**UNIT II(Topic1-3)**

**MULTIPLE CHOICE QUESTIONS**

1. Mutual inductance depends on \_\_\_\_\_\_\_\_\_

a) self-inductance

b) self-inductance and coefficient of coupling

c) coefficient of coupling

d) permittivity of air

Ans:b

2.4. Reluctance of a coil is given by which of the following relation?

a) S = 1⁄A

b) S = 1⁄μ

c) S = a⁄μA

d) S = 1⁄μA

Ans:d

3.Self-inductance depends on \_\_\_\_\_\_\_\_

a) permeability

b) permittivity

c) plank’s constant

d) rydberg constant

Ans:a

4. What is the relation between the self-inductance and the reluctance of a coil?

a) directly proportional

b) inversely proportional

c) no relation

d) constant

Ans:b

5.9. An inductive transducer measures the variation in \_\_\_\_\_\_\_\_

a) reluctance

b) resistance

c) capacitance

d) self-inductance

Ans:d

6.Which of the following represents drawback of the inductive transducer for displacement measurement?

a) Act of electromagnetic force of attractionsz

b) Lower sensitivity

c) Requirement of large displacement

d) None of the mentioned

Ans:a

7.Which of the following represents the application of inductive transducers?

a) Displacement measurement

b) Thickness measurement

c) Both displacement and thickness measurement

d) None of the mentioned

Ans:c

8.Which of the following represents materials used for thickness measurement using inductive transducers?

a) Material should be magnetic in nature

b) Material should be magnetic and conducting

c) Material should be magnetic and non-conducting

d) All of the mentioned

Ans:d

9.For thickness measurement, the material should have constant permeability and resistivity.

a) True

b) False

Ans:a

10.Electrodynamic vibration transducers are based on \_\_\_\_\_\_\_\_\_\_\_\_\_

a) Magnetostriction

b) Electromagnetic induction

c) Self inductance

d) None of the mentioned

Ans:b

11.LVDT is a \_ \_ \_ \_ \_

a) Active transducer

b) Passive transducer

c) Both a) and b)

d) None of the mentioned

Answer: b

13. Synchro is a rotating device that operates on the same principle as a \_ \_ \_ \_ \_ \_

and produces a set of voltages, correlated to angular position.

a. Transformer principle

b. Faradays principle

c. Lens law

d. Tesla principle

Answer: Transformer principle

14.The size of air-cored transducers in comparison to their iron-cored counter parts is

a.smaller

b.bigger

c.same

d.unpredictable

Answer: B

15.Capacitive transducer operate upon the principle of

a.variation of over -lapping area of plates

b.variation of separation of plates

c.variation of relative permittivity of dielectric material between two plates

d.all of the above

Answer: d

16.A Differential transformer is a

(i).Differential voltage of Two secondary windings of a transformer is varied by positioning

the magnetic core through an externally applied force

(ii).is used for Pressure measurement

(iii).is used for Force measurement

(iv).is used for Position measurement.Choose the correct option

a.(i) only

b.(ii)only

c.(iii) only

d.(i)(ii)(iii)(iv)

Ans:a

17.A Displacement of results in the secondary voltage of 5V in an LVDT.If the secondary voltage is 3.2V,the absolute value of the corresponding displacement is

A.4mm

B.6mm

C.8mm

D.10 mm

Ans:c

**Hint:**

V1/V2=d1/d2

d2=(V2/V1)\*d1

18.Which of the following represents the drawback of the inductive transducer for displacement measurement?

a) Act of electromagnetic force of attraction

b) Lower sensitivity

c) Requirement of large displacement

d) None of the mentioned

Ans:a

19.For measuring the Magnitude as well as direction of displacement using LVDT,it is used in conjunction with

a.an Amplitude modulator with LPF

b.a Phase sensitive demodulator followed by LPF

C.a Twin T network

D.integrator

Ans:b

20.Which of the following represents correct conversion for magnetostrictive transducers?

a) Mechanical energy to magnetic energy

b) Mechanical energy to electrical energy

c) Magnetic energy to electrical energy

d) Mechanical energy to acoustic energy

Ans:a

21.Which of the following represents negative magnetostriction?

a) On increasing stress permeability decreases

b) On decreasing stress permeability decreases

c) On increasing stress conductivity decreases

d) None of the mentioned

Ans:a

22.Which of the following elements shows increase in magnetic flux density on decreasing stress applied?

a) Nickel Iron alloy

b) Nickel

c) Both Nickel and Nickel iron alloy

d) None of the mentioned

Ans:b

23.Which of the following materials shows an increase in permeability with increase in tensile stress?

