VALLIAMMAI ENGINEERING COLLEGE
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Subject code: EI6401 Semester: IV
Subject Name: TRANSDUCER ENGINEERING Class: II EIE A&B
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QUESTION BANK

UNIT I- SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS

PART A

1. Classify the types of instrumental errors.(May /June 2014)
Gross Error, Systematic & Random errors.

2. Mention the advantages of MKS system of units. (May /June 2014)
The MKS system of units is a physical system of units that expresses any given measurement using fundamental units of the metre, kilogram, and/or second (MKS).
Historically the MKS system of units succeeded the cgs system of units and laid the blueprint for the International System of Units, which now serves as the international standard.

3. What do you mean by static calibration? [NOV/DEC 2013]
It refers to a process in which all the inputs(desired,modifying,interfering)except one are kept at some constant values.

4. What do you mean by Calibration? [May/June 2012]
Calibration is the process of making an adjustment or making a scale so that the readings of an instrument agree with the accepted and the certified standard.

5. Classify transducers. [May/June 2012 Nov/Dec 2011]
On the basis of transduction form used, transducer is classified as,

i. primary and secondary transducers
ii. active and passive transducers
iii. analog and digital transducers

6. What is a Standard? What are the different types of Standards? [Nov/Dec 2011] [May/June 2011]
The physical embodiment of a unit of measurement is a standard. For example, the fundamental unit of mass in the International System is the kilogram and defined as the mass of a cubic decimeter of water at its temperature of maximum density of 4˚C.
Types:

i. International Standards
ii. Primary Standards
iii. Secondary Standards
iv. Working Standards

7. What is an electrical transducer? Give examples. [May/June 2011]

The output in the form of electrical eg: LVDT, POT

8. Define transducer. [May/June 2011]

A transducer or pickup is a device that converts any physical quantity into an electrical quantity for the purpose of measurement

9. Distinguish passive and active transducers and give an example of each. [May/June 2010] [Nov/Dec 2009] [NOV/DEC 2013]

S.No.	Active Transducer	Passive Transducer
1.	The quantity to be measured activates some external power input source, which in turn produces the output.	The output is produced entirely by the quantity being measured.
2.	Additional external energy input source is required.	Additional external energy input source is not required.
3.	The resolution is high	The resolution is less.
4.	Complicated to design	Simple to design.
5.	Examples are liquid level indicator, flow indicator	Examples are pressure gauge,voltmeter,ammeter

10. What is primary calibration? [May/June 2010]

Primary calibration means testing an instrument for accuracy and sensitivity throughout the complete range specified by the manufacturer.

11. Differentiate gross errors and systematic errors. [Nov/Dec 2009]

Gross: This error is mainly due to human mistakes in reading or in using instruments or errors in recording observations. cannot be treated mathematically. The Systematic Errors These errors occur due to shortcomings of, the instrument, such as defective or worn parts, or ageing or effects of the environment on the instrument

12. Distinguish between Limiting error & Component error.

Component Errors are due to inherent shortcomings in the instrument , misuse of Instruments & due to loading effects of instruments. In those Components which are guaranteed to be within a certain percentage of the rated value , the manufacturer has to specify the deviation from the nominal value of a particular quantity . The limits of these deviation from the specified value are defined as Limiting Errors

13. Define relative (fractional) limiting error?

It is defined as the ratio of the error to the specified (nominal) magnitude of a quantity.

14. Write the significance of Odds.

The probability of occurrence is stated in terms of Odds. Odd is the number of chances that a particular reading will occur when the error limit is specified

15. What is analog transducer?

These transducers convert the input quantity into an analog output which is a continuous function of time. Thus a strain gauge, an LVDT, a thermocouple or a thermistors may be called analog transducer, as they give an output which is a continuous function of time.

16. List the factors responsible in selection of a transducer.

1.Operating principle
2.Sensitivity
3.Operating range.
4.Accuracy.

17. Define an Inverse transducer. Give an example.

A device which converts an electrical quantity into an non-electrical quantity.A piezo-electric crystal acts as a inverse transducer because whwn a voltage is applied across its surfaces ,it changes its dimensions causing a mechanical displacement.

18. Mention the purpose of the measurement.

· To understand an event or an operation.
· To monitor an event or an operation.
· To control an event or an operation.
· To collect data for future analysis
· To validate an engineer design.

