DEPARTMENT OF PHYSICS
C. M. Dubey Post Graduate College, Bilaspur (C.G.)
2017-18

Learning Outcomes in M.Sc. PHYSICS Programme:

- **PROGRAMME OUTCOMES (POs):**

The student who will be completing Post Graduation with the Degree M.Sc. PHYSICS should be able to

PO1. Science knowledge: Knowledge of basic science fundamentals

PO2. Problem analysis: Develop analytical skills to identify, formulate, analyze complex mechanisms using first principles basic sciences.

PO3. Development of solutions: Design solutions for complex chemical process problems and evolve procedures that meet the specified needs with appropriate consideration for the public health and safety and environmental considerations.

PO4. Critical review of solutions: Use of research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern analytical tool usage: Select, and apply appropriate techniques, resources, and modern analytical tools

PO6. The scientist and society: Apply reasoning through the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional chemical practice.

PO7. Environment and sustainability: Understand the impact of the chemical processes in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the chemistry practice

PO9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex scientific activities with the science community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the scientific and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

- **PROGRAMME SPECIFIC OUTCOMES (PSOs):**

PSO1: Students will demonstrate knowledge of mathematical physics, quantum mechanics, electrodynamics, statistical physics, and be able to apply this knowledge to analyze a variety of physical phenomena and related subjects.

PSO2: Students will acquire experimental skills which enable them to take precise measurements in physics labs and analyze the measurements to draw valid conclusions. In addition, students will exhibit skills in solving problems numerically using computer programming, plotting tools, and related software.

PSO3: Students will show enhanced oral and written scientific communication skills and be able to think critically and work independently as well as in a team and play beneficial role in the society as a person with better scientific outlook.

❖ **COURSE OUTCOMES (COs):**

SEMESTER-I

PAPER – I: MATHEMATICAL METHODS-I

COURSE CODE: 521-01

❖ **Broad contents of the course:**

1. Vector Spaces, Matrices and Eigen Value Problems
2. Special Functions: Legendre's, Laguerre's, Bessel's, and Hermite's Differential Equation.
3. Laplace and Fourier Transform and their Inverse Transforms
4. Dirac Delta Function

❖ **Course Learning Outcomes:**

After going through the course, the student should be able to

CO1. Generalize the concept of real/complex vector space to an arbitrary finite dimensional vector space.

CO2. Investigate the properties of vector spaces and sub-spaces using Linear Transformation.

CO3. Compute Eigen values and Eigen Vectors using characteristic polynomial.

CO4. Identify the eigen value problems in quantum mechanics.

CO5. Get an idea of Power series method to solve differential equations.

CO6. Learn about the special functions, such as the Hermite polynomial, the Legendre polynomial, the Laguerre polynomial and Bessel functions and their differential equations and their applications in various physical problems such as in quantum mechanics.

CO7. Analysis the Fourier expansion of periodic functions and their applications in physical problems such as vibrating strings etc.

CO8. Learn the Dirac delta function its properties, which have applications in various branches of Physics, especially quantum mechanics.

SEMESTER-I

PAPER – II: CLASSICAL MECHANICS

COURSE CODE: 521-02

❖ Broad contents of the course:

1. D'Alembert's Principle, Lagrangian formulation and it's applications.
2. Variational Principle and Calculus of Variation.
3. Hamiltonian formulation of mechanics and it's applications.
4. Principle of least action.
5. Canonical Transformation, Hamilton-Jacobi Theory.
6. Poisson's Brackets and Lagrange's Brackets.

❖ Course learning outcome:

After going through the course, the student should be able to

CO1. Understand the basic conservation laws in physics and the concept of phase portrait.

CO2. Comprehend and apply the Lagrangian formalism to simple dynamical systems

CO3. Apply Hamilton's equations and solve problems related to dynamical systems.

CO4. Transform the phase-space coordinate system preserving the form of Hamilton's equation.

CO5. Analyze the properties of Poisson's bracket and canonical transformations for solving simple systems.

