Government Degree College (Autonomous), Baramulla

SEMESTER 6th **Major/Minor COURSE**

Subject: Physics

Course Title: Solid State Physics **Course Code: BPH22C601**

Credits: Theory: 04; Practical: 02 **Contact Hours: Th 64 Hr, Pr 64Hr**

Unit 1:

- Solids: Amorphous and Crystalline solids, concept of space lattice and Basis, unit cells, Periodicity and Symmetry elements, two and three dimensional Bravais lattices, Miller indices for axes and planes, Crystal systems, Braggs law (scalar form), Reciprocal Lattice and its properties, Construction of reciprocal lattice, Wigner Seitz cell, Braggs law in vector form, reciprocal lattice of SC, BCC and FCC, The Laue, powder and rotating crystal methods for observing crystal structure.

Unit 2:

- Concept of Specific heat, Dulong and Petit Law for specific heat of solids, Einstein Theory of Specific heat, Debye theory of specific heat, Debye T^3 law, Lattice waves in one-dimensional monoatomic lattice, Density of states of a monoatomic lattice; Dynamics of one dimensional lattice vibrations- Dispersion curve, . The concept of Phonons, thermal conductivity in metals. Drude model, Quantum mechanical free electron gas; electrical conductivity; electrical resistivity versus temperature and pressure; heat capacity of conduction electrons, Matthiessen's rule

Unit 3:

- The periodic potentials, Bloch theorem, Electrons in one dimensional periodic potential; Kronig- Penney model; Concept of Brillouin zones; Explanation of energy bands on the basis of Brillouin zones; concept of effective mass, Fermi surface, construction of Fermi surfaces, Hall effect.

Unit 4:

- Magnetic properties of materials, Diamagnetic, paramagnetic, ferromagnetic and antiferromagnetic materials, Magnetisation, Magnetic permeability, Magnetic susceptibility, Magnetic dipoles and Bohr Magneton, Electron spin and magnetic moment, Langevins theory of diamagnetism and Paramagnetism, Curie law of paramagnetism and its extension to Ferromagnetism, Domain theory of ferromagnetism (qualitative discussion only).
- Superconductivity: Discovery of superconductivity, critical temperature, persistent current, Meissner effect, Specific heat and Isotope Effect, Applications of Superconductivity.

List of Practicals

- To measure the resistivity of a semiconductor (Ge) with temperature (up to 1500C) by four-probe method and determine its band gap.
- To determine the Hall coefficient of a semiconductor sample.
- Study of magnetic Hysteresis.
- Measurement of Dielectric constant of a given material.
- Measurement of change in resistance of a semiconductor with magnetic field.
- Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method).
- Influence of temperature on resistivity of a semiconductor and find its band gap.
- Verification of the Stefan-Boltzmann's Law for Thermal Radiation.

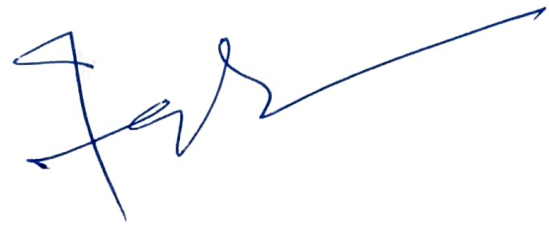
Text Books:

1. Introduction to Solid State Physics by Charles Kittel
2. Solid State Physics by Neil W Ashcroft, N. David Mermin
3. Solid State Physics by Azaroff and Mermin.
4. Solid State Physics by Giuseppe Grosso and Giuseppe Pastori Parravicini (2nd Edition)
5. Solid State Physics: An Introduction to Principles of Materials Science by Harald Ibach and Hans Lüth (4th Edition)
6. Solid State Physics by M. A. Wahab (1st Edition)

7. Fundamentals of Solid State Physics by B. S. Saxena, R. C. Gupta, and P. N. Saxena (1st Edition)
8. Concepts in Solid State Physics by M. S. Rogalski and S. B. Palmer (1st Edition)