19. Give the classification of units.

1.Absolute units
2.Fundamental and derived units
3.Electromagnetic units
4.Electrostatic units

20. What are the desirable features of a transducer?

The transducer must be sensitive. The transducer should have a good resolution over its entire range. High degree of accuracy should be assured. The transducer should maintain the expected input-output relationship as described by its transfer function. The transducer should have a high input impedance and low output impedance to avoid loading effects

PART B

1. Briefly discuss the Units(16)
2. Classify standards and give example for each level of standard (16)
3. What are the Calibration methods also explain the Static calibration(16)
4. Explain the different classifications of error in measurement system and explain how they are corrected? [May/June 2010] (16)
5. What is Error analysis also explain their Statistical methods (16)
6. Based on the 3 effects Classify the transducers (16)

7. a. Discuss in detail about the Odds and uncertainty (8)
   b. Describe the factors to be considered in the selection of a transducer Selection of transducers. (8)
8. In a test temperature is measured 100 times with variations in apparatus and procedures. After applying the corrections, the results are:

Temperature ˚C :	397	398	399	400	401	402	403	404	405
Frequency :	1	3	12	23	37	16	4	2	2

   Calculate the arithmetic mean, the average deviation, the standard deviation and the probable error. [NOV/DEC 2013] (16)
9. (i) Discuss:(1) Observational error and(2) Random error. (6)
   (ii) The following values were obtained from the measurement of current: (10)
   12.35 A, 12.71 A, 12.48 A, 10.24 A, 12.63 A and 12.58 A.
   Calculate:
   a. The arithmetic mean
   b. The average deviation
   c. The standard deviation
   d. Variance.
10. How instrument errors are classified? Explain about the causes and remedies for each error in detail. [May/June 2012] (16)

UNIT II - CHARACTERISTICS OF TRANSDUCERS

PART A

1. Define Sensitivity and Linearity of an instrument. [May/June 2012/May /June 2014]
Sensitivity should be taken depending on the operating point. The sensitivity is expressed in output unit/input unit. Linearity is a measure of the maximum deviation of the plotted transducer response from a specified straight line.

2. Distinguish between accuracy and precision. [Nov/Dec 2011/May /June2011/ May /June2014]

Accuracy	Precision
It is measure of degree of closeness between the measured and true values.	It is a measure of degree of closeness among the measured values.
If an instrument is accurate, it can be concluded that it is free from errors.	If an instrument is precise, It cannot be concluded whether it is error free or not

3. Explain how the nonlinearity of a measuring system is defined and estimated? [Nov/Dec 2009]

$$\text{Non-Linearity} = \frac{\text{max. deviation of o/p from the idealized straight line x 100}}{\text{Actual reading}}$$

4. Distinguish Range and Span of an instrument. [Nov/Dec 2009]
Range: The scale range of an instrument is defined as the minimum and maximum values between which the instrument can provide output values.

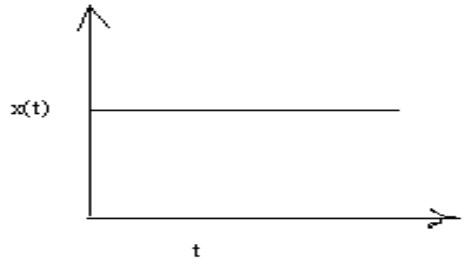
Span: The scale span of an instrument is defined as the difference between the maximum and minimum values of the instrument.

5. Obtain the step response of a first order system. [Nov/Dec 2011]

Step response

$y(t) = Ak\ (1-e^{-t/\tau})$

Step Input



$x(t) = k$ for $t > 0$

$= 0$ for $t < 0$

6. Differentiate static and dynamic characteristics of an instrument. . [May/June 2010]

S.No.	Static characteristics	Dynamic characteristics
1.	The set of criteria defined for the instruments, which are used to measure the quantities.	The set of criteria defined based on dynamic differential equations.
2.	Defined for the instruments which measure the quantities which do not vary with time.	Defined for the instruments which measure the quantities which vary with time.
3.	Various static characteristics are accuracy,precision,error,sensitivity, threshold,reproducibility,zero drift, stability and linearity	Various Dynamic characteristics are speed of response, Fidelity, lag and dynamic error.

