

MOST IMPORTANT TOPICS (MUST DO):

1. CO₂ Laser
2. Numerical Aperture of Optical Fiber
3. de Broglie Wavelength
4. Schrödinger Equation
5. Particle in Box
6. Thin Film Interference
7. Malus Law
8. Huygens Theory of Double Refraction
9. Fermi Level in P & N Type Semiconductor
10. Hall Effect with Derivation
11. Solar Cell
12. Generation of Ultrasonics
13. Quantum Confinement Effect
14. Meissner Effect
15. SQUID

Based on the **SPPU 2024 Pattern Engineering Physics syllabus**, previous university trends, repeated derivations, and weightage patterns, these are the **90% probability questions** that you should prepare first.

TOP 20 QUESTIONS FOR LAST-MINUTE PREPARATION

1. CO₂ Laser
2. Numerical Aperture of Optical Fiber
3. de Broglie Wavelength
4. Schrödinger Equation
5. Particle in Box
6. Thin Film Interference
7. Wedge-Shaped Film
8. Malus Law
9. Huygens Theory of Double Refraction
10. Fermi Level in Intrinsic Semiconductor
11. Fermi Level in N-Type Semiconductor
12. Fermi Level in P-Type Semiconductor
13. Hall Effect
14. Hall Coefficient
15. Solar Cell
16. Generation of Ultrasonics
17. Quantum Confinement Effect
18. Meissner Effect
19. Josephson Effect
20. SQUID

realistically target **30–40+ marks out of 50**

UNIT WISE IMP QUESTIONS

UNIT I: FUNDAMENTALS OF PHOTONICS

Must Study

1. **CO₂ Laser – Construction and Working**
2. **Population Inversion and Stimulated Emission**
3. **Characteristics of Laser**
4. **Numerical Aperture (NA) – Derivation and Numerical**
5. **Acceptance Angle and Acceptance Cone**
6. **Total Internal Reflection**
7. **Types of Optical Fibers**
8. **Applications of Optical Fiber Communication**

Most Important Numerical

- Numerical Aperture
- Acceptance Angle
- Critical Angle

UNIT II: QUANTUM PHYSICS

Must Study

1. de Broglie Hypothesis and Derivation of $\lambda = h/p$
2. de Broglie Wavelength for Electron Accelerated Through Potential V
3. Wave Function and Probability Density
4. Conditions for Acceptable Wave Function
5. Time Independent Schrödinger Equation
6. Particle in One Dimensional Box
7. Quantum Tunneling
8. STM (Scanning Tunneling Microscope)
9. Quantum Computing: Superposition and Entanglement

Most Important Numerical

- de Broglie wavelength
- Particle in box

UNIT III: WAVE OPTICS (Highest Weightage Unit)

Must Study

1. Thin Film Interference – Derivation
2. Conditions for Maxima and Minima in Thin Film
3. Wedge-Shaped Thin Film – Derivation
4. Testing Optical Flatness
5. Anti-Reflecting Coating (ARC)
6. Polarization and Types
7. Malus Law with Proof
8. Double Refraction
9. Geometry of Calcite Crystal
10. Huygens Theory of Double Refraction

Most Important Numerical

- Thickness of thin film
- Fringe width of wedge film
- Malus law numerical

Expect at least **one 6–8 mark question** from Thin Film or Polarization.

UNIT IV: SEMICONDUCTOR PHYSICS & ULTRASONICS

Semiconductor Physics

Must Study

1. **Energy Band Theory**
2. **Fermi Level and Fermi Energy**
3. **Fermi Level in Intrinsic Semiconductor**
4. **Fermi Level in N-Type Semiconductor**
5. **Fermi Level in P-Type Semiconductor**
6. **PN Junction Diode Based on Fermi Energy**
7. **Solar Cell – Principle, Construction and Working**
8. **I-V Characteristics of Solar Cell**
9. **Hall Effect – Derivation of Hall Voltage**
10. **Hall Coefficient Derivation**

Most Important Numerical

- Hall Voltage
- Hall Coefficient
- Solar Cell Efficiency

Ultrasonics

Must Study

1. **Generation of Ultrasonic Waves using Inverse Piezoelectric Effect**
2. **Thickness Measurement using Ultrasonics**
3. **Flaw Detection using Ultrasonics**

Most Important Numerical

- Echo Time Calculation

Hall Effect and Fermi Level are extremely likely.

UNIT V: NANOPARTICLES & SUPERCONDUCTIVITY

Nanoparticles

Must Study

1. **Quantum Confinement Effect**
2. **Ball Milling Method**
3. **Physical Vapor Deposition (PVD)**
4. **GMR Effect**
5. **Applications of Nanotechnology**

Superconductivity

Must Study

1. **Meissner Effect**
2. **Type I and Type II Superconductors**
3. **Critical Temperature, Critical Field and Critical Current**
4. **Cooper Pair Formation**
5. **AC Josephson Effect**
6. **DC Josephson Effect**
7. **SQUID – Principle and Applications**
8. **Maglev Train Principle**

NOTE : SQUID + Meissner Effect is one of the most repeated combinations.