SEMESTER-I

PAPER- III: NUMERICAL METHOD AND C-PROGRAMMING

COURSE CODE: 521-03

❖ Broad contents of the course:

1. Problem analysis and Flow Chart
2. Structure of a simple C-program, Variables, Constants
3. Logical Operators and Arithmetic Operators.
4. Decision making statements and the concept of Loops in C-programming.
5. Functions, Arrays and Strings.
6. Solution of simultaneous linear equations using Gaussian Elimination Method.
7. Solution of Algebraic and Transcendental equations: Bisection, Newton-Raphson and False-Position Method.
8. Approximate Methods for Eigen value and Eigen Vector: Power and Jacobi Method.

9. Method of Curve Fitting.

10. Calculus of Finite Differences and Interpolation.

11. Numerical differentiation and Integration.

❖ **Course learning outcome:**

After going through the course, the student should be able to

CO1. Learn the fundamentals of the C programming languages and their applications in solving simple physical problems involving interpolations, differentiations, integrations, differential equations as well as finding the roots of equations.

CO2. Solve system of linear equations through constructing upper and lower triangular matrix by applying the method of Gaussian Elimination.

CO3. Implement the concept of pivoting.

CO4. Deal with different Algebraic and Transcendental equations through Bisection, Newton-Raphson and False-Position Method and hence comparative study of convergence will be done.

CO5. Distinguish between exact methods and approximate methods.

CO6. Solve mathematical problems using approximate methods viz. Power method and Jacobi Method.

SEMESTER-I

PAPER- IV: ELECTRONICS-I

COURSE CODE: 521-04

❖ **Broad contents of the course:**

1. Biasing of BJT and Concept of Feedback.
2. Working and Characteristics of FET, MOSFET and UJT.
3. Charge accumulation devices: MIS, MOS and CCD.
4. Microwave devices: Tunnel Diode.
5. Transfer Electron Devices: Gunn Diode
6. Backward diode and IMPATT diode.
7. Types of Modulation, Amplitude Modulation, DSBSC and SSB Modulation.
8. Frequency division multiplexing (FDM).

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Analyze the different biasing and equivalent circuits, coupled amplifiers and feedback in amplifiers and oscillators.

CO2. Characterize Metal oxide semiconductors, UJT, JFET, MOSFET, Charge coupled Devices and Tunnel Diode and their working principle.

CO3. Distinguish between different modulation techniques and compare their superiority.

CO4. Explain the conventional digital communication system.

CO5. Apply the knowledge of signals and system and evaluate the performance of digital communication system.

SEMESTER-II

PAPER- I: MATHEMATICAL METHODS- II

COURSE CODE: 522-21

- **Broad contents of the course:**

1. Tensor Algebra: Contravariant, covariant tensors, Christophell's symbol, Covariant differentiation.
2. Green's Function: Boundary Value Problems.
3. Boundary Value Problems in Heat flow equations and in Electrostatics.
4. Function of Complex Variables: Analytic Function, Singularities, Cauchy-Riemann equation, Cauchy's Integral formula, Residue Theorem and Contour integration.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Learn some basic properties tensors, their symmetric and antisymmetric nature, the Cartesian tensors, the general tensors, contravariant, covariant and mixed tensors and their transformation properties under coordinate transformations, physical examples of tensors such as moment of inertia tensor, energy momentum tensor, stress tensor, strain tensor etc.

CO2. Deal with the physical situation in the presence of an impulsive load through Green's function.

CO3. Solve Electrostatic Boundary Value problems and Scattering problems in Quantum Mechanics.

CO4. Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics.

CO5. Learn about analytic functions and how to check analyticity based on Cauchy-Riemann equation.

CO6. Evaluate complex integrals by various methods.