7. Explain the terms accuracy and precision. . [May/June 2010]

Accuracy is the closeness to true value where as precision is the closeness amongst the readings. Precision is the degree of closeness with which a given value may be repeatedly measured.

8. State the importance of resolution for a measuring instrument. [NOV/DEC 2013]

If the input is slowly increased from some nonzero input value, there will be some minimum increment for which for which no output change can be detected.

9. What are the test inputs of the transducer?

Impulse input
Step input
Ramp input

Parabolic input
Sinusoidal input

10. Define- zero order transducer.

The input- output relationship of a zero- order transducer is given by Y(t) = K r(t)Where r(t) is the input, Y(t) is the output and K is the static – sensitivity of the transducer.
Example for zero- order transducer is a potentiometer

11. What is damping ratio?

The damping ratioς is an important parameter which decides the nature of oscillation in the transducer output . when ς =0 , the second – order system is said to be un damped and the system behaves like an oscillator . when ς =1 , the second – order system is said to be critical damped and when ς >1 , the second – order system is said to be over damped.

12. What is frequency response of ZOT?

Frequency response is thus defined as the steady – state output of a transducer When it is excited with sinusoidal input . the frequency response is represented with the help of two plots namely amplitude radio verses frequency and phase angle shift versus frequency.

13. Mention different types of static characteristics.

(i) accuracy (ii) sensitivity (iii) Reproducibility (iv) Drift (v) Static error and (vi)Dead zone

14. Define static characteristics.

Static characteristics of a measurement system are, in general, those that must be considered when the system or instrument is used to measure a condition not varying with time.

15. Mention different types dynamic characteristics?
Speed of response, Measuring lag, Fidelity, Dynamic Error

16. A thermometer has a time constant of 3.5 s. it is quickly taken from a temperature 0 degree c to a water bath having temperature 100degree c. what temperature will be indicated after 1.5 s ?

$$\theta = \theta o\,[\,1 - \exp(1 - t/\tau)]$$

$$= 100[\,1 - \exp(1 - 1.5/3.5)] = 34.86^{\circ}c.$$

17. A temperature-sensitive transducer is subjected to a sudden temperature change. It takes 10 s for the transducer to reach equilibrium condition (5 time constant). How long will it take for the transducer to read half of the temperature difference?

Time to reach equilibrium conditions = $5\tau = 10s$.

Time constant $\tau = 10/5 = 2s$.

$\theta = \theta o [\ 1 - \exp(1-t/\tau)]$

$0.5 = 1-[\exp(-t / 2)]$

$\therefore t = 1.39s$.

18. Define hysteresis.

When the input to a transducer which is initially at rest is increased from zero to full-scale and then decreased back to zero, there may be two output values for the same input. Hysteresis effects can be minimized by taking readings corresponding to ascending and descending values of the input and then taking their arithmetic average.

19. Define resolution.

When the input to a transducer is increased slowly from some non-zero arbitrary value, the change in output is not detected at all until a certain input increment is exceeded. This increment is defined as the resolution.

20. Give an example of first order transducer.

Thermal System, Liquid level System, A series RC circuit

PART B

1. (i) Discuss about the desirable dynamic characteristics of a measuring system. (8)
   (ii) Derive the time response of a second order under damped measuring system for a unit step input. Draw the response. (8)
2. (i) Discuss the following static characteristics Accuracy, Precision and resolution. (8)
   (ii) Explain the following terms : Speed of response, Overshoot, Peak time, Settling Time. (8)
3. (i) Obtain the ramp response of a first order instrument. (8)
   (ii) Explain the frequency response of a first order instrument. (8)
4. (i) Derive the operational transfer function of a second-order instrument. (8)
   (ii) Obtain the step response of a second-order instrument. (8)
5. (i) Draw the waveforms of four important types of standard test signals. (4)
   (ii) What is meant by zero order instrument? illustrate with two examples. (6)
   (iii) Obtain the impulse response of a first order system. (6)
6. (i)Explain the terms sensitivity and linearity of transducers With an example for each. (4)
   (ii)Derive the expressions for magnitude and phase of a first order transducer for sinusoidal input.(6)
   (iii) The observations of a particular frequency measurement bydifferent persons are 325, 330, 338, 320 and 336. Determine the standard deviation and the probable error. (6)
7. Explain in detail the parameters used for analyzing dynamic characteristics of instruments. Derive the equations for each parameter from the time response of second order system. (16)
8. (i)What are the different standard inputs for studying the dynamic response of a system. Define and sketch them. [Nov/Dec 2011] (8)
   (ii)Discuss on the dynamic characteristics of measuring system. How they play a role in measurement

system. (8)

