

ANNAI MATHAMMAL SHEELA ENGINEERING COLLEGE
DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING
INDUSTRIAL INSTRUMENTATION-1

Two mark Questions and Answers

Unit I

MEASUREMENT OF FORCE, TORQUE AND VELOCITY

1. Define force.

Force may be defined as a cause that produces resistance or obstruction to any moving body or change the motion of a body.

Force is given as

$$F = MA$$

Where, F = Force

M = Mass(Kg)

A = Acceleration (kg/m^2)

2. Define speed.

Speed is a variable which refers to the revolutions per minute of some piece of rotating equipment.

3. What are the types of electromagnetic tachometer generator?

- a) A.C. tacho generator
- b) D.C. tacho generator

4. What are the types of D.C. tacho generator?

- a) Permanent magnet type
- b) Separately excited field type

5. What are the disadvantages of D.C. tachogenerator?

A.C. ripple is present in the output signal. The magnitude of the ripple is 2% of the output D.C. level.

6. Name the types of rotor used in A.C. tacho generators.

- a) Drag cup rotor
- b) Squirrel cage rotor

7. What are the advantages of Squirrel cage rotor?

- a) Cheaper
- b) Occupies less space

8. Give some applications of drag cup tacho generator.

It is commonly used in the speedometers of motor vehicles and as a speed indicator for aero engines.

9. Give the formula to calculate the shaft speed.

Shaft speed = (disk speed * No. of openings in the disk) / No. of images

10. Define torque.

Torque is defined as the force which tends to change the linear motion or rotation of a body.

11. What are the types of torque transducer?

- i) Inline rotating torque sensor
- ii) Inline stationary torque sensor
- iii) Optical torque sensor
- iv) Proximity torque sensor

12. What are the advantages of optical torque sensor?

- i) Low cost,
- ii) small physical size

13. Write the formula for determining the actual speed in a stroboscope.

Actual speed,

$$F_r = f_l f_n (n-1) / (f_n - f_l)$$

f_n is the highest flashing speed

f_l is the lowest flashing speed

n is the no. of flashing frequencies

14. Define load cell.

Load cell are devices that convert force into pressure, which are then measured.

15. Why magneto elastic load cell is also called pressductor load cell?

The degree of change has a direct relationship with the applied stress or force. So it is called pressductor load cell.

16. What are the advantages of magneto elastic load cell?

- i) Extremely robust transducer
- ii) Produces relatively high output signal levels
- iii) Overload ratings are as high as 15 times the rated loads

17. What are the factors affecting the accuracy of force measurement?

- i) Force must either be reasonably constant in value or changing gradually and continuously in one direction. Otherwise the fluctuating forces of the masses of moving parts may result in a very low frequency and consequent lag in accurate indication.
- ii) The force must act perpendicular to the platform of the scale, otherwise only the cosine component is measured.
- iii) The measurement may require correction for local variation in gravitational constant.
- iv) The delicate parts of the force measuring devices must be properly maintained and protected from abuse.

18. Why magneto-elastic load cell is called pressductor?

The degree of change has a direct relationship with applied stress or force. So it is called pressductor.

19. What are the types of load cells?

- i) Hydrostatic type
- ii) Pneumatic load cell
- iii) Magneto-elastic load cell
- iv) Strain gauge type load cell

20. What is meant by stroboscope?

The stroboscope is a simple, portable manually operated device, which may be used for measurement of periodic or rotary motions. Basically, the instrument is a source of variable frequency flashing brilliant light, the flashing frequency being set by the operator. The circuit used is based upon variable frequency oscillator, which controls the flashing frequency. The speed is measured by adjusting the frequency so that moving objects are visible only at specific intervals of time.

21. What is meant by strobotron?

The stroboscope consists of a source of flashing light whose frequency can be varied and controlled. This source is called a strobotron.

