch the equivalent circuit for LVDT.	BTL-1	CO4	Remember
3.	Point out any four applications of LVDT.	BTL-1	CO4	Remember
4.	Point out the advantages of differential output.	BTL-1	CO4	Remember
5.	Write the output equation for LVDT.	BTL-2	CO4	Understand
6.	What is induction potentiometer?	BTL-1	CO4	Remember
7.	Give the principle of operation of induction potentiometer.	BTL-2	CO4	Understand
8.	What is the principle of variable reluctance transducer?	BTL-1	CO4	Remember
9.	Define reluctance of coil.	BTL-1	CO4	Remember
10.	What is the working principle of EI pickup transducer?	BTL-1	CO4	Remember
11.	Generalize the applications of Variable reluctance transducers	BTL-2	CO4	Understand
12.	What is meant by pt-100?	BTL-1	CO4	Remember
13.	How to increase the sensitivity of capacitive transducer?	BTL-1	CO4	Remember
14.	Show the frequency response of typical capacitor microphone.	BTL-1	CO4	Remember
15.	How a capacitive transducer is used as a pressure sensor?	BTL-1	CO4	Remember
16.	List the features of capacitive transducers.	BTL-1	CO4	Remember
17.	Mention the uses of capacitive transducer as a pressure sensor.	BTL-2	CO4	Understand
18.	Classify different types of capacitive transducers.	BTL-2	CO4	Understand
19.	Give advantages and disadvantages of capacitive transducer.	BTL-2	CO4	Understand
20.	Point out the application of capacitive transducer.	BTL-2	CO4	Understand
21.	What is the function of capacitor microphone?	BTL-2	CO4	Understand
22.	What is the principle of Proximity sensor?	BTL-2	CO4	Understand
23.	Classify different types of Proximity sensor.	BTL-2	CO4	Understand
24.	What is the principle of Synchros?	BTL-1	CO4	Remember

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PART – B				
1.	Develop the transfer function of LVDT with equivalent circuit and explain any two adjustment circuits for LVDT. **(16)**	BTL-5	CO4	Evaluate
2.	Explain the principle of operation and construction details of LVDT. **(16)**	BTL-3	CO4	Apply
3.	Illustrate the construction, operation and limitations of an induction potentiometer. **(16)**	BTL-3	CO4	Apply
4.	Classify three types of variable inductance transducers. Explain the working on the principle of change in self-inductance. **(16)**	BTL-5	CO4	Evaluate
5.	Illustrate the principle of operation, construction and characteristics of variable reluctance transducer. **(16)**	BTL-3	CO4	Apply
6.	A pressure measuring instrument uses a capacitive transducer having a spacing of 4 mm between its diaphragms. A pressure of 600 kN/m^2 produces an average deflection of 0.3 mm of the diaphragm of the transducer. The transducer which has a capacitance of 300 pF before application of pressure and is connected in an oscillator circuit having a frequency of 100 kHz. Deduce the change in frequency of the oscillator after the pressure is applied to the transducer. **(16)**	BTL-3	CO4	Apply
7.	Describe the principle of operation of capacitive transducer and how pressure is measured using capacitive transducer. **(16)**	BTL-4	CO4	Analyze
8.	Illustrate the methods by which capacitive transducers are used for the measurement of linear displacement. **(16)**	BTL-3	CO4	Apply
9.	Illustrate the methods by which capacitive transducers are used for the measurement of angular displacement. **(16)**	BTL-3	CO4	Apply
10.	Explain in detail about capacitive transducer and what the types of Capacitive transducer are. **(16)**	BTL-5	CO4	Evaluate
11.	Examine Capacitive transducer for the measurement of level in a non-conducting liquid. **(16)**	BTL-3	CO4	Apply
12.	The output of an LVDT is connected to a 5V voltmeter through an amplifier whose amplification factor is 250. An output of 2 mV appears across the terminals of LVDT when the core moves through a distance of 0.5 mm. The milli-voltmeter scale has 100 divisions. The scale can be read to 1/5 of a division. Calculate the sensitivity of LVDT and that of the whole setup. Also calculate the resolution of the instrument in mm. **(16)**	BTL-5	CO4	Evaluate
13.	Analyze the capacitive displacement transducers based on change in distance between plates. **(16)**	BTL-4	CO4	Analyze
14.	Analyze the capacitive displacement transducers based on change in overlapping area between plates. **(16)**	BTL-4	CO4	Analyze
15.	Analyze the capacitive displacement transducers based on change in dielectric constant between plates. **(16)**	BTL-4	CO4	Analyze

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16.	Illustrate the Principle of operation, characteristics and applications of capacitor microphone. **(16)**	BTL-3	CO4	Apply
17.	Describe the working of Synchors with a neat schematic. **(16)**	BTL-3	CO4	Apply

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UNIT V - OTHER SENSORS AND TRANSDUCERS

Piezoelectric transducer – Hall Effect transducer – Magneto elastic sensor – Digital transducers – Fiber optic sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors - Environmental Monitoring sensors for Water Quality and Air pollution.