9. (i) Draw and explain the step response of I order transducer. (8)
(ii)Explain the frequency response of I order transducer. (8)

10. (i)Differentiate static and dynamic performance characteristics of an instrument. Derive the mathematical model of a measurement system. (8)
(ii) Draw the impulse response of a first order instrument and analyze its characteristics. (8)

UNIT III - VARIABLE RESISTANCE TRANSDUCERS

PART A

1. What is the principle of Strain gauge? [May/June 2012]

If a metal conductor is stretched or compressed, its resistance changes on the fact that both length and diameter of conductor change. There is a change in the value of resistivity of the conductor, when it is strained. This property is called piezo-resistive effect. The strain gauges are resistive transducers used for measurement of strain and associated stress in experimental stress analysis.

2. What are the different types of strain gauge?

Unbonded metal strain gauges
Bonded metal wire strain gauges
Bonded metal foil strain gauges
Vacuum deposited thin metal film strain gauges
Sputter deposited thin metal strain gauges
Bonded semiconductor strain gauges
Diffused metal strain gauges

3. Define gauge factor. [Nov/Dec 2011]

The gauge factor is unit resistance change per unit strain.

4. Mention any four applications of strain gauge in measurements. [NOV/DEC 2013]

- ✓ Measurement of strain
- ✓ Measurement of stress
- ✓ Used as secondary transducer with load cell, torque meters, diaphragm type pressure gauges, temperature sensors, accelerometers and flow meters.

5. What are the advantages and disadvantages of potentiometer?

Advantages : Inexpensive
Useful for measurement of large amplitudes
Efficiency is very high
Frequency response of wire wound potentiometers is limited

Disadvantages : Require a large force to move

6. What are the factors to be considered for bonded strain gauge?

- ✓ Filament construction
- ✓ Material of the filament wire
- ✓ Base carrier material or backing material

- ✓ Cement used to bond the filament to the carrier
- ✓ Lead wire connections

7. What is young's modulus ?

It is a ratio of stress and strain , dR/R / Dl/l

8. What is resistance thermometers?

A resistance thermometer consists of a resistive element which is exposed to the temperature to be measured. If the conductors or metals are used to measure the temperature, they are known as resistance thermometers and if semiconductors are used then they known as thermistors.

9. What is strain?

It is a ratio of changing length to original length.

10. State the principle of the strain gauge.

If a metal conductor is stretched or compressed ,its resistance changes on account of the fact that both length and diameter of conductor change .Also there is a change in the value of resistivity of the conductor when it is strained and this property is called Piezo-resistive effect.

11. What are the requirements for the materials used in RTDs? [Nov/Dec 2011]

The requirements for the materials used in RTDs are

i. The change in resistance of a material per unit change in temperature should be as large as possible.
ii. The resistivity of material should be high, so that minimum volume of material is used for the construction.
iii. The resistance should have a continuous and stable relationship with temperature.
iv. The material should have positive temperature resistance coefficient.

12. Mention some applications of capacitive transducer. [May/June 2011]

Measurement of Level,thickness,displacement etc.

13. State the working principle of piezoresistive sensor. [May/June 2011]

Piezoresistive sensors change resistance when pressure is applied.

14. Write some applications of RTD. . [May/June 2010]

i. A high electrical output can be obtained by using the RTD with many types of simple resistance bridges. This high output can then be fed directly into recorders, temperature controllers, transmitters, or digital readouts which can be calibrated to read very precise increments of temperature over wide dynamic ranges.
ii. RTD's can also be read out on precision laboratory bridges and digital ohmmeters.
iii. Air conditioning and refrigeration servicing
iv. Food Processing
v. Stoves and grills
vi. Textile production
vii. Plastics processing

15. What are the characteristics of thermistors? [May/June 2010]

i. Resistance –Temperature characteristics
ii. Voltage -Current characteristics
iii. Current –Time characteristics.