22. What is prony brake?

The prony brake is the device, which is most popular for determining the torque exerted by engines or motors. It consists of a hollow drum attached to the motor or engine shaft and an arm attached to a band with friction lining, which passes around the drum. The free end of the arm either is attached to a hanging scale or rests on the platform of a bench scale. Load is applied by increasing tension, on the band. The heat generated due to friction is dissipated by water contained in the drum.

23. What are the needs for viscosity measurement?

- a) We can analyze the flow rate by measuring viscosity
- b) In spray painting applications, the viscosity of the fluid should be maintained at a particular level.

24. What is the principle of pressductor?

The operation of this sensor is based on the change in permeability of ferromagnetic materials under applied stress. When a load is applied, the stresses cause distortions in the flux pattern, generating an output signal proportional to the applied load.

25. What are the types of electric tachometer?

- 1. Eddy current or drag type tachometer
- 2. Electric generator type tachometer
- 3. Contact less type tachometer
- 4. Ignition type tachometer
- 5. Frequency type tachometer
- 6. Strboscopic type tachometer

26. What are the types of mechanical type tachometer?

1. Revolutions counter with time period
2. Centrifugal force tachometer
3. Resonance tachometer

27. What is tachometer?

Tachometer is the devices most commonly used for measuring speed.

28. What are the advantages of stroboscope?

1. Used to measure periodic or rotary motions without making contact with rotating body or disturbing the equipment under test.
2. Mechanical equipment may be observed under actual operating conditions with the aid of stroboscopes.
3. Parasitic oscillations, flaws, and unwanted distortion at high speeds are readily detected.
4. The flashing-light stroboscopes employ gas discharge tubes to provide a brilliant light source of very short duration.

Unit II

MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY

1. What is meant by seismic instrument?

A system which consists of a mass- spring and damper combination housed in a chamber is called seismic instrument.

2. Give some of the materials which are used for the manufacturing of a float.

- i. Pyrex,
- ii. Plastic

3. For what purpose accelerometers are used?

- i. For the measurement of shock & vibration
- ii. For gross measurement of acceleration of vehicles like aircraft, submarines etc.

4. What are the advantages of LVDT?

- i. It is used for steady state and low frequency vibration measurements.
- ii. It is used for the measurement of vibrations of higher frequencies.

5. Define piezo electric effect.

If the dimension of crystal are changed by the application of a mechanical force, an electrical potential appears across the crystal. This effect is called piezo electric effect.

6. What are the features of piezo electric accelerometers?

- i. Small in size and weight
- ii. It can be used for vibration and shock measurements.
- iii. High output impedance
- iv. Their response is poor at low frequencies

7. List some of the applications of strain gauge accelerometers.

It is used for the measurement of acceleration and vibration in vehicles, aircrafts, bridges, hoists, cranes & lifts.

8. What are the two modes of seismic instrument?

- i. Displacement mode
- ii. Acceleration mode

9. Define density.

It is defined as the mass per unit volume of a substance under fixed conditions.

10. Define specific gravity.

It is defined as the ratio of density of one substance to the density of another reference substance both obtained at same temperature & pressure.

11. Define viscosity.

It is the property of the fluid which gives the resistance to the flow.

12. For what purpose mechanical type vibration instruments are used?

It is used for the measurement of

- a. Motion of 2 points w.r. to each other (relative motion)
- b. Motion w.r.to earth (absolute motion)

13. Write down the excitation voltage and accuracy strain gaugeload cell.

Excitation voltage may be a.c. or d.c in the range of 5 to 25 volts. Accuracy is +0.1% of the full scale output.

14. What are the types calibrations used for accelerometers?

1. Static calibration.
2. Steady-state periodic calibration.
3. Pulsed calibration.

15. What are the needs of accelerometer?

Accelerometers are constructed for two specific types of purposes:

1. For measurement of shock and vibration (this type generally employs the deflection method where basically the displacement is measured by known displacement transducers and from the knowledge of the proof mass, the value of acceleration is found out which usually is the absolute value).
2. For gross measurement of acceleration of vehicles like aircraft, submarines. (Both deflection as well as null balance methods are used.)

