UNIT IV

1.Which one the following is not a component of smart sensor?
a) Power supply b) Microcomputer
c) DAC **d) Diaphragm**

2.MEMS stands for the following abbreviation
a) Micro electrical mechanical
b) Micro electro mechanical system
c) Mini electro mechanical
d) Mini electrical mechanical system system

3.Which of the following is a correct description about different types of conveyors ?
a) Belt conveyors transport materials in any direction
b) Slat conveyors requires high maintenance
c) Vibrating conveyor can convey materials of any friction factor

4.Screw conveyors usually handle lightweight materials
Today almost all electronic weighing scales use _____for the measurement of weight.
a) Magneto resistance
b) Strain guage
c) Load cell
d) Gyroscope

5.In a longitudinal field,changes in magnetization due to torsion given in a ferromagnetic rod is called
a. Hall effect
b. Matteucci effect
c. Villari effect
d. Thomson effect

6.The change of the magnetization of a material when subjected to a mechanical stress is called
a. Hall effect
b. Matteucci effect
c. Villari effect
d. Wiedemann effect

7.The twisting of a ferromagnetic rod through which an electric current is flowing when the rod is placed in a longitudinal magnetic field
a. Hall effect
b. Matteucci effect
c. Villari effect
d. Wiedemann effect

8.A _____sensor uses the fact that the electrical resistance in a ferromagnetic thin film alloy is changed through an external magnetic field
a. Thermoemf sensor

b. Inductive sensor
c. Magnetoresistive sensor
d. Magnetostriction sensor

1. The ‘eddy current’ forces the current flowing through the interior of a material to move to its surface level is referred to as
   a. Skin effect
   b. Matteucci effect
   c. Villari effect
   d. Wiedemann effect

2. SQUID refers to
   a. **sensitive magnetometer used to measure extremely subtle magnetic fields**
   b. sensitive magnetometer used to measure extremely crude magnetic fields
   c. sensitive magnetometer used to measure crude magnetic fields
   d. sensitive magnetometer used to measure subtle magnetic fields

3. _____is a property of ferromagnetic materials that causes them to change their shape when subjected to a magnetic field.
   a. Magnetoresistive sensor
   b. Magnetization
   c. Magnetostriction
   d. Pyroelectric

4. _____is a mechanical property that denotes the elasticity in tension or compression.
   a. Magnetization
   b. Δy effect
   c. Villari effect
   d. Wiedemann effect

5. _____ which is basically a change in resistance of specified materials with magnetic field impressed.
   a. Thomson effect
   b. Matteucci effect
   c. Villari effect
   d. Wiedemann effect

6. The output voltage of a Hall sensor is directly proportional to the
   a. Electric field
   b. Magnetic field
   c. Total moment
   d. Total Flux

7. Tiny devices that use variations in an external magnetic field to generate electrical signals and energy
   a. Wiegand and pulse wire sensors
   b. Thermal sensor
   c. Magnetic sensor
   d. Inductive sensor

8. SQUID means

a. Superior Quantum Interference Devices
b. Super Quantum Interference Devices
c. Superconducting Quantum Indicating Devices
d. Superconducting Quantum Interference Devices

9. The ability of two weakly coupled superconductors to sustain at zero voltage, a super current is associated whose magnitude depends on the phase difference between the two superconductors is called
   a. Hall effect
   b. Josephson effect
   c. Villari effect
   d. Wiedemann effect

10. The maximum current which Josephson weak link can support without developing any voltage across it is known as _____
    a. Josephson effect
    b. Villari effect
    c. Wiedemann effect
    d. Critical current

11. _____ arise because of Lorentz force on the charge carrier transport phenomena in condensed medium.
    a. Galvanomagnetic effects
    b. Josephson effect
    c. Villari effect
    d. Wiedemann effect

12. _____is a mechanical property that measures the tensile or compressive stiffness of a solid material when the force is applied lengthwise.
    a. Elasticity
    b. Young's modulus
    c. Solidity
    d. Tensile modulus

13. Villari effect is also called as
    a. Mateucci effect
    b. Josephson effect
    c. **inverse magnetostrictive effect**
    d. Wiedemann effect