16. What are the differences between RTD and thermistor? [Nov/Dec 2009]

It has ptc.A resistance thermometer consists of a resistive element which is exposed to the temperature to be measured. If the conductors or metals are used to measure the temperature,

they are known as resistance thermometers and if semiconductors are used then they known as thermistors. It has ptc and NTC .

17. What is the basic principle of humidity sensors? [Nov/Dec 2009]

Some Hygroscopic Salts exhibit a change in resistivity with humidity. Resistive hygrometer humidity sensors use the change in resistance of a hygroscopic material between two electrodes on an insulating substrate

18. Mention any four applications of strain gauge in measurements. [NOV/DEC 2013]

- Measurement of strain
- Measurement of stress
- Used as secondary transducer with load cell, torque meters, diaphragm type pressure gauges, temperature sensors, accelerometers and flow meters

19. Define absolute humidity and relative humidity. [May/June 2012]

Humidity is a measure of water vapor present in gas.

Absolute humidity is the ratio of water vapor present per unit volume.

Relative humidity is the ratio of water vapor pressure actually present to water vapor pressure required for saturation at a given temperature. The ratio is expressed in percent

20. What is the principle of hotwire anemometer?

Another resistance variation type transducers is hot wire anemometer. In general anemometers are devices used for measurement of velocity of flow.

PART B

1. (i) Describe various types of Strain gauge with their advantages and disadvantages. (10)
   (ii) Explain the operation of piezo resistive sensor. (6)
2. (i) Define strain gauge factor. Express piezo resistivity In terms of gauge factor.(4)
   (ii) Describe the construction, principle and working of thermistor.(8)
   (iii) Write a short note on humidity sensors.(4)
3. (i) With neat diagram explain potentiometric resistance transducer. List its advantages and disadvantages.(8)
   (ii) Explain briefly bonded and unbounded type strain gauges with their principle of operation.(8)
4. Describe the construction of different types of strain gauge and working principle.(16)
5. What are the sources of error in strain gauges? How the temperature effect is compensated? What is the basic principle of strain gauge? Explain its types with suitable diagram. (16)
6. (i)Explain the principle of operation, construction details and applications of Hot-wire anemometer. [May/June 2012] (8)
   (ii)Describe the principle of operation, construction details of resistance thermometers. Tabulate different metals used for resistance thermometer construction with their range of temperature measurement. (8)
7. (i) Explain how a thermistor can be used for temperature measurement.(8)
   (ii) Explain the measurement of humidity with the help of humidity sensor.(8) [Nov/Dec 2011]
8. (i) Explain in detail about constant temperature anemometer and constant current anemometer. (8)
   (ii) What is the basic principle of strain gauge? Explain its types with suitable diagram. [May/June 2010] (8)
9. (i) Explain the principle of operation and construction of hot wire Anemometer. (8)
   (ii) Describe the procedure for measuring humidity using hair hygrometer. (8)

10. Explains the construction and working and signal conditioning circuits of resistance thermometers with temperature compensation. (16)

UNIT_IV- VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS

PART A

1. What is the basic principle of Inductance potentiometer? [Nov/Dec 2009]

Transducers based on the variation of inductance are another group of importance devices used in many application. In these transducers self inductance or the mutual of a couple of coils is changed when the quantity to be measured is varied

2. Write a note on Induction potentiometer. [May/June 2011]

The primary is excited with alternating current. This induces a voltage into the secondary. The amplitude of this output voltage varies with the mutual inductance between the two coils and this varies with the angle of rotation.

3. Mention three principles of inductance transducer.

- Change of self inductance
- Change of mutual inductance
- Production of eddy currents.

4. Write the principle of Variable reluctance transducers. [May/June 2012]

Reluctance in a magnetic circuit is equivalent to resistance in an electrical circuit. Whenever the spacing (or coupling) between the two magnetic devices (or coils) changes, the reluctance between them also changes.

5. What is the need of demodulator in Variable Reluctance Accelerometer?

To detect motion on both sides of zero, a fairly involved phase- sensitive demodulator would be required. To eliminate the demodulator the iron core and springs were adjusted so that core was offset to one side by an amount equal to the spring deflection corresponding to 4 g acceleration.