16. What are the methods of vibration measurement?

1. Methods based on sensory perception
2. Mechanical methods
3. Electrical methods
4. Optical methods

17. What is Baume scale?

The Baume scale is actually two scales, one for liquids that are more dense (heavier) than water and one for liquids that are less dense (lighter) than Water.

18. What are the causes of vibration?

Imbalance, Resonances, Misalignment, Mechanical and Electrical asymmetry, Worn Ball Bearings, Slippage, Oil Whirl and Oil Whip.

19. What are the possible systematic errors in vibration measurement?

1. Errors in amplitude and phase in seismic systems.
2. Contact resonance.
3. Faulty mounting of relative vibration pick-up.
4. Crinkles.
5. Influence of the pick-up on the vibrating object.
6. Acceleration too high for a relative vibration pick-up.
7. Distortion on the CRO
8. Hum.
9. Effect due to impact.

20. What are the choices of vibration pick-up?

The choice of a proper vibration pick-up is made by considering following points:

1. Mechanical impedance pick-up
2. Sensitivity
3. Accuracy of measurement
4. Frequency ranges
5. Phase characteristics
6. Power for electrical equipment

21. What is Stokes Law?

If a solid body is passed through a liquid, a thin layer of the liquid in immediate contact with the solid body is at rest and due to the viscosity of the liquid a viscous drag is exerted on the moving body. In order to keep the body moving inside the liquid with a uniform velocity, a steady force should be applied to the body to overcome the effect of the viscosity of the liquid.

22. What are methods for controlling exposure to vibration?

1. Anti-vibration tools
2. Anti-vibration Gloves
3. Safe work practices
4. Employee education
5. Whole-body vibration

**UNIT-III
PRESSURE MEASUREMENT**

1. What are the main parts of an electrical pressure transducer?

- (a) Pressure sensing element such as a bellows, a diaphragm or a Bourdon tube.
- (b) Primary conversion element. e. g. resistance or voltage.
- (c) Secondary conversion element.

2. What are the advantages of strain gauge pressure transducer?

- i) Small & easy to install
- ii) Good accuracy
- iii) More stable
- iv) Fast speed response
- v) Simple to maintain

3. What are the disadvantages of strain gauge pressure transducer?

- i) High cost
- ii) Requires constant voltage supply.
- iii) Electrical readout is necessary.
- iv) Temperature compensation is required.

4. What is the principle of operation of a piezoelectric pressure transducer?

When pressure is applied to a piezoelectric crystal such as quartz, an electrical charge is generated.

5. What are the types of thermal conductivity gauges?

- (a) Pirani gauge
- (b) Thermocouple gauge

6. What is the purpose of ionization gauge?

Ionization gauge is used to measure the density of a gas.

7. Write down the formula for calculating the pressure in a McLeod gauge

$$P = KHH_0(1-KH)$$

K -> Constant

H -> Difference in heights of the two mercury columns.

H₀-> Height of the top of the closed capillary tube above the line marked on the tube.

8. What is the function of a dead weight tester?

Dead weight tester is used to calibrate bourdon gauges .It is used as a measuring device and also as a calibration method.

9. What are the disadvantages of using thermocouple gauge?

- (i) Easily damaged by organic vapours
- (ii) The filaments can be coated with a deposit of devapourised vapours
- (iii) which alters the way the filament transfers heat.

10. Define thermal conductivity.

The ability of the material to carry heat by conduction is called as the thermal conductivity.

11. What are the materials used in the construction of piezoelectric pressure transducer?

These devices use piezoelectric characteristic of crystalline and ceramic materials such as quartz.

12. What are the main parts in electrical pressure transducer?

- i) Pressure sensing element such as a bellow, a diaphragm or a bourdon tube.
- ii) Primary conversion element
- iii) Secondary conversion element.

13. What are the advantages of capacitive pressure transducer?

- i) It gives rapid response to changes in pressure
- ii) It can withstand a lot of vibration
- iii) It has a good frequency response and can measure both static & dynamic changes.

