



# Shree H.N.Shukla group of colleges

## PHYSICS

T.Y.B.Sc. (Sem. VI) (CBCS)

### Syllabus

#### Paper: Physics-602

(Statistical Mechanics & Solid state physics)

##### **UNIT -1: (12 hour: 14 Mark)**

**Classical Distribution Law:** Phase Space (till the derivation of  $dr > =h^3$ ), Volume in Phase Space, Micro States and Macro States (number of microstates accessible to a macroscopic system onwards not included), Stirling's approximation, Thermodynamic Probability, Division of Phase Space into Cells, Classical Maxwell Boltzmann Distribution law. Bose-Einstein and Fermi Dirac Statistics Derivation of the distribution law of Bose-Einstein Statistics, Derivation of the distribution law of Fermi Dirac Statistics, Comparison of the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics, Numerical Problems.

##### **Basic Reference Book:**

Elementary Statistical Mechanics by Gupta and Kumar, Publisher: Pragati Prakashan.

##### **UNIT 2: (12 hour : 14 Mark)**

**Crystal structure:** The crystal lattice and lattice translation vector, Unit cell, Bravais lattice in three dimension, Crystal planes and mirror indices, Simple crystal Structure ( hcp, fcc, bcc, sc, Dimond)

**Crystal binding:** Ionic crystals, Covalent crystals, Metallic crystals, Hydrogen bonded crystals.

**Thermal conductivity of solids:** Heat capacity, classical theory of heat capacity of solids, Einstein model, Debye model, Density modes (one and three dimensions), Debye formula, criticism of Debye model, Thermal expansion, Thermal conductivity of solids, Numerical Problems.

##### **UNIT 3: (12 hour : 14 Mark)**

**Free electron theory of metals:** Free electron model, Free electron gas in one and three dimensions, Density of states, Effect of temperature, Thermal conductivity of free electron system, Sommerfield

theory of thermal conductivity, The Boltzmann equation, Wiemann-Franz law, Hall effect, Band theory of metals: The Block theorem, Kronig Penny model, Numerical Problems.

**UNIT 4: (12 hour : 14 Mark)**

**Semiconductor physics:** Insulators, Semiconductors, Intrinsic semiconductors: Electron-Hole carrier concentrations, Fermi level, Electrical conductivity and bonding, effect of impurities

Extrinsic semiconductors: Donor-Acceptors states, Fermi level, Thermal ionization, Band structure of Si and Ge crystals, Numerical Problems.

**Basic Reference Book for ( 2 to 4):**

A text book of Solid State Physics By S.L.Kakani & C. Hemrajani, Publisher: S Chand .

**UNIT 5: (12 hour : 14 Mark)**

**Superconductivity:** Experimental Aspects, Influence of external agents on Superconductivity, Meissner effect, Critical field of Small Specimens, Thermodynamic of Superconducting transition, Alloys & Compounds, London's theory, Josephson effects, BCS theory, Applications of Superconductivity, Numerical Problems.

**Basic Reference books:**

1. Fundamental of Solid State Physics By Saxena, Gupta, Saxena, Publisher: Pragati Prakashan

2. A text book of Solid State Physics By S.L.Kakani & C. Hemrajani, Publisher: S Chand .

**Other Reference Books:**

1. Statistical Mechanics by Mayor and Mayor
2. Statistical Mechanics by Agrawal and Eisner
3. Introduction to Solid State Physics by Charles Kittel (7th edition), John Wiley & Sons
4. Solid State Physics by A.J.Dekker, Macmillan India Ltd.