14. If External magnetic field is applied to ferromagnetic material in vertical direction, the dipoles gets arranged in _____
    a. same direction
    b. in different direction
    c. horizontal direction
    d. transverse direction

15. A _____sensor is an electronic device that is designed to monitor, detect, record and regulate linear and rotational forces exerted upon it.
    a. Radiation
    b. Magnetic

c. force torque
d. Inductive

16. Packed in a small package with low power consumption, this _____ sensor allows for continuous distance reading.
    a. Thermal sensor
    b. Magnetic sensor
    c. Inductive sensor
    d. IR proximity sensor

17. Proximity sensor operate over a range of
    a. **10cm to 80cm**
    b. **20cm to 90cm**
    c. **30cm to 60cm**
    d. **1m-2m**

18. A specific type of material when subjected to pulse voltages under stress shows switching effect is called _____
    a. Sixtus-Tonks effect
    b. Magnetic sensor
    c. Inductive sensor
    d. IR proximity sensor
19. When exposed to an alternating external magnetic field, a Wiegand wire will initially retaining its magnetic polarity - when the external field reaches a certain threshold, the polarity of the wire segment will _____
    a. Be same
    b. Reverse
    c. abruptly Reverse
    d. adverse

20. Wiegand sensors
    a. Has self-powering capacity
    b. Does not have self powering capacity
    c. Takes power from another source
    d. None of the above

21. SQUIDs are sensitive enough to measure fields as low as _____
    a. 6×10^{-14} T
    b. 5×10^{-14} T
    c. 7×10^{-14} T
    d. 4×10^{-14} T

22. When certain materials are cooled below a _____ temperature remarkable interactions of electric currents and magnetic field occur.
    a. Certain
    b. Superconducting transition
    c. Curie
    d. Critical

23. In solid or hollow cylindrical shaft, stress develops in two principal orthogonal directions, one compressive and other tensile, each at angle _____

a. ±60°
b. ±45°
c. ±120
d. ±65°

24. Lorentz force is
a. F=eE+e[vxB]
b. F=eE+v[exB]
c. F=ev+e[vxB]
d. F=vE+e[vxB]

25. Hall mobility is the product of
a. drift mobility of the carrier and hall scattering factor
b. drift mobility of the carrier and scintillation factor
c. Brownian movement and hall scattering effect
d. Scattering and drift mobility

26. **A Sensor is a _____.**
a. Subsystem
b. Machine
c. Module
d. **All the above**

27. The function of a sensor is to _____.
a. Detect events within specified environment
b. Separate physical parameters
c. Track and transfer data to computer processor
d. **Both a and c**

28. Which of the following are examples of sensors?
a. Tactile sensor
b. MARG sensor
c. Biosensor
d. All the above

29. Sensor provides output signal depending on _____.
a. **Input**
b. Physical quantity
c. Both a and b
d. None of the above

30. Sensors convert signals from analog to _____ domain.
a. Digital
b. Electrical
c. Mechanical
d. **Both a and b**

31. LDR sensor is abbreviated as _____.
a. **Light Dependent Resistor**
b. Luminous Duplicated Resistor
c. None of the above

32. **Which _____ sensors resistance value varies with respect to light intensity?**
    a. Photosensitive
    b. Bio
    c. All the above

33. **LDR sensor is made up of _____ material.**
    a. Conductors
    b. Insulators
    c. **Semiconductor**
    d. None of the above

34. What is the resistance value of the LDR sensor in absence of light _____.
    a. Several mega ohms
    b. 100's of megaohms
    c. 10-100ohms
    d. 10,0000 ohms

35. The ratio between the resultant output signal to a measured property of a sensor is called _____.
    a. **Sensitivity**
    b. Resistivity
    c. Conductivity
    d. Both b and c

36. _____ sensor provides data about the chemical composition of its environment in terms of gas, and liquid phase.
    a. **Chemical sensor**
    b. Liquid sensor
    c. Air sensor
    d. All the above

37. Analog sensors generate _____ analog kind of output signals.
    a. Discrete
    b. **Continuous**
    c. Both a and b
    d. Does not generate