SEMESTER-II

PAPER- II: QUANTUM MECHANICS-I

COURSE CODE: 522-22

- **Broad contents of the course:**

1. Introduction to Quantum mechanics: Uncertainty principle, Schroedinger Equation and it's application to One dimensional problems (Potential well and barrier, Harmonic oscillator)
2. Bra and Ket notation.
3. Matrix representation of an Operator.
4. Commutation Relations, Angular momentum, Pauli's Matrices.
5. Spherically Symmetric Potential: H-atom problem.
6. Time-independent perturbation theory and application to Zeeman Effect, Stark Effect.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Explain microscopic phenomena, quantum theory formulation- introduced through Schrodinger equation after an exposition of inadequacies of classical mechanics.

CO2. Have the interpretation of wave function of quantum particle and probabilistic nature of its location and subtler points of quantum phenomena are exposed to the student.

CO3. Apply the various postulates of quantum mechanics to 1D and 3D Problems through understanding the behavior of quantum particle encountering a barrier or potential.

CO4. Understand and familiarize the mathematical background viz. Hilbert space, Bra-Ket notation, matrix method etc. in which the basic and applied quantum mechanics are framed.

CO5. Comprehend the basic concepts of angular momentum and improve problem solving Skills.

CO6. Solve non-relativistic hydrogen atom, for its spectrum and eigenfunctions.

CO7. Gain knowledge of approximation methods for stationary and non-degenerate states of a system.

CO8. Apply the time-independent quantum approximation method to solve quantum mechanical problems like Harmonic Oscillator, Zeeman Effect, Stark Effect etc.

SEMESTER-II

PAPER- III: ELECTRDYNAMICS

COURSE CODE: 522-23

- **Broad contents of the course:**

1. Equation of continuity, Maxwell's equations
2. Gauge Transformations: Lorentz gauge and Coulomb gauge.
3. Wave equations in terms of Scalar and Vector Potentials.
4. Poynting’s Theorem for system of particles and EM field.
5. Electromagnetic waves in different media.
6. Fresnel’s equations: Reflection and transmission coefficients at the interface between two non-conducting media.
7. Wave guides.
8. Einstein's special theory of relativity and Covariant formulation of Electrodynamics.
9. Retarded Potential, Lienard-Wiechart potentials, the electromagnetic field of a uniformly moving point charge, Radiation from an accelerated charge at low velocity.
10. Radiation from different Charge and Current distribution.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Achieve an understanding of the Maxwell’s equations, role of displacement current, gauge transformations, scalar and vector potentials, Coulomb and Lorentz gauge, boundary conditions at the interface between different media.

CO2. Apply Maxwell’s equations to deduce wave equation, electromagnetic field energy, momentum, and angular momentum density.

CO3. Analyze the phenomena of wave propagation in the unbounded, bounded, vacuum, dielectric, guided and unguided media.

CO4. Understand the laws of reflection and refraction and to calculate the reflection and transmission coefficients at plane interface in bounded media.

CO5. Acquire knowledge about the fundamentals of propagation of electromagnetic waves through optical fibres and calculate numerical apertures for step and graded indices and transmission losses.

CO6. Recapitulate and learn the special theory of relativity- postulates of the special theory of relativity, Lorentz transformations on space-time and other four vectors, four-vector notations, space-time invariant length, length contraction, time dilation, mass-energy relation.

CO7. Review the retarded potentials, potentials due to a moving charge, Lienard-Wiechert potentials, electric and magnetic fields due to a moving charge, power radiated, Larmor's formula and its relativistic generalization.

SEMESTER-II

PAPER- IV: ELECTRONICS-II

COURSE CODE: 522-24

- **Broad contents of the course:**

1. Radiative and non-radiative transitions.
2. LEDs: Visible and Infrared LEDs, Diode Laser.
3. Photo detectors: Photoconductor, Phototransistor and Solar cells.
4. Differential Amplifier: DC analysis and AC analysis.
5. Operational Amplifier: Open and Closed loop Gain, CMRR.
6. Op-Amp as Inverting, Non-inverting, Scaling amplifier etc.
7. Principle of Oscillator: Phase Shift, Wein Bridge Oscillator.
8. Multivibrators and Comparators.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Gain knowledge about transitions in visible and infra-red regions.

CO2. Interpret the photoconduction, photodetection phenomena.

