

1. What is geometric scaling in the context of physical systems?

- a) Scaling based on electrical properties
- b) Scaling based on geometric dimensions
- c) Scaling based on magnetic properties
- d) Scaling based on thermal properties

Answer: b) Scaling based on geometric dimensions

Explanation: Geometric scaling involves proportionally changing the dimensions of a physical system while keeping certain properties constant, such as shape or aspect ratio. This is commonly used in miniaturization processes like MEMS and NEMS fabrication.

2. Which actuation principle relies on the conversion of electrical energy into mechanical motion?

- a) Thermal actuation
- b) Piezoelectric actuation
- c) Capacitive actuation
- d) Magnetic actuation

Answer: b) Piezoelectric actuation

Explanation: Piezoelectric actuation involves the use of piezoelectric materials that generate mechanical deformation when subjected to an electric field, enabling precise control of movement in microsystems.

3. MEMS stands for:

- a) Micro Electrical Mechanical Systems
- b) Micro Electronic Mechanical Sensors
- c) Micro Electro Mechanical Systems
- d) Miniature Electronic Mechanical Systems

Answer: c) Micro Electro Mechanical Systems

Explanation: MEMS refers to microelectromechanical systems, which integrate mechanical and electrical components on a small scale to create devices like sensors, actuators, and microstructures.

4. Which type of sensor is commonly used in detecting changes in the concentration of gases or liquids?

- a) Acoustic wave sensor
- b) Biomedical sensor
- c) Chemical sensor
- d) Optical sensor

Answer: c) Chemical sensor

Explanation: Chemical sensors are designed to detect specific chemical species or changes in chemical concentrations, making them suitable for applications such as environmental monitoring and industrial process control.

5. What is the principle behind an optical sensor?

- a) Detection of sound waves

- b) Detection of light waves
- c) Detection of magnetic fields
- d) Detection of thermal radiation

Answer: b) Detection of light waves

Explanation: Optical sensors utilize the interaction between light and a target substance or phenomenon to measure parameters such as distance, position, or composition. This is achieved through various optical techniques such as absorption, reflection, or refraction.

6. Thermal sensors operate based on the principle of:

- a) Converting temperature into electrical signals
- b) Converting light intensity into electrical signals
- c) Converting sound waves into electrical signals
- d) Converting pressure into electrical signals

Answer: a) Converting temperature into electrical signals

Explanation: Thermal sensors detect temperature variations and convert them into electrical signals. This can be achieved through various mechanisms such as thermocouples, resistance temperature detectors (RTDs), or thermistors.

7. Which type of actuation relies on the expansion and contraction of materials due to changes in temperature?

- a) Piezoelectric actuation
- b) Thermal actuation

- c) Capacitive actuation
- d) Magnetic actuation

Answer: b) Thermal actuation

Explanation: Thermal actuation involves the use of temperature-induced expansion and contraction of materials to generate mechanical motion or deformation. This principle is commonly utilized in MEMS devices for actuation purposes.

8. Capacitive sensors operate based on changes in:

- a) Electrical resistance
- b) Magnetic field strength
- c) Temperature
- d) Capacitance

Answer: d) Capacitance

Explanation: Capacitive sensors detect changes in capacitance, which occur due to variations in the distance or dielectric properties between two conductive surfaces. This principle is widely employed in sensing applications such as proximity sensing and touch sensing.

9. Which type of sensor is commonly used in monitoring physiological parameters such as heart rate and blood pressure?

- a) Acoustic wave sensor
- b) Biomedical sensor
- c) Chemical sensor

d) Pressure sensor

Answer: b) Biomedical sensor

Explanation: Biomedical sensors are specifically designed for monitoring biological or physiological parameters, including vital signs like heart rate, blood pressure, and body temperature. These sensors play a crucial role in medical diagnostics and wearable health monitoring devices.

10. What is the primary function of an acoustic wave sensor?

- a) Detection of light waves
- b) Detection of sound waves
- c) Detection of magnetic fields
- d) Detection of pressure changes

Answer: b) Detection of sound waves

Explanation: Acoustic wave sensors are used to detect and analyze acoustic signals or mechanical vibrations, making them suitable for applications such as ultrasonic imaging, gas sensing, and structural health monitoring.