14. What is a vacuum pressure?

Pressure which are below the atmospheric pressure are called vacuum pressure.

15. What is the purpose of calibrating a pressure measuring instrument?

It is used to adjust the output signal to a known range of pressure. It includes zero, span and linearity adjustment.

16. Determine the range of pressure which can be measured by pirani gauge & thermocouple gauge.

- a) In pirani gauge-> Pressure range from 10^{-5} torr to 1 torr can be measured.
- b) In thermocouple gauge-> Pressure range from 10^{-4} torr can be measured.

17. What are the disadvantages of LVDT pressure transducer?

- i) Large core displacement are required for appreciable amount of differential output.
- ii) Temperature affects the performance of the transducer.
- iii) They are sensitive to stray magnetic fields.

18. What is the principle of operation of a capacitive pressure transducer?

It is based on the principle of the familiar capacitance equation of the parallel plate capacitor (ie) $C = \epsilon_0 \epsilon_r A / d$ farad

(ie) capacitance = $\epsilon A / d$

$\epsilon_0 = 8.85 \times 10^{-12} \text{ f/m}^2$

ϵ_r = Dielectric constant

d = Distance between two plates.

A = Area of each plate

19. Define Atmospheric pressure.

The pressure due to the air surrounding the earth surface is called as atmospheric pressure.

20. Define Gauge pressure.

The gauge pressure is the difference between the absolute and the local atmospheric pressure.

21. Define Ionization.

Ionization is the process of knocking off an electron from an atom and thus producing a free electron and positively charged ion

22. What are the shapes of Bourdon tube available?

- a) C-shape
- b) Helical type
- c) Spiral type

23. What are the fluids used for manometers?

The most common fluids for manometers are Water, red oil and mercury. To minimize the effects of freezing and evaporation, kerosene or antifreeze may be used.

24. What is corrugated diaphragm?

By introducing corrugation in the circular diaphragms, the pressure deflection relationship is maintained for larger movement. The deflection is proportional to

- a) the radius of the diaphragm
- b) the radius of each corrugation
- c) the depth of the corrugation
- d) the thickness of the material

25. What is bellows element?

The bellows element is cylindrical in shape and the wall of this cylinder is thin and corrugated. The wall of the bellow is about 0.1mm thick and is made of some springy material such as stainless steel, brass or phosphor bronze. This bellows element is open at one end to receive the applied pressure and is closed at its other end. This other end is usually attached with a rod. In many cases a spring is placed inside the bellow to enable the bellows to regain its original shape when the applied pressure is relieved.

**UNIT-IV
TEMPERATURE MEASUREMENT-I**

1. Define temperature.

The temperature of a substance is a measure of hotness or coldness of that substance.

2. What is the difference between temperature and heat?

Temperature is defined as “degree of heat” Heat is used to mean “quantity of heat”.

3. What are the temperature scales?

- i) Lower fixed point or ice point.
- ii) Upper fixed point or steam point.

4. Define triple point.

A particular temperature and pressure at which three different phases of one substance can exist in equilibrium is known as “triple point”.

5. Write some methods of measurement of temperature.

- i) Expansion Thermometer.
- ii) Filled system Thermometer.
- iii) Electrical Thermometer.
- iv) Pyrometer.

6.What are the different types of filled system Thermometer?

- i) Gas-filled Thermometer.
- ii) Liquid-filled Thermometer.
- iii) Mercury-filled Thermometer.
- iv) Vapour-filled Thermometer.

7.How radiation error occurs?

It occurs due to the temperature difference between bulb and other solid bodies in filled system Thermometer.

8.Define Seeback effect.

If two dissimilar metals are joined together to form a closed circuit, there will be two junction where they meet each other. If one of these junctions is heated, then a current flow in the circuit which can be detected by a galvanometer. The amount of current depends on the difference in temperature between the two junctions and on the characteristics of the two metals. This was observed by Seeback & hence known as Seeback effect.