CO3. Learn about semiconductor light emitting diodes (LEDs) and lasers, and the important rules for their analysis, planning, design, and implementation.

CO4. Apply knowledge through challenging homework problem sets to cement understanding of the material and prepare for their career.

CO5. Choose suitable semiconductor materials for light emitting devices.

CO6. Gain comparative knowledge of Organic and Inorganic Solar cells and their working principle.

CO7. Understand the basics and working of Op-Amp and it's wide applications as devices and hence their efficiencies.

CO8. Explain basic working of an oscillator including its different components and to employ the same to study different wave forms and to measure voltage, current, frequency and phase.

CO9. Construct multivibrators, Design monostable/astable multivibrators using IC555, I-V characterization of build Wein-bridge oscillators and construct amplifying circuits using IC 741.

SEMESTER-III

PAPER- I: QUANTUM MECHANICS-II

COURSE CODE: 523-31

- **Broad contents of the course:**

1. Variational Principle: application to He, H- atom and SHO.
2. WKB Method: Connection formula and application to potential well and barrier problems.
3. Time dependent Perturbation Theory, Fermi's Golden rule; Harmonic Perturbation
4. Einstein's Transition Probabilities: Absorption and Emission phenomena.
5. Selection Rule for transitions.
6. Theory of Scattering: Born's approximation, Partial Wave analysis and their applications.
7. Identical particles: Symmetric and Anti symmetric wave function.
8. Relativistic quantum mechanics: Dirac equation, Theory of Positron, Covariant Formulation.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Acquire knowledge and calculate the minimum energy state of a quantum system.

CO2. Demonstrate the propagation of a particle(wave) in a quasi-classical condition.

CO3. Deal with the problems related to slowly varying potentials.

CO4. Solve and calculate the probability of a transition from lower state to higher one for a quantum system where the perturbation depends on time, harmonic in nature.

CO5. Find Einstein's transition coefficients using Time dependent perturbation theory.

CO6. Comprehend the concepts of absorption and emission phenomena.

CO7. Gain knowledge about the scattering theory.

CO8. Solve different quantum problems using Born's approximation and Partial Wave Analysis.

CO9. Identify basic difference between the identical particles and their corresponding wave functions.

CO10. Understand the relativistic behavior of quantum particles and their dynamics.

SEMESTER-III

PAPER- II: STATISTICAL MECHANICS

COURSE CODE: 523-32

❖ Broad contents of the course:

1. Concept of Phase Space, Microstate and Macrostate.

2. Postulates and Hypothesis: Boltzmann Entropy relationship.

3. Ensemble average and Time average.

4. Thermodynamics in different types of Ensembles.

5. Indistinguishability of Particles: MB, BE and FD statistics, applications to Ideal gas, Blackbody radiation and free electron in metals.

6. Cluster expansion for a classical gas.

7. Ising model in 3, 2 and 1 dimension.

8. Thermodynamic fluctuations, Random Walk Problem, Brownian motion.

❖ Course learning outcome:

After going through the course, the student should be able to

CO1. Understand the concepts of microstate, macrostate, ensemble, phase space, thermodynamic probability, and partition function.

CO2. Demonstrate the combinatoric studies of particles with their distinguishably or indistinguishably nature and conditions which lead to the three different distribution laws e.g. Maxwell-Boltzmann distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles and their derivation.

CO3. Comprehend and articulate the connection as well as dichotomy between classical statistical mechanics and quantum statistical mechanics.

CO4. Learn to apply the classical statistical mechanics to derive the law of equipartition of energy and specific heat.

CO5. Get an idea about the Gibbs paradox, equipartition of energy and concept of negative temperature in two level system.

CO6. Derive classical radiation laws of black body radiation. Wiens law, Rayleigh-Jeans law etc.

CO7. Conceptualize ensembles and relations between partition function and thermo dynamical potentials.