6. What are the advantages and disadvantages of LVDT?

Advantages: High range, Friction and electrical Isolation, Immunity from external effects, High input and high sensitivity, Ruggedness, Low hysteresis and Low power consumption
Disadvantages: Relatively large displacements are required for appreciable differential output, They are sensitive to stray magnetic fields but shielding is possible, Many a times, the transducer performance is affected by vibrations, The receiving instrument must be selected to operate on A.C, The dynamic response is limited and Temperature affects the performance of the transducer.

7. Write the basic working principle of LVDT.[May/June 2010]

The primary winding is excited by an alternating current source. It produces an alternating magnetic field which in turn induces alternating current voltages in the two secondary windings. The amount of voltage change in either secondary winding is proportional to the amount of movement of the core. Hence we have an indication of amount of linear motion.

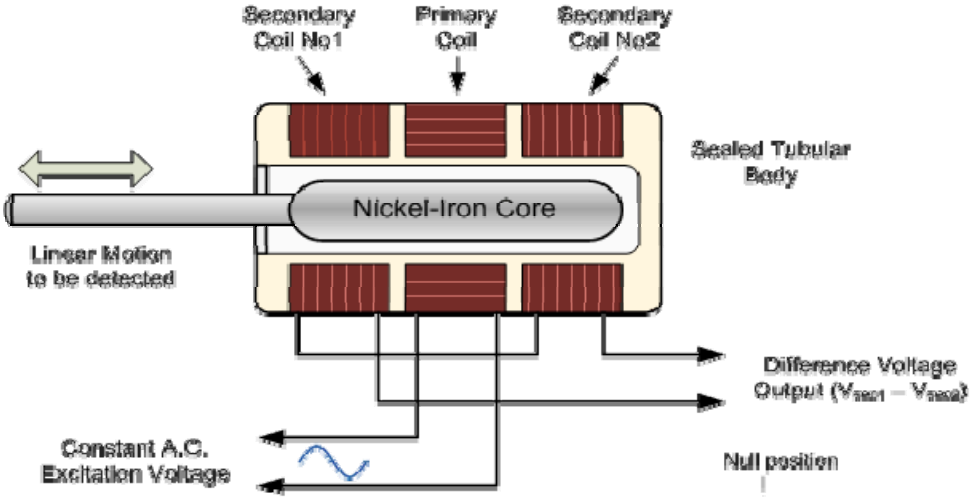
8. Mention any four applications of LVDT. [May/June 2012]

i. Displacement measurement and LVDT gauge heads.
ii. LVDT pneumatic servo follower
iii. LVDT load cells
iv. LVDT pressure transducer.

9. How to minimize null voltage in LVDT?

By choosing a core material which as less retentivity property

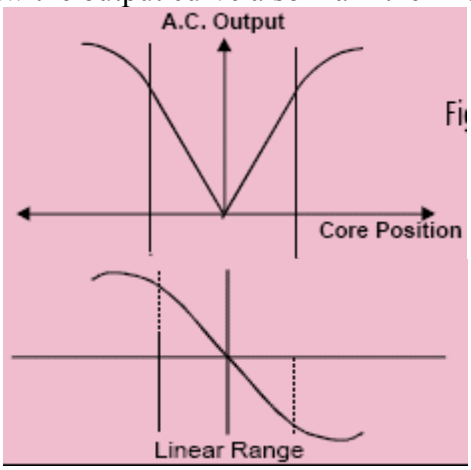
10. Draw the construction diagram of LVDT



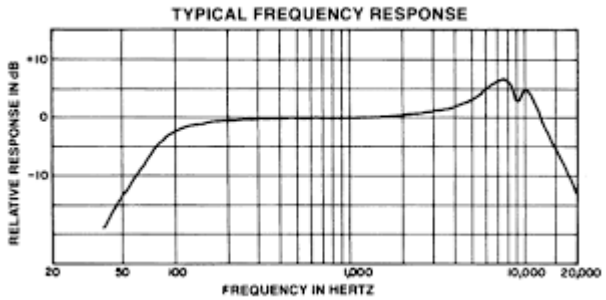
11. What is variable reluctance mutual induction tramsducer? [Nov/Dec 2009]

The Linear Variable Differential Transformer (LVDT) is the most common mutual inductance element

12. Draw the output curve also mark the linear range



13. Sketch the desired frequency response of a capacitor microphone. [Nov/Dec 2011]



14. What is the purpose of capacitor microphone? [May/June 2011]

The capacitive microphone is a modified version of the capactive pressure transducer in which the vibratory displacement of the membrane due to pressure variation result in variation of the capacitance.