9.Which effect is used in thermocouple?

Seeback effect is used in thermocouple.

10.What are the various types of the thermometers?

Copper-Constantan, Iron-Constantan, Platinum-Rhodium, Chromal-Constantan & Chromal-Alumel.

11.What is the purpose of protecting tube in a thermocouple?

It is used to protect the thermocouple from harmful atmosphere, corrosive fluids and also to prevent from mechanical damage.

12.State the principle of operation of thermistor

They have negative temperature coefficient of resistance i.e. with increase in temperature the resistance decreases and vice-versa.

13.What is the drawback in two wire RTD?

Two wire RTD's will give a large lead wire & hence it is impossible for accurate measurement of temperature.

14.Give some of the temperature instruments.

- i) Resistance thermometer.
- ii) Thermocouple.
- iii) Thermistor.

15.Define Barometric effect.

The effect due to change in atmospheric pressure is known as Barometric effect.

16.How Barometric error can be minimized?

It can be minimized by keeping the filled system at a pressure sufficiently larger than the atmospheric pressure.

17.What are the advantages of Filled system Thermometer?

- i) Low cost.
- ii) Less maintenance requirement.
- iii) Rugged construction.
- iv) Absence of need of electric power.

18.List some of the disadvantages of bimetallic thermometers.

- i) Possibility of calibration change due to rough handling.
- ii) Limitation to local maintaining.
- iii) Availability of indication type only.

19.What is aging effect?

The resistance of the thermistor increases when time lapses. This is called aging effect.

20.What is self heating effect ?

When the current passes through the thermistor, it gets heated. This is called as self heating effect.

21.What are the shapes of thermistors ?

- a) Bead type
- b) Wafer type
- c) Washer type
- d) Disc type
- e) Rod type

22.What are the materials used in thermistors?

Thermistors are composed of sintered mixture of metallic oxides such as manganese, nickel, cobalt,copper, iron and uranium.

23.What are the characteristics of thermistors?

1. Resistance – temperature characteristics.
2. Voltage – current characteristics.
3. Current- Time characteristics.

24.What are the common liquids used in filled system thermometer?

The common liquids that are used in filled in system thermometers are mercury, ethyl alcohol,xylene, ether, toluene,etc.

25.What is radiation effect? How it is compensated?

Radiation error occurs due to temperature difference between the bulb and other solid bodies around it. A radiation shield around the bulb minimizes radiation error.

26.What are the three electrical methods of temperature measurements ?

1. Resistance thermometer (RTD).
2. Thermistors.
3. Thermocouple.

27. What is the disadvantages of two wire RTD ?

Two wire RTD's will give a large lead wire error & hence it is impossible for accurate measurement of temperature.

28.What is three lead RTD?

Three leads coming out of the resistance thermometers, the method is known as three lead method.

29.What is thin Film RTD?

Thin film RTD's are made up of a thin layer of a base metal embedded into a ceramic substrate and trimmed to produce the desired resistance value. This method allows for the production of small, fast response, accurate sensors.

UNIT-V TEMPERATURE MEASUREMENT-II

1. Define first law of thermocouple.

The thermal emf of a thermocouple with junctions at T1 and T2 is totally unaffected by temperature elsewhere in the circuit if two metals used are each homogenous.

2.What are the two types of signal conditioning?

- a. Analog
- b. Digital

3. What are the possible ways of signal conditioning?

- a. A .Linearisation
- b. Conversion
- c. signal transmission.
- d. D. Digital interface.

4. Define heat radiation.

When a body is heated, it emits thermal energy known as heat radiation.

5. Define pyrometry.

Pyrometry is the technic for measuring the body's temperature by measuring its electromagnetic radiation.

6. What are the two types of pyrometer ?

- a. Radiation pyrometer
- b. optical pyrometer.

7.What is radiant energy?

Radiant energy is the energy transmitted in the form of electromagnetic waves and is explained by radio and radar radiation, infrared light and ultrasonic radiation and X ray and gamma-ray radiation.