Suggested Reading:

1. Solid State Physics, 2nd Edition by J. R. Hook and H. E. Hall
2. The Oxford Solid State Basics by Steven H. Simon
3. Elementary Solid State Physics by M. Ali Omar
4. Principles of the Theory of Solids by J. M. Ziman



Government Degree College (Autonomous), Baramulla

SEMESTER 6th **MAJOR COURSE**

Subject: Physics

Course Title: Nuclear and Particle Physics **Course Code: BPH22C602**

Credits: Theory: 04 **Contact Hours: Th 64 Hr**

Unit-I

- Structure of nuclei, Basic Properties of Nuclei: Mass, Radii, Charge, Angular Momentum, Spin, Magnetic Moment, Stability and Binding Energy. Nuclear Forces, Meson Theory of Nuclear Forces and Discovery and types of Pions.
- Radioactivity: Law of Radioactive Decay, Half-life, Theory of Successive Radioactive Transformations, Radioactive Series, Binding Energy vs Mass Number curve

Unit-II

- Nuclear Models: Liquid Drop Model, Shell Model (qualitative description). Compound Nucleus. Fission and Fusion.
- Accelerators: Linear Accelerator, Betatron, Detectors of Nuclear Radiations: Interaction of Energetic particles with matter. Ionization chamber. GM Counter. Bubble Chamber. Scintillation Detectors. Semiconductor Detectors.

Unit-III

- Alpha-decay: Range of α -particles, Geiger-Nuttal law and α-particle Spectra. Gamow Theory of Alpha Decay.
- β-decay: Energy Spectra and Pauli's Neutrino Hypothesis, Discovery of neutrino Gamma-Decay: Origin of gamma-rays.
- Nuclear Reactions: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction. Scattering Cross-section. Reaction Rate. Q- value of Reaction.

Unit-IV

- Fundamental Forces: Electromagnetic, weak, strong, and gravitational forces, with a focus on particle interactions via photons, W/Z bosons, and gluons.
- Introduction to Particle Physics: Particle classification, and the role of quantum mechanics.
- Quantum Numbers: Charge, spin, isospin, parity, strangeness, charm, baryon number, and lepton number, along with their significance in particle behaviour and classification. Overview of the Standard Model
- Symmetries and Conservation Laws: Conservation of energy, momentum, angular momentum, and quantum numbers in particle interactions; CPT symmetry and symmetry breaking (Qualitative discussion), Quarks and Gluons: Quark model

Text Books:

1. Introduction to Nuclear Physics by S. N. Ghoshal
2. Introductory Nuclear Physics by David Halliday (John Willey)
3. Nuclear Physics by Irving Keplan (Narosa Publishing House)
4. Introductory Nuclear Physics by Kenneth S. Krane
5. Introduction to Nuclear Physics by H. A. Enge (Addison-Wesley)

Suggested readings:

1. Experimental Nuclear Physics by Glenn F. Knoll
2. Experimental Techniques in Nuclear Physics by William R. Leo
3. Introduction to Experimental Nuclear Physics by R. M. Singhru
4. Introductory Nuclear Physics by Kenneth S. Krane
5. Introduction to Nuclear Physics by H. A. Enge (Addison-Wesley)

Government Degree College (Autonomous), Baramulla

SEMESTER 6th **MAJOR COURSE**

Subject: Physics

Course Title: Digital Electronics **Course Code: BPH22C603**

Credits: Theory: 04; Practical: 02 **Contact Hours: Th 64 Hr, Pr 64Hr**

Unit -I:

- Number Systems: Decimal, binary, hexadecimal number system and their conversion, Introduction to Binary codes, Data representation: signed and unsigned numbers, 1's and 2's complement representation, Binary arithmetic Operations (AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR), Logic gates and their Digital Circuits with truth tables, NOR and NAND as Universal Gates.
- Laws of Boolean algebra, De-Morgan's theorems, realizing different Operations using Universal Gates.
- Half adder and Full Adder.