a) Negative magnetostriction materials

b) Non magnetostriction materials

c) Positive magnetostriction materials

d) None of the mentioned

Ans:C

24.Magnetostrictive transducer can be used to measure \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a) Force

b) Acceleration

c) Torque

d) All of the mentioned

Ans:d

25.Which of the following represents the use of including additional mass in acceleration transducer?

a) To prevent system response to transverse acceleration

b) To prevent system response to linear acceleration

c) To prevent system response to angular acceleration

d) None of the mentioned

Ans:a

26.Magnetostrictive transducers are more sensitive than piezoelectric transducers.

a) True

b) False

Ans:b

27.Which of the following torque can be measured using magnetostrictive transducers?

a) Large amplitude torque

b) Small amplitude torque

c) Torque of an amplitude

d) Cannot be used to measure torque

Ans:b

28.Which of the following represents correct expression for sensitivity in a magnetostrictive transducer?

a) ΔB

b) ΔB/σ

c) σ

d) σ/ΔB

Ans:b

29.Magnetostrictive transducers can only be used in static forces.

a) True

b) False

Ans:b

30.Which sensor is used in mobile phones?

a) Capacitive touch sensor

b) Temperature sensor

c) Humidity sensor

d) Weight sensor

Answer: a. Capacitive touch sensor

**Topics (4-6)MCQs**

1)---------is a modified version of the plunger type sensors.

**a)LVDT** b)Strain Gauge c)Magnetostrictive Transducer d)Electromagnetic Transducer

2) -------is a differential transformer.

**a)LVDT** b)Strain Gauge c)Magnetostrictive Transducer d)Electromagnetic Transducer

3) The LVDT’s can be designed in various sizes for various ranges from a -------movement of the core.

a) few µm to even 1 mm **b) few µm to even 1m** c) few µm to even 1cm d) few µm to even 2cm

4) Depending on the choice of the materials the LVDT can be used in a temperature range of------

a) +50 to +1500˚ C b) +50 to +500˚ C c) -50 to -1500˚ C **d) -50 to -500˚ C**

5)In the inductive transducer, the variation of inductance can often be measured by -----circuits

a) Wheatstone Bridge b) Kelvin bridge **c)AC bridge** d)DC bridge

6) In LVDT the output voltage induced in a secondary coil is Vos = ------

**a) -n(dɸ/dt)** b) -2n(dɸ/dt) c) –n/(dɸ/dt) d) -2n/(dɸ/dt)

7) In the variable reluctance type inductive transducer, the core is a ----

a) Paramagnetic materials b) Diamagnetic materials c**) Ferromagnetic materials** d) Ferrites

8)In which of the following coil arrangement , the linearity range is extended by proper profiling of the secondary coils?

a) **balanced profile secondaries** b) balanced over wound linear tapered secondaries c) over wound linear tapered secondaries d) balanced linear tapered secondaries

9) In LVDT using ferrite core, the supply frequency may be -------,so that the sensitivity can be ----- to a certain extent.

a) decreased, decreased **b) increased, increased** c) decreased, increased d) increased, decreased

10)In inductive transducer , the coil is wound on -------

a) Ferrite Core b**) Iron Powder Cores** c) Laminated Core d) air core

1. How many types of synchros are available?
2. **2** b)3c)4 d)5

12)In torque type sensors, when θ1 ≠ θ2, the torque produced on the receiver synchro rotor T will be ---

**a) Kt sin (θ1- θ2)**  b**)** 2Kt sin (θ1- θ2) c)Kt sin (2θ1-2 θ2) d) Kt cos (θ1- θ2)

13)In case of synchro control transformer, the rotor of the receiver unit is usually made ------ to make the air gap uniform.

a)spherical b)hexagonal c) circular **d)cylindrical**

14)For a parallel plate capacitor the capacitance Cp= ---

**a) εα/x** b) 2εα/xc) ε/αx d)2 ε/αx

15)The parallel plate capacitive sensor is often used in a differential form with --------number of plates .

a)2 **b)3** c)4 d)5

1. The field strength H is given by --------
2. **nI/l** b)2nI/l c)nIl d)2nIl
3. The self inductance L of the coil is given by ------
4. **nBa/I**  b)2nBa/I c)nBa/2I d)nBaI
5. In synchros the stator with windings S1,S2 and S3 are separated by ---degree in space.