8. Define dissipation constant.

It is the power required to raise the RTD temperature by 1 degree centigrade.

9.What is meant by thermopile?

When thermocouples are connected in series they are called as thermopiles.

10.What is temptip?

The thermocouple has to be dipped inside the molten metal and kept inside till it senses the correct temperature normally such thermocouples are called thermocouple tips (Temptips).

11. What are the errors in total radiation pyrometer?

- a. They are sensitive to emittance errors.
- b. Sensitive to any obstructions in the line of sight between the pyrometer and the hot body.

12.List some of the applications of total radiation pyrometer.

- i) Use for moving target.
- ii) Used in furnaces.
- iii) Used for the temperatures above the practical operating range of thermocouple.

13. What are the advantages of total radiation pyrometer?

- i) High temperature measurement.
- ii) Fast response speed
- iii) Modulate cost and high output

14. What are the advantages of selected radiation pyrometer?

The transmission losses are minimized and accuracy is improved.

15.What are the types of two colour pyrometer?

- a) Selected radiation pyrometer
- b) broad band pyrometer
- c) Chopper broad- band pyrometer
- d) Narrow band radiation pyrometer.

16.What is bolometer?

Bolometer is a thermal detector, which changes its electrical resistance as a function of the radiant energy striking it.

17. What are the advantages in ratio pyrometer?

- a) Less accurate
- b) More cost about 50-100% more than other types of pyrometer.

18. What are the disadvantages of total radiation pyrometer?

- i) Non linear scale.
- ii) Emissivity of target material affecting measurement.
- iii) Errors due to presence of gases and vapours.

19. Give the formula for rate of radiation emitted per second.

$$E = KT^4$$

T -> Temperature

K -> Constant

20. Write the formula for rise in temperature of RTD due to self heating effect.

$$T = P/P_d$$

P -> power dissipated from RTD circuit

P_d -> Dissipation constant of RTD in mW/C

21. What is meant by narrow band pyrometer?

A radiation pyrometer that is sensitive to only a narrow segment of wavelength within the total radiation spectrum. Optical pyrometers are one of the devices in this category.

22. What is wide band (total) pyrometer?

A radiation thermometer that measures the total power density emitted by the material of interest over a wide range of wavelengths.

16 Mark Questions

UNIT-I

1. Explain the method of force measurement using Strain gauge load cell. **(Dec 2013)**
2. Describe the principle and construction of
 - 1) Piezo electric load cell
 - 2) Drag cup DC tachogenerator **(May 2012, 2013) (May2010)**
3. With neat diagram explain, the construction and working of
 - 1) Capacitive torque transducer
 - 2) Stroboscope **(May 2012)**
4. Explain the magneto-elastic load cell with neat Diagram. **(May 2013, Dec 2009)**
5. Explain the DC & AC tachogenerator with diagram and mention its merits and demerits. **(May 2013)**
6. Explain how the torque is measured by strain gauge torsion meter?
7. Write note on: (1).Hydraulic Load Cell. (8) (2).Strain Gauge type torque measurement.(8) **(Dec 2009)**
8. Discuss construction and working of TachoGenerator with neat diagram.(16) **(Dec 2009)**
9. Explain the construction and principle of operation of drag cup rotor A.C. tachogenerator. **(Dec 2010)**
10. With a neat diagram, explain the construction and working of Stroboscope and (8) **(Dec 2010)**
11. Explain the piezoelectric load cell with block diagram and its equivalent circuits. **(May2010)**
12. Explain the principle and construction of **(Dec 2011)**
 - (i).Piezo electric transducer. (8)
 - (ii).Stroboscope. (8)
13. Draw the diagram and describe the working and construction of **(Dec 2011)**
 - (i).Inductive torque transducer. (8)
 - (ii).Electric balance.
- 14.(i) Explain any two types of load cell with a neat diagram. (8) **(May2011)**
 - (ii) Write short notes on stroboscope. (8)
15. (i) What are the differences between AC and DC tachogenerator. (8) **(May2011)**
 - (ii).Explain any two types of torque measurement with a neat sketch. (8) **(May2011)**

