****

1. **Short Notes**
2. **10 MCQs with correct answers**
3. **20 Word Meanings**
4. **15 One-word Question Answers**

**📘 Notes (Ultrasonic Sensor)**

* **Ultrasonic Sensor**: An electronic instrument that measures distance using ultrasonic sound waves.
* **Working Principle**:
  1. Emits ultrasonic waves.
  2. Detects echoes that bounce back.
  3. Calculates distance using time-of-flight (TOF).
* **Frequency**: Above 20 kHz (beyond human hearing range).
* **Formula**:  
  Distance = (Speed of Sound × Time) ÷ 2
  1. Speed of sound = 343 m/s (air, room temperature).
  2. Time = TOF (round trip).
* **Applications**: Robotics, obstacle detection, distance measurement.
* **Arduino Use**: Converts reflected sound waves into electrical signals, calculates distance.

**❓ 10 MCQs (with highlighted answers)**

1. Ultrasonic sensors work on which waves?  
   a) Infrared  
   **b) Ultrasonic**  
   c) Microwave  
   d) Visible
2. Human hearing range is up to:  
   a) 10 kHz  
   b) 15 kHz  
   **c) 20 kHz**  
   d) 25 kHz
3. Speed of sound in air is approximately:  
   a) 300 m/s  
   b) 320 m/s  
   **c) 343 m/s**  
   d) 400 m/s
4. Formula for distance in ultrasonic sensors includes:  
   a) Speed × Time  
   b) Speed ÷ Time  
   **c) (Speed × Time) ÷ 2**  
   d) Speed + Time
5. Ultrasonic frequency is above:  
   a) 5 kHz  
   b) 10 kHz  
   **c) 20 kHz**  
   d) 200 kHz
6. Which device interprets ultrasonic signals in robotics?  
   a) Microphone  
   b) Sensor  
   **c) Arduino**  
   d) Motor
7. Time-of-flight measures:  
   a) Light travel  
   b) Voltage  
   **c) Sound wave return time**  
   d) Temperature
8. Ultrasonic sensors are used in:  
   a) Music  
   b) Cooking  
   **c) Robotics**  
   d) Photosynthesis
9. Which component converts sound to electrical signal?  
   a) Resistor  
   b) Capacitor  
   **c) Ultrasonic sensor**  
   d) Transformer
10. Why divide time by 2 in formula?  
    a) Half-speed  
    **b) Round trip travel**  
    c) Echo loss  
    d) Arduino delay

**📝 20 Word Meanings**

1. **Ultrasonic** – Sound waves above human hearing range (>20 kHz).
2. **Sensor** – Device detecting physical input.
3. **Arduino** – Microcontroller for electronics.
4. **Echo** – Reflected sound wave.
5. **Time-of-Flight (TOF)** – Time taken for wave to return.
6. **Microcontroller** – Small computer on a chip.
7. **Frequency** – Number of wave cycles per second.
8. **Distance** – Space between two points.
9. **Formula** – Mathematical equation.
10. **Signal** – Electrical representation of information.
11. **Measurement** – Process of finding size/quantity.
12. **Reflection** – Bouncing back of waves.
13. **Calculation** – Mathematical working.
14. **Obstacle** – Object blocking path.
15. **Emission** – Sending out waves.
16. **Detection** – Finding something.
17. **Conversion** – Changing from one form to another.
18. **Application** – Practical use.
19. **Accuracy** – Correctness of result.
20. **Wave** – Vibration that transfers energy.

**🔹 15 One-word Question Answers**

1. Device using ultrasonic waves? → **Sensor**
2. Ultrasonic frequency range starts from? → **20 kHz**
3. Human ear maximum hearing? → **20 kHz**
4. Speed of sound in air? → **343 m/s**
5. Formula unit of distance? → **Meters**
6. Controller used in robotics? → **Arduino**
7. Sound reflection term? → **Echo**
8. Time taken by wave? → **TOF**
9. Ultrasonic sensor main application? → **Robotics**
10. Conversion of sound into? → **Electrical**
11. Sensor works on principle of? → **Reflection**
12. Measurement type? → **Distance**
13. Sound wave type? → **Ultrasonic**
14. Dividing by 2 accounts for? → **Round-trip**