FULL TOPIC NOTES

1. Physical Significance of Wave Function
• Wave function (ψ) itself has no direct physical meaning.
• $|\psi|^2$ gives probability density of finding a particle at a given position.
• Total probability = 1 (normalization).
• Describes complete state of a quantum particle.

2. Classification of Sound
Based on Frequency:
• Infrasonic (<20 Hz)
• Audible (20 Hz – 20 kHz)
• Ultrasonic (>20 kHz)
Based on Nature:
• Musical sound
• Noise
Based on Medium:
• Solids, liquids, gases

3. Characteristics of Sound
• Pitch – depends on frequency
• Loudness – depends on amplitude
• Quality – distinguishes different sound sources
• Speed – depends on medium

4. Reverberation
• Persistence of sound due to multiple reflections after the source stops.
• Reduced by carpets, curtains, acoustic panels.

5. Reverberation Time
• Time for sound to drop to one■millionth intensity after source stops.
• RT60 = 60 dB decay time.

6. Absorption Coefficient
• Fraction of incident sound energy absorbed by a material.
• Value between 0 and 1.

7. Properties of Ultrasonics
• High frequency & short wavelength.
• Travel in straight lines.
• Strong reflection, penetration, cavitation.
• Used in SONAR, NDT, cleaning, imaging.

8. Principle of Ultrasonics
Piezoelectric Effect:
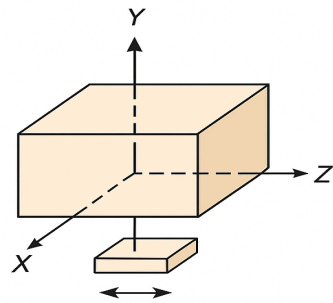• Crystal vibrates at high frequency when AC voltage is applied.
Magnetostriction:
• Ferromagnetic rod changes length in alternating magnetic field.

9. X■cut and Y■cut Crystals
X■cut: Cut perpendicular to X■axis, thickness shear vibration.
Y■cut: Cut perpendicular to Y■axis, face shear vibration.
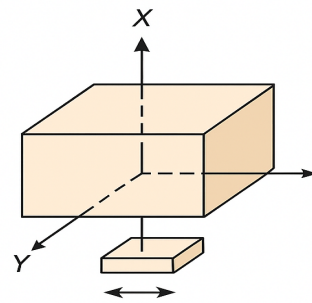
X-CUT CRYSTAL

Cut perpendicular to X–axis

Vibration in thickness
shear mode

Y-CUT CRYSTAL

Cut perpendicular to Y-axis

Vibration in
face shear mode