15. What is capacitive microphone? [May/June 2010]

Capacitive microphone is a transducer which converts sound energy into electrical energy. The diaphragm is deflected by the sound pressure and acts as a moving plate of a capacitance displacement transducer.

16. What is null voltage?

Ideally the output voltage at the null position should be equal to zero. However, in actual practice there exists a small voltage at the null position

17. What is analog transducer?

These transducer convert input quantity into an analog output which is a continuous function of time. Thus a strain gauge, LVDT, thermocouple, thermistors,may be called as analog trasnducer.

18. Explain the working of a variable reluctance transducer.

When the displacement to be measured is applied, the air gap changes, causing a change in the reluctance, which in turn causes a change in inductance. Hence the change in inductance is a measure of the displacement applied. As the air gap decreases, the reluctance decreases, causing an increase in the inductance.

19. What is meant by pt-100?

ANS: Pt-100 is platinum RTD whose resistance at 0˚C is 100Ω.Hence Pt stands for platinum and 100 represents the resistance at 0˚C

20. What is principle of EI pickup transducer?

Theseinductivetransducers.workontheprinciplethatif'aconductingplate is placed. near.a coil carryingalternatingcurrent,eddycurrentsareproducedintheonductingplate.Theconductingplateacts asashort-circuitedsecondary winding of a transformer. The eddycurrents flowing in the plate produce a magneticfield oftheir ownwhichactsagainstthe magneticfield produced by the coil. This results in reduction of flux and thus the inductance,ofthe coil is reduced. Theneareris the plateto the coil, the higherarethe eddycurrents and thus higher is,the reduction in the inductance of the coil. Thusthe inductance ofthe coil alters with.variation' ofdistance-between the plate and the coil.

PART B

1. Explain Induction potentiometer (16)

2. Describe the principle of operation , Construction and characteristics of Variable reluctance transducers (16)
3. Write a note on EI pick up [Nov/Dec 2011] also Give the advantages, disadvantages, and applications of LVDT. (16)
4. Explain the Principle of operation and construction details of LVDT [May/June 2012] (16)
5. Describe in detail about the characteristics and applications of LVDT [NOV/DEC 2013] (16)
6. Explain the Principle of operation and construction details of Capacitive transducer [May/June 2011] (16)
7. List the characteristics and applications of capacitive transducer, Also explain how it can be used for level measurement. [May/June 2012] (16)
8. what are the types of Capacitive transducer also Explain in detail about capacitive thickness transducer and capacitive displacement transducer.[Nov/Dec 2009] (16)
9. Explain the operation of capacitor microphone with its frequency response. (16)
10. Compare capacitive and inductive transducers(16)

UNIT V - OTHER TRANSDUCERS

PART A

1. How can piezoelectric transducer be used as an accelerometer? [May/June 2012]
Piezoelectric crystal or element primarily responds to force input. A proof mass is added to the acceleration transducer for developing force under acceleration inputs. Thus a piezoelectric transducer can be used as an accelerometer.

2. What are the features of smart sensors? [May/June 2012]
   i. Automatic ranging and calibration through a built in digital system.
   ii. Auto-acquisition and storage of calibration constants in local memory of the field device.
   iii. Auto correction of offsets, time and temperature drifts.
   iv. Auto linearization of nonlinear transfer characteristics.

3. Explain the principle of Hall Effect transducer. [Nov/Dec 2011]
Voltage produced due to current and magnetic field

4. Distinguish between photovoltaic and photo conductive transducer. [Nov/Dec 2011]
The photo-electric effect causes a current to pass between two plates that already have a voltaic potential difference. The photovoltaic effect causes a voltage to grow between two plates that don't already have one. In photo electric effect, when light strikes on the one plate, electron in outer shell of atom is ejected.