38. Which of the following is the function of the accelerometer sensor?
    a. Detects changes in position, orientation
    b. Detects variation in velocity, shock
    c. Detects variation in tilt and vibration
    d. **All the above**

39. Analog accelerometers are classified based on _____.
    a. Sensitivity
    b. Configuration
    c. **Both a and b**
    d. Power dissipation

40. _____ sensors detect a quantity of light striking the sensor component.
    a. **Light sensor**
    b. Beam sensor
    c. Velocity sensor
    d. Speed sensor

41. _____ is used as a switch in Analog sensors.

a. **LDR**
b. PN diode
c. Thyristor
d. All the above

42. A dynamic microphone is based on _____ principle.
a. **EM induction**
b. Electric induction
c. Magnetic induction
d. All the above

43. Pressure sensor generates output in _____ form.
a. Digital
b. **Analog**
c. Both a and b
d. Heat

44. The output generated by the piezoelectric sensor is _____.
a. Mechanical
b. **Electric charge**
c. Chemical
d. All the above

45. Do digital sensors overcome the disadvantages of analog sensors?
a. Yes
b. No
c. Maybe

46. Which of the following are the components of a digital sensor?
a. Cable
b. Transmitter
c. Sensor
d. All the above

47. Lithography process is used to pattern:
a. Metal and semiconductor layers
b. Metal and insulating layers
c. Metal, Semiconductor and insulation layers
d. Semiconductor and insulation layers

48. Why are commercially available silicon wafers circular in shape?
a. For fabricating maximum number of devices per unit area
b. For ease of handling during process flow execution
c. **Because the ingot from which it is derived is cylindrical owing to upstream processes**
d. Making flats to identify the silicon type is easier on circular wafer

49. Micromachining process is used to increase selectivity, accuracy, performance etc.,
a. True
b. False

50. Thermal deformation is the major problem in micromachining
a. True
b. False

51. Interest of increasing wafer diameter from 200 mm to 300 mm

a. The price of a 300 mm wafer is lower
b. It is easier to fabricate
c. To produce more silicon devices from a single wafer
d. To increase the size of a die

52. What is a n type Si semiconductor (SC)
a. A Si semiconductor without impurities
b. A Si Semiconductor with impurities from column III and V of Mendeleev table
c. A Si Semiconductor with impurities from column III of Mendeleev table
d. A Si Semiconductor with impurities from column V of Mendeleev table

53. What is the thickness of the dielectric in a 28 nm MOS transistor
a. Lower than 1 μm
b. Lower than 10 nm
c. Lower than 1 nm
d. Lower than 0.1 nm

54. The graphene-based sensors are normally highly sensitive for individual gas molecule detection, …
a. because of linear energy dispersion and low density of states near the Dirac point
b. because that the molecules are absorbed on a uniform single atomic sheet
c. because of interaction with π electrons
d. because of high conductance in grapheme

55. In a nanobiosensor based on a cantilever used in dynamic mode, the shift of the resonance frequency is due to:
a. A variation of absorbed mass
b. A variation of temperature
c. A variation of stress
d. A piezoelectric effect

56. A nano biosensor made of?
a. A probe and a surface
b. A sensing layer and a transducer
c. A target and a probe molecule
d. A biomarker and a probe

57. The quantities cannot be measured by a load cell is….
a. Pressure
b. Temperature
c. Level
d. All of the above

58. A load cell is a
a. Strain gauge
b. Photovoltaic cell
c. Thermistor
d. Pressure picks up

59. A cadmium sulfide cell is a
a. Solar cell
b. Dry cell
c. Photovoltaic cell
d. Photoconductive cell

60. What is a conveyor?

a. A conveyor is a static equipment that is used to store heavy and bulky materials
b. A conveyor is a moving equipment that is used to store heavy and bulky materials
c. A conveyor is a moving equipment that is used to carry heavy and bulky materials
d. A conveyor is a moving equipment that is used to carry light and compact materials only

61. Which of the following is true about the speed of the conveyor belt?
a. Fixed conveyors need not be shut down during any speed change
b. Adjustable speed belts can be changed only manually
c. Fixed speed drives can undergo minor speed changes
d. Variations of speed is not possible with conveyors