Unit -II:

- SOP & POS, Min term, Max term, Simplification of logic functions using Karnaugh-Maps up to 4 variables, Introduction to digital logic families: RTL, DTL, TTL, ECL, CMOS etc., their comparative study.
- Combinational Logic Circuits: Binary Adder and Subtractor, 4 bit adder circuit. Binary Encoder & Decoder. Multiplexer & Demultiplexer, Binary Comparator.

Unit -III:

- Types of Memory: RAM, ROM. Static and Dynamic RAM; PROM; EPROM and EEPROM, Memory address space.
- Sequential Logic circuits: Flip-flops, SR Flip flop, D flip flop, JK flip flop, Shift Registers, Counters: Modulus, Decade, Up/Down, Counters (asynchronous, synchronous counters: Ring counters, Ripple counter, up, down and decade counters), Introduction to various registers, Flag register and Program counter.
- Microprocessors, Architecture of 8085 Microprocessor; 555 Timer Chip, Minimum CPU.

Unit – IV:

- Microcontrollers; Introduction/Evolution and Applications of Microcontrollers, Comparison of Microprocessor and Microcontroller. Microcontrollers for embedded system, Criteria for choosing a Microcontroller.
- Architecture of 8051 microcontroller: Overview and Internal Structure, Pin description of 8051 microcontroller: Pin configuration and functions, Connection schematics
- Programming Languages: Assembly language – basics and usage, High-level languages—advantages and usage (e.g., C), Introduction to IoT: Significance of IoT; Applications of microcontrollers in IoT.

List of Practicals:

- To design basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) using discrete components.
- To design basic logic gates (AND, OR, NOT) using universal gates.
- To verify Boolean expressions using basic and universal gates.
- To design and realize Half and Full Adder Circuits using basic logic gates/universal gates.
- To design a 4-bit magnitude comparator using basic/universal logic gates.

- To design a 4:1 multiplexer and 1:4 de-multiplexer circuits using basic/universal logic gates.
- To implement a 4/5 variable Boolean function using a suitable MUX.
- To design a 2n to n line encoder using basic universal logic gates.
- To design a control signal generator for 2n :1 MUX and 1: 2n DEMUX using decoder.
- Design a BCD to 7 segment decoder using IC"s (7447).
- To design the following flip-flops using universal gates. S-R flip-flop, D flip-flop , J-K flip-flop, (b) Study race around condition of J-K flip-flop and design edge-triggered J-K-flip flop.
- To design Johnson & Ring counter
- Addition and subtraction of numbers using direct addressing mode
- Addition and subtraction of numbers using indirect addressing mode
- Multiplication by repeated addition.
- Division by repeated subtraction.
- Handling of 16-bit Numbers.
- To find that the given numbers is prime or not.
- To find the factorial of a number.
- Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
- Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.
- Program to glow the first four LEDs then next four using TIMER application.

Textbooks:

1. Digital Electronics: An introduction to theory and practice, Gothmann and William H, PHI
2. Fundamentals of Digital Circuits, Anand Kumar, PHI
3. Digital Fundamentals, Thomas L. Floyd, 11th Edition, Pearson
4. Digital Design (fourth Edition), M. Morris Mano and Michael D Ciletti, Pearson
5. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, Penram International, 5th edition

Suggested Reading:

1. Advanced Digital Design with the Verilog HDL, Michael D. Ciletti, 2nd Edition, Pearson
2. Digital Systems: Principles and Applications, Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, 12th Edition, Pearson
3. Contemporary Digital Design, Randy Katz and Gaetano Borriello, 2nd Edition, Pearson
4. Introduction to Embedded Systems, Shibu K.V., 1st Edition, McGraw Hill Education
5. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj and Anupama C. Raman, CRC Press