**a)120** b)30 c)45 d)90

19)For a single synchro unit with the rotor angle θ for an input

sinusoidal voltage Vr = Vro sin ωt, the voltage induced in winding S1 is-----

1. **Vs1 = KVro sinωt cos(θ + 120°)**
2. Vs1 = KVro sinωt cosθ
3. Vs1 = KVro sinωt cos(θ + 240°)
4. Vs1 = KVro sinωt cos(θ + 360°)

20)For a single synchro unit with the rotor angle θ for an input sinusoidal voltage Vr = Vro sin ωt, the voltage induced in winding S2 is-----

a)Vs2 = KVro sinωt cos(θ + 120°)

1. **Vs2 = KVro sinωt cosθ**
2. Vs2 = KVro sinωt cos(θ + 240°)
3. Vs2 = KVro sinωt cos(θ + 360°)

21)For a single synchro unit with the rotor angle θ for an input sinusoidal voltage Vr = Vro sin ωt, the voltage induced in winding S3 is-----

a)Vs3 = KVro sinωt cos(θ + 120°)

b)Vs3 = KVro sinωt cosθ

**c)Vs3 = KVro sinωt cos(θ + 240°)**

d)Vs3 = KVro sinωt cos(θ + 360°)

22)For a single synchro unit with the rotor angle θ for an input sinusoidal voltage Vr = Vro sin ωt, the constant K in Vs1 is defined as -------

**a)ratio of the rotor to the stator turns**

b)product of the rotor to the stator turns.

c)product of the magnetic flux and primary current.

d)ratio of primary current and . magnetic flux

23)In synchros the error voltage Ve(t) is proportional to the -----

a) sin(θ1- θ2) b)cos( θ1- θ2)/2 c)cos2( θ1- θ2) **d)cos( θ1- θ2)**

1. In synchros the error voltage is-----

**a) proportional to the angular rotational difference of the rotors**

b) proportional to the angular rotational difference of the stators

c) inversely proportional to the angular rotational difference of the rotors

d)inversely proportional to the angular rotational difference of the stators

25)In synchros if ST1 rotor rotates by θ1 and ST2 by θ2  then the free SDR rotor would rotate by ------ angle for balancing.

**a)(θ1- θ2)**  b)2(θ1- θ2) c)tan (θ1- θ2) d)tan 2(θ1- θ2)

26)The capacitance Cpd  for a three plate capacitor arrangement is given as ----

a) εα/x **b) 2εα/x** c) ε/αx d)2 ε/αx

27)In a parallel plate pair, if the dielectric has a number of layers of dielectric constants with corresponding permittivity as εi for thickness xi then the capacitance Cpd  will be----

**a) α/(Σxi/εi )**b) 2εiα/Σxi c) εi/Σαxi d)2 εi/Σαxi

1. In the Parallel Plate Capacitive Sensor , when λ increases , the sensitivity factor β -----

**a)increases with εs** b)decreases with εs c)increases with 2εs d) decreases with 2εs

29) The fringing effects in capacitors can be reduced by --

**a)using guard ring** b) increasing the edge length c)increasing the side area of electrodes d)increasing the plate length

30)For the cylindrical sensor with the electrode thickness negligible as compared to dielectric thickness ,the capacitance is ----

1. **Cc = 2πεl/(ln(D/d))** b) Cc = πεl/(ln(D/d) ) c) Cc = εl/(ln(D/d))
2. d) Cc = 2πεl/(ln(Dd))

**Module II**

**Topics(7-9)MCQ’s**

1. Piezoelectric effect is when materials produce electric charges when \_\_\_\_\_\_\_\_\_\_\_\_  
a) Voltage is applied  
**b) Mechanical Stress is applied**  
c) Electric field is applied  
d) Magnetic field is applied

2. Piezoelectricity means \_\_\_\_\_\_\_\_\_\_\_\_\_\_  
a) Electric polarization  
b) Electric dielectric  
**c) Pressure electricity**  
d) Polar dielectric

3. All Piezoelectric materials are Ferroelectric.  
a) True  
**b) False**

4. Piezoelectric transducer consists of \_\_\_\_\_\_\_\_\_\_\_\_\_\_  
a) copper rod  
b) aluminum wire  
c) gold crystal  
**d) quartz crystal**5. Which transducer measure changes in acceleration, pressure, strain and temperature?

a) Photoelectric transducer

b) Capacitive transducer

**c) Piezoelectric transducer**

d) Inductive transducer

6. Which of the following transducers measures the pressure by producing emf as a function of its deformation?

a) Photoelectric transducer

b) Capacitive transducer

c) Inductive transducer

**d) Piezoelectric transducer**

7. What is the piezoelectric effect in a crystal?

a) change in resistance because of temperature

b) change of frequency because of temperature

c) current is developed due to force applied

**d) voltage is developed because of mechanical stress**

8. Self-inductance depends on \_\_\_\_\_\_\_\_\_\_\_\_

**a) Permeability**

b) Permittivity

c) Plank’s constant

d) rydberg constant

9. Basically sound waves are \_\_\_\_\_\_\_\_\_\_\_\_\_\_  
a) Voltage signals  
**b) Pressure waves**  
c) Current  
d) Radiation