62. Which of the following is not of importance when a conveyor is designed?
a. Type of industry where the conveyor is being used
b. Type of material being carried by the conveyor
c. Cost
d. Length of travel of the conveyor

63. Which of the following is true about frame configuration?
a. Frame configuration refers to the size of the conveyor
b. Frame configuration refers to the size and shape of the conveyor
c. Frame configuration refers to the capacity of the conveyor
d. Frame configuration refers to the shape of the conveyor

64. Which of the following is a correct description about the different types of conveyors?
a. Belt conveyor transports material in any direction
b. Slat conveyor requires high maintenance
c. Vibrating conveyor can convey materials of any friction factor
d. Screw conveyors usually handle lightweight materials

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66. Choose the correct unit of throughput (Throughput is a measure of the capacity of the conveyor tohandle bulky materials).
a. Cubic feet per minute
b. Meter cube
c. Square feet per second
d. Meter square

67. Which of the following is false about conveying systems?
a. An essential factor to consider before choosing the right conveyor system is the environment ofoperation
b. Conveyors cannot be used as feeders
c. The composition of the material being conveyed is very important
d. The surrounding temperature is one of the deciding factors

68. Which of the following is false about conveyors?
a. Cleats can be used to prevent slipping
b. Backstopping brakes are used for straight belts
c. Anti-static belts are used when electric components are conveyed
d. Soft starters avoid overloading the motor

69. Sensors that use an additional energy source for their operation are called…….
a. modulating sensors

b. Interrogating sensors
c. Direct sensors
d. Both a) and b)

70. ……..sensors are not affected by ambient conditions, such as dust, humidity and vibrations and are insensitive to some ambient conditions based on the principle that these sensors display a constant flow of electrical current, making their characteristics constant over time.
a. A LVDT
b. LVDT
c. Hall effect
d. Load cell

71. The maximum amount a weight reading may deviate from a straight line between zero and themaximum capacity of the balance is:
a. Repeatability
b. Capacity
c. Linearity
d. Net weight

72. The smallest increment of weight a balance will display:
a. Tare weight
b. Readability
c. Net weight
d. Capacity

73. A hook or connection point on the bottom of the balance that suspends items for weighing
a. Auto zero tracking
b. Full-scale tare
c. Calibration mass
d. Below-balance weighing

74. Capability that lets users tare via computer or manually
a. Checkweighing
b. Digital tare
c. Net weight
d. Digital filters

75. Weighing application that uses a preset reference weight to equal 100%
a. Percent weighing
b. Keypad calibration
c. Net total formulation
d. Checkweighing

76. Strain gage load cells provide accuracies from within
a. 0.03% to 0.25% full scale
b. 0.3% to 2.5% full scale
c. 3% to 5% full scale
d. 3% to 4% full scale

77. Gauge Factor is defined as the ratio between
a. the unit change in resistance to the per unit change in length.
b. the unit change in resistance to the per unit change in area.
c. the unit change in resistance to the per unit change in resistivity.
d. the unit change in resistance to the per unit change in temperature.

78. Hydraulic load cells are ------least accurate, lease sensitive and capacitance load cells are ----

a. least accurate, highly accurate
b. most accurate, highly accurate
c. moderately accurate, highly accurate
d. least accurate, less accurate

Part -B (4 marks)

1. Compare MEMS sensors and Nano Sensors
2. List the advantages of MEMS.
3. Identify the important features of smart sensors.
4. What is Hall effect transducer?
5. Discuss the operation of magneto elastic sensor.
6. Define weimann effect
7. Compare microelectronics and microsystems.
8. Explain Micromachining.
9. Define hall effect.
10. Define villari effect.

Part-C (12 marks)

1. Describe the role of MEMS in instrumentation.
2. Explain Hydraulic and pneumatic load cell with neat diagram
3. Explain Electrical type load cell with neat diagram
4. What is meant by thick film and thin film technology? Explain.
5. Explain with a neat block diagram the construction, operation and important characteristics of a smart sensor.
6. Explain Galvanomagnetic effect sensor
7. Discuss the operation of magneto elastic sensor.
8. Explain the different designs of weighing systems.
9. Explain about weigh feeder type.