

**CONDENSED MATTER PHYSICS-I**  
**PHY301**

**UNIT-I**

**Crystal structure:** Bravais lattice in two and three dimension. Simple crystal structures: Hexagonal close packed structure, Diamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.

**UNIT-II**

**Crystal diffraction by X-Ray:** Reciprocal lattice, Reciprocal lattice of bcc and fcc lattice. Relation between crystal lattice axes and crystal reciprocal lattice axes. Bragg diffraction. Condition in term of reciprocal lattice vector. Brillouin zones.

**UNIT-III**

**Elastic properties of solids:** Stress and strain components, elastic compliance and stiffness constants, elastic energy density, reduction of number of elastic constants, elastic stiffness constants for isotropic body, elastic constant for cubic isotropic bodies, elastic waves, waves in (100) direction, experimental determination of elastic constants.

**UNIT-IV**

**Lattice vibration and phonons:** Lattice dynamic of a diatomic linear lattice. Lattice vibrational spectrum. The concept of phonons momentum of phonons. Inelastic scattering of photons by phonons. Inelastic scattering of neutrons by phonons. Inelastic scattering of X-Ray.

**UNIT-V**

**Thermal properties and band theory of solids:** Anharmonicity, thermal expansion, thermal conductivity, equation of state of solids, gruneisen constant. Band theory, classification of solids, concepts of effective mass. Fermi surfaces, anomalous skin effect, De Hass van alphen effect, cyclotron resonance, magneto resistance.

**Suggested Readings:**

1. Velma and Srivastava: Crystallography for solid State physics.
2. Azaroff: Elementary to Solids.
3. Omar: Introduction Solids state physics.
4. Kittle: Solids state physics
5. Huang: theoretical solid state physics.

**NUCLEAR & PARTICLE PHYSICS**  
**PHY302**

**UNIT-I**

**Nuclear Interaction and Nuclear reaction:** Nuclear forces, exchange and tensor forces, meson theory of nuclear forces, Low-energy n-p scattering and spin dependence of n-P forces. Direct and compound nuclear reaction mechanism, reciprocity theorem.

**UNIT-II**

**Accelerators of charged particles:** Study of cyclotron, phase stability, frequency modulated cyclotron (synchrocyclotron) magnetic induction accelerator (Betatron), Electron synchrotron and linear accelerator (Linac).

**UNIT-III**

**Nuclear models:** Liquid drop model, Bohr-wheeler's theory of nuclear fission, shell model, spin orbit interaction, magic number, spin and angular momenta of nuclear ground state, nuclear quadrupole moment.

**UNIT-IV**

**Nuclear decay and elementary particles:**  $\beta$  Decay, general features of  $\beta$  ray spectrum, Fermi theory of  $\beta$  decay, selection rules, parity in  $\beta$  decay, multipole radiation, internal conversion, nuclear isomerism.

**UNIT-V**

**Elementary particles:** Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU (3).

**Suggested Readings:**

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|------------------------------------|--------------------------------|
| 1. Introduction to Nuclear physics | H.A. Enge                      |
| 2. Nuclear radiation detectors     | S.S. Kapoor and V.S.Ramamurthy |
| 3. Atomic and Nuclear physics      | S.N. Ghoshal                   |
| 4. Nuclear and Particle physics    | D.C. Tayal                     |
| 5. Nuclear Physics                 | R.C. Sharma                    |

**DIGITAL ELECTRONICS**  
**PHY303**

**UNIT-I**

Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsigned binary numbers, 1's complement, 2's complement.

**UNIT-II**

Codes: BCD, Gray, ASCII, EBCDIC, Demorgans theorem, Gates: OR, AND, NOT, NOR, OR, NAND, XOR, XNOR, Boolean algebra, karnaugh map, adder and subtractor circuit design.

**UNIT-III**

Multiplexer, demultiplexer, encoder, decoder, parity checker and generator, Flip-Flops: R-S, D, J-k, J-k Master slave flip flop, race around condition registers, shift registers (left and right shift).

**UNIT-IV**

Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter).

**UNIT-V**

Digital to analog conversion (Binary weighted register method, R-2R ladder network method, complete DAC structure. Analog to digital converters (Stair case or counter method, single slope, equal slope, successive approximation ADC).

**Suggested Readings:**

1. "Digital principles and applications" by A.P.Malvino and Donald P.Leach, Tata Megraw-Hill company, New Delhi, 1993.
2. "Microprocessor Architecutre, Programming and Applications with 8085/8086 by Rames S. Gaonkar, Wiley-eastern Ltd. 1987 (for unit V)".
3. Digital electronics —S.N. Ali.
4. Digital electronics- Morries Mano.
5. Microprocessor and Microcompuetrs- B.Ram-Dhanpat Rai publications V edition.

## ATOMIC & MOLECULAR PHYSICS-I

### PHY304

#### UNIT-I

**Nuclear Magnetic Resonance Spectroscopy:** Concept of Nuclear Magnetic resonance spectroscopy, Interaction between nuclear spin and magnetic field, population of energy level, relaxation processes, spin-spin interaction and spin-spin coupling between two and more nuclei (Qualitative)

#### UNIT-II

**Electronic spectra of Diatomic Molecules:** Franck Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence).

#### UNIT-III

**Raman Spectra:** Raman effect, quantum theory of Raman effect, Molecular polarisability in Raman effect, Vibrational Raman spectra, vibration-rotation Raman Spectra of diatomic molecules, application of Raman and infrared spectroscopy in the structure determination.

#### UNIT-IV

**Mossbauer Spectroscopy:** Mossbauer Effect, principles of Mossbauer spectroscopy, recoil less emission of gamma emission, line width and resonance absorption, application of mossbauer spectroscopy (Isomer shift, Quadra pole splitting magnetic field effect).

#### UNIT-V

**Electron Spin Resonance spectroscopy:** Elementary Idea about ESR, Principle of ESR, ESR spectrometer, splinting of electron energy levels by a magnetic field, G-Values, simple experimental setup of ESR. ESR spectra of free radicals in solution, An Isotropic system.

#### Suggested Readings:

1. Fundamentals of Molecular Spectroscopy-C.B. Banwell.
2. Spectra of Diatomic Molecules-Herzberg.
3. Mossbauer Spectroscopy-M.R.Bhide
4. NMR and Chemistry-J.W.Akitt 5. Modern Spectroscopy-J.M.Hollons
5. Modern Spectroscopy-J.M. Hollons

**SUBJECT: PHYSICS**

**List of Experiments for M.Sc. (III Sem)**

**Lab A: General**

1. Susceptibility measurements.
2. Study of Hall Effect.
3. Study of Hysteresis Curve.
4. Study of Frank and Hertz experiments.
5.  $e/m$  using Zeeman Effect.

**Lab B: Electronics**

1. To Study gates and verify truth tables.
2. To verify De-Morgan's theorem.
3. To verify truth table for RS, D, T & JK flip flop.
4. To Study synchronous and Asynchronous Counter.
5. Study of Multivibrator circuits.