UNIT-II

1. Explain in detail about LVDT and Strain gauge Accelerometer. Give its merit and demerits.**May2010**
2. Explain float type and bridge type density meter? **(May 2013)**
3. Explain pressure head type and ultrasonic type density meter.
4. List the types of Accelerometers. Explain any one type of accelerometers in detail.(16) **(Dec 2009)**
5. Describe the working of Pressure Head Type Densitometer (16) **(Dec 2009)**
6. Draw the schematic diagram of seismic transducer and explain its operation both in the displacement mode and acceleration mode. (16)
7. Discuss the construction and working of (i) Potentiometric type accelerometer and (8) (ii) LVDT accelerometer.
8. Explain the differential pressure type densitometer. **(may 2010)**
9. Draw and explain variable reluctance type accelerometer and mention the merits and demerits with application. (16) **(Dec 2011) (May 2012) (May 2013)**
10. Discuss the seismic transducer with diagram and explain the operation in the displacement mode and acceleration mode. (16) **(Dec 2011) (Dec 2012).**
11. Explain mechanical type vibration measuring instruments with merits and demerits. (8) **(May 2011)**
12. Explain the merits and demerits of ultrasonic densitometer with its application. **(May 2011)**

UNIT-III

1. Explain Bourdon tube and its types
2. Explain about bellows with neat diagram
3. Explain about diaphragm with diagram
4. Explain Piezoresistive pressure sensor and capacitive pressure transducer (**May 2011**)
5. Explain hot and cold cathode type ionization gauge
6. Describe the pressure measurement using (i) LVDT with diagram, (ii) Capacitive transducer (**Dec 2011**)
7. Explain the pressure measurement for the following categories (i) McLeod gauge (ii) Thermal conductivity gauge (**Dec 2011**)
8. Discuss the principle and the construction of LVDT with neat diagram. Explain the merits and demerits (**Dec 2012**)
9. With a neat sketch derive and explain any two types of Manometers. (**June 2012**)
10. How are the following transducers used to measure low pressure? (i) Thermocouple vacuum gauge (ii) Pirani gauge (iii) Ionization gauge (**Dec 2010**)
11. Explain the concept of vacuum measurement with one example (**May 2011**)

UNIT-IV

1. Explain filled system thermometers with its types (**June 2012**)
2. What are the possible sources of errors in filled system thermometers and how it is compensated? (**Dec 2011**)
3. Explain in detail about RTD and its characteristics
4. Explain in detail about thermistors and its characteristics
5. How temperature scale has been standardized? What are the fixed points and how they are used in temperature standards?
6. Explain bimetallic thermometer and its types (**Dec 2010, Dec 2011, and Dec 2012**)
7. Discuss the electrical methods of measuring temperature
8. Describe the construction and working of 3 wires and 4 wires RTDs. (**Dec 2010, May 2011, Dec 2012, and June 2012**)
9. Explain the different types of expansion thermometers
10. Discuss the various types of vacuum pressure measurement

UNIT-V

1. Explain the Thermocouple junctions and different types of Reference junction used.
2. Describe about the fabrication of Industrial Thermocouple and protective sheath.
3. Explain the Thermocouple laws.
4. Explain Cold junction compensation in Thermocouple. (**May 2011**)
5. What is Thermocouple? How Thermocouple is used for measuring temperature?
6. Explain Fiber optic temperature measurement. (**May 2011**)
7. Write short notes on Selective radiation pyrometer.
8. Explain Optical radiation pyrometer. (**May 2011, May 2013**)
9. Discuss in detail about Total radiation pyrometer. (**May 2013**)
10. Describe about Two-color radiation pyrometer. (**May 2011, May 2013**)
11. Explain Signal conditioning circuit for thermocouple. (**Nov 2011**)