10. Which of the following is not a character of a sensor of a sound wave?  
a) Causes no health hazard  
b) They are suitable in a harsh environment  
**c) They are only suitable in cold environment**  
d) They can be used in corrosive environment

11. Which of the following type sound generators are not possible?  
a) Piezo electric  
b) Magnetostrictive  
c) Both piezo electric and magnetostrictive  
**d) None of the mentioned**

12. Piezo electric materials are well cut for \_\_\_\_\_\_\_\_\_\_\_\_\_  
a) Good dimension  
**b) Good coupling coefficient**  
c) Compact shape of device  
d) Increasing frequency

13. Which of the following quantities cannot be measured by capacitive transducers?  
a) Displacement  
b) Speed  
c) Moisture  
**d) None of the mentioned**

14. Capacitive microphone is an application of \_\_\_\_\_\_\_\_\_\_\_\_\_\_  
**a) Capacitive displacement transducer**  
b) Capacitive moisture transducer  
c) Hygrometer  
d) None of the mentioned

15. Quartz and Rochelle salt belongs to \_\_\_\_\_\_\_ of piezo-electric material

**a) Natural group**b) Synthetic group  
c) Natural or Synthetic group  
d) Fiber group

16. The capacitance microphone is used for the detection of

a) Heart rate  
b) Blood flow  
**c) Heart sound**d) Foot pressure

17. In a variable capacitor, the dielectric material is generally

a) mica

**b) air**

c) ceramic

d) electrolyte

18. Sounds of frequency higher than 20,000 Hz which are inaudible to normal human ear are called

a) noise

b) frequency

**c) ultrasonic**

d) amplitude

19. SONAR is the abbreviation of

a) small navigation and random

b) sky navigation and ranging

c) sun nuclear ranging

**d) sound navigation and ranging**

20. Ultrasonic waves carry more

a) energy only

b) frequency only

c) heat

**d) energy and frequency**

21. The wavelength of ultrasonic waves is

a) more than audible sound

b) less than audible sound

**c) equal to audible sound**

d) greater than light wave

22. Sensor effectiveness depends on \_\_\_\_\_\_\_\_\_ parameter

**a) Sensitivity**

b) Radiation

c) Restively

d) All of the above

23. Sound to electrical energy transducer is called what?

**a) microphone**

b) AFR

c) Tactile sensor

d) Pellistor

24. Which type of sensor is used to measure the distance between the vehicle and other objects in its environment:

**a) Ultrasonic sensor**

b) Tactile sensor

c) Motion sensor

d) None of these

25. Certain type of materials generates an electrostatic charge or voltage when mechanical force is applied across them. Such a materials are called

**a) Piezoelectric**

b) photoelectric

c) thermoelectric

d) photo resistive

26. Piezoelectric transducers are

a) Passive transducers

**b) Inverse transducers**

c) Digital transducers

d) Pulse transducers

27. Which of the following are piezo electric substances

a) Barium titanate

b) Leda titanate

c) Lead Zirconate

d) Cadmium and Sulphate

i) a,b,d

ii) a,c,d

**iii) a,b,c**

iv) b,c,d

28. Piezo electric transducers work when we apply \_\_\_\_\_\_\_\_\_ to it.

a) Mechanical force

b) Vibrations

c)Illuminations

**d) Heat**

29. Piezo electric crystal can produce an emf

**a) when external mechanical force is applied to i**

b) when radiant energy stimulates the crystal

c) when external magnetic field is applied

d) when the junction of two such crystals are heated

30. Self- generating type transducers are \_\_\_\_\_\_\_\_\_ transducers.

**a) Active**

b) Passive

c) Secondary

d) Inverse

**PART-B**

| 1. |  |
| --- | --- |
| 2. | Explain the classification of inductive sensors. |
| 3. | Derive relation between inductance and reluctance with neat diagram. |
| 4. | Derive Hysteresis Dissipation factor in variable reluctance type transducers. |
| 5. | Compare Electromagnetic & Magnetosrtictive transducer based on its working and applications |
| 6. | Write short note about three types of stator cores used in synchros. |
| 7. | Classification on synchros. |

**PART-C**

| 1. | Explain the effect of thickness in working of capacitive transducers with necessary equation and diagram. Also compare the same with normal capacitive transducer. |
| --- | --- |
| 2. | Write short notes about working of ultrasonic sensor using appropriate diagram. Also compute the sensitivity of the device with characteristics. |
| 3. | What is meant by LVDT and explain how position of core affects its working . |
| 4. | Explain in detail with necessary diagram about electromechanical device which is used to produce output voltage based on angular position. |
| 5. | Explain how synchros can be used in transmission and error detection with neat diagrams |
| 6. | Identify which effect produces electric polarization by mechanical strain in the crystals. Derive constant and classify the materials used in piezoelectric effect. |