PART – A

Q.No.	Questions	BT Level	CO	Competence
1.	Point out the modes of operation in piezoelectric systems.	BTL-1	CO5	Remember
2.	List out any four materials by which piezoelectric transducers are made off.	BTL-1	CO5	Remember
3.	What is the principle of piezoelectric transducer?	BTL-1	CO5	Remember
4.	How a piezoelectric transducer could be used as an accelerometer?	BTL-2	CO5	Understand
5.	What is Hall effect transducer?	BTL-1	CO5	Remember
6.	Illustrate the principle of 'Hall effect' with a sketch.	BTL-2	CO5	Understand
7.	Discuss the operation of magneto elastic sensor.	BTL-2	CO5	Understand
8.	Identify any one digital transducer for speed measurement.	BTL-1	CO5	Remember
9.	What is the function of optical encoder?	BTL-1	CO5	Remember
10.	Show the block diagram of architecture of smart sensor.	BTL-2	CO5	Understand
11.	Combine smart sensor with reference to ordinary sensor in terms of four salient features.	BTL-2	CO5	Understand
12.	Summarize the features of smart sensors.	BTL-2	CO5	Understand
13.	Name three advantages of fibre optic sensors	BTL-1	CO5	Remember
14.	Give the types of fibre commonly used.	BTL-2	CO5	Understand
15.	Compare photovoltaic and photo conductive transducer.	BTL-2	CO5	Understand
16.	Analyze the difference between biomedical sensors and bio sensors	BTL-2	CO5	Understand
17.	Distinguish between thck film sensor and thin film sensor.	BTL-2	CO5	Understand
18.	List the Nano fabrication techniques	BTL-1	CO5	Remember
19.	Point out the applications of Nano materials in various fields.	BTL-1	CO5	Remember
20.	What is Nano products?	BTL-1	CO5	Remember
21.	List the applications of Nano products.	BTL-1	CO5	Remember
22.	What do you mean by NANO?	BTL-1	CO5	Remember
23.	What is Nano fabrication?	BTL-1	CO5	Remember

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24.	Identify any three applications of thin films.	BTL-2	CO5	Understand
	PART – B			
1.	Consider a piezoelectric transducer which has capacitance of 1000 pF and a charge sensitivity of 40 X 10^{-3} C/m. the connecting cable has a capacitance of 300pF while the oscilloscope used for read out has a readout input resistance of 1MΩ with a parallel capacitance of 50Pf. **a.** What is the sensitivity of transducer alone? **(4)** **b.** What is the high frequency sensitivity of the entire measuring system? **(4)** **c.** What is the lowest frequency that can be measured with 5% amplification error by the entire system? **(4)** **d.** Design the value of external shunt capacitance that can be connected in order to extend the range of 5% error down to 10Hz. **(4)**	BTL-6	CO5	Create
2.	Define piezoelectric effect. Draw the equivalent circuit of a piezoelectric crystal and obtain the transfer function of piezo electric transducer. **(16)**	BTL-3	CO5	Apply
3.	Illustrate the principle of operation of piezoelectric transducers. What are the applications of this sensor? **(16)**	BTL-3	CO5	Apply
4.	Illustrate the principle of operation of hall transducer for displacement and current measurement. **(16)**	BTL-3	CO5	Apply
5.	Expalin the various types of applications that can be used with Hall effect sensor. **(16)**	BTL-4	CO5	Analyze
6.	Explain the principle of Hall transducer for power measurement. **(16)**	BTL-5	CO5	Evaluate
7.	Explain the working principle of Magneto elastic sensor with neat sketch. **(16)**	BTL-4	CO5	Analyze
8.	Briefly discuss the principle and working of digital speed transducers. **(16)**	BTL-5	CO5	Evaluate
9.	Explain the construction and operation of shaft angle encoder and optical encoder with a neat diagram. **(16)**	BTL-5	CO5	Evaluate
10.	Explain with a neat block diagram the construction, operation and important characteristics of a smart sensor. **(16)**	BTL-5	CO5	Evaluate
11.	Explain Smart sensors with neat sketch in detail. **(16)**	BTL-4	CO5	Analyze
12.	Explain in brief the measurement of linear displacement, angular displacement, force and level of liquid in a tank using optic sensors. **(16)**	BTL-4	CO5	Analyze
13.	Illustrate the working principle and characteristics of micro-bend displacement sensor. **(16)**	BTL-3	CO5	Apply
14.	Explain the working principle of LASER sensor with neat sketch. **(16)**	BTL-5	CO5	Evaluate
15.	Explain the working principle of Chemical Sensor with neat sketch. **(16)**	BTL-5	CO5	Evaluate
16.	Explain the working principle of thick film sensor with neat sketch.	BTL-3	CO5	Apply

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		(16)			
17.	Discuss about nanotechnology and nano sensors in detail.	**(16)**	BTL-5	CO5	Evaluate

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