5. What is the principle of operation of SQUID sensor? [May/June 2011]
A ring of superconducting material incorporating two Josephson Junctions is called the Superconducting Quantum Interference Device (SQUID). The SQUID is the most sensitive magnetic field detector in existence, and can also serve as radiofrequency detector

6. Define Hall Effect transducer. [May/June 2011]
The electrical voltage is produced due to magnetic field and current through the conductor v=IB

7. Write some properties of smart sensors. [May/June 2010]
   i. Automatic ranging and calibration through a built in digital system.
   ii. Auto-acquisition and storage of calibration constants in local memory of the field device.
   iii. Auto correction of offsets, time and temperature drifts.

iv. Auto linearization of nonlinear transfer characteristics.

8. What is Villari effect? [May/June 2010]

Certain ferromagnetic materials are considerably affected in their magnetic properties when they are mechanically stressed. This phenomenon is known as Villari effect.

9. Write the principle of piezoelectric transducer. [NOV/DEC 2013]

Piezoelectric transducers are based on piezoelectric effect according to which when a piezoelectric material is subjected to mechanical stress or force an electric potential appears across certain surfaces of the crystal on account of change in dimensions of the crystal.

10. How a smart sensor differs from ordinary sensor? [NOV/DEC 2013]

A smart sensor producing an electric output when combined with interface electronics circuits is said to be an intelligent sensors if the interfacing circuits can perform

(i) ranging (ii) calibration and(iii) decision making for communication and utilization of data.

11. Write any two applications of smart sensors.

- Smart sensors provide new sensing methods, improved computing capability and digital communication.
- As the number and nature of input variables is increasing in industries the computers are loaded with task of conditioning the signals coming from sensors.

12. What is meant by MEMS?

Micro Electro Mechanical Systems or MEMS is a technology that can be defined as miniaturized mechanical and electro mechanical elements that are made using the techniques of micro fabrication.

13. What does the smart sensor consist?

A smart sensor will be essentially composed of transducers, conditioners, an appropriate power supply, an inner computing capability, a communication interface for digital information and identification.

14. Name the types of fibre commonly used.

1. Mono mode 2. Multimode 3. Birefringent 4.coated

15. List the advantage of Fibre Optic Transducer.

i. Compatible with fiber optic communication systems
ii. Do not conduct electric current hence very useful in explosive environment
iii. Immune to electromagnetic interference and radiated signals.

16. Write the Classification of Fibre Optic Transducer

i. Intensity or Intrinsic transducer ii. Interferometric or extrinsic transducer .

17. Define optical fibre.

An optical fibre is a hair line thin strand of glass (or) glass like material having 2 (or) more layers. The refractive indices of the different layer will be reducing from inner core to outer layer. Because if reducing refractive indices of inter layers any light passed thro' the inner core can't go out of the fiber.

18. State the desirable properties of piezoelectric material.

The desirable properties of piezoelectric material are high stability, high output sensitivity, high output insensitivity to temperature and humidity and the ability to be formed into most desirable shape.

19. Give some application of Piezo Electric Transducer

i Used in measurement of Temperature. Pressure. Level and displacement
ii. Used to measure acceleration , Velocity

20. List the main advantage of smart sensor

The advantage of the smart sensors would be probably their higher credibility in measurements.

PART B

1. What is meant by piezo electric effect? Discuss in detail how the pressure can be measured by using piezo electric transducer? [Nov/Dec 2011] (16)
2. Describe the principle of operation of Hall Effect transducers. Discuss about its current sensing application. [May/June 2012] (16)
3. Define magnetostrictive effect also name two materials used in magnetostrictive transducers and describe any one application of magnetostrictive transducer. (16)
4. Explain in detail about digital displacement transducer with suitable diagram. [Nov/Dec 2009] (16)
5. Write short notes on:
   (i) Smart sensor (8)
   (ii) IC sensor of measurement (8)
6. Explain with a sketch the working of a fiber–optic displacement transducer. Draw its input–output characteristic (16)
7. Describe the fundamentals of SQUID sensor. Explain working of DC SQUID and RF SQUID. List some of the applications also Write short notes on Film sensors (16)
8. Describe the role of MEMS in Instrumentation. (16)
9. Write notes on
   a) Fiber optic sensors
   b) Smart Sensors
   c) Nano Sensors [May/June 2011] (16)
10. Write short notes on:
    (i) Piezoelectric accelerometer (8)
    (ii) Digital encoder (8)