CO8. Calculate the macroscopic properties of degenerate photon gas using BE distribution law, understand Bose-Einstein condensation law and liquid Helium. Bose derivation of Plank's law

CO9. Understand the concept of Fermi energy and Fermi level, calculate the macroscopic properties of completely and strongly degenerate Fermi gas, electronic contribution to specific heat of metals.

CO10. Apply F-D statistical distribution law to derive thermodynamic functions of a degenerate Fermi gas, electron gas in metals and their properties.

CO12. Predict the energies of different configurations and concentrations of a several elements arranged on a fixed lattice.

CO13. Solve phase transition problems, in complex three dimensional geometries. Applications include ground state searches, modeling the energy of solid solutions, and precipitate formation

CO14. Discuss the statistical nature Thermodynamic fluctuations of thermodynamical quantities of a system.

SEMESTER-III

PAPER- III: CONDENSED MATTER PHYSICS - I

COURSE CODE: 523-33

- ❖ **Broad contents of the course:**

1. Crystal Structures: Unit cells, Direct lattice. 2D and 3D Bravais lattice,
2. Miller indices, Closed Packed Structures
3. Symmetry operations.
3. Bragg's Law and Laue's Equation, Reciprocal Lattice and Brillouin Zone.
4. Defects in Crystals: Point defects, Vacancies and Dislocations.
5. Band theory of Solids: Bloch theorem, Kroning-Penny model.
6. Tight binding approximation, Fermi surface.
7. Ferromagnetism: Weiss theory, Curie-Weiss law.
8. Spin waves and magnon, Neel temperature.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Have a brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.

CO2. Reveal various structural imperfections as well as to discover their formation mechanism and to understand their effects on the properties of solid materials.

CO3. Comprehend the understanding on the basic approaches to the formation of electronic Band structure of materials and the Fermi surfaces.

CO4. Understand the band structure effects that arise from differently shaped potentials.

CO5. Obtain simple numeric solutions for the eigen values and eigenstates for any confining one-dimensional potential.

CO6. Acquire complete knowledge on the classical and quantum theories of the different types of magnetism and elucidate the exchange interaction and domain theories of ferromagnetism.

SEMESTER-III

PAPER- IV: ELECTRONICS-III

COURSE CODE: 523-34

- **Broad contents of the course:**

1. Number system: Decimal, Binary, Octal and Hexadecimal.
2. Logic gates: Universal building block, K-Map, SOP and POS expressions.
3. Gate Circuitry.
4. Digital logic Families: RTL, DTL, TTL, ECL and CMOS logic.
5. Decoder, Encoder, Multiplexer, De-Multiplexer.
6. Flip-flops and timing diagrams.
7. Counters and timing diagram.
8. Registers: Application of Shift Register.
9. D/A converters, A/D converters.
10. Intergraded Circuit: Fabrication of components on monolithic IC.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Synthesis of Boolean functions, simplification, and construction of digital circuits by employing Boolean algebra.

CO2. Gain knowledge of basics of network theory for understanding the working of logic families.

CO3. Construct both combinational circuits and sequential circuits by employing NAND as building blocks and demonstrate Adders, Subtractors, Shift Registers, and multivibrators using 555 ICs.

CO4. Analyze sequential systems by choosing Flip-Flop as a building block.

CO5. Understand and implement the function of a counter.

CO6. Learn how to Switch or route signals through MUX.

CO7. Implement the understanding of data communication and data bus control.

CO8. Acquire knowledge about Operational amplifiers and it's different configurations namely inverting and non-inverting and applications of operational amplifiers in D to A and A to D conversions.

CO9. Gain the knowledge of basic structure and different layers of monolithic ICs.

CO10. Learn the structure forming process of a monolithic IC.

CO11. Fabricate different components.

SEMESTER-IV

PAPER- I: CONDENSED MATTER PHYSICS - II

COURSE CODE: 524-41

- **Broad contents of the course:**

1. Superconductivity: Critical Temperature, Meissner Effect.
2. Thermodynamics of superconducting transitions.
3. London's equations.
4. BCS theory of superconductivity.
5. Polarization: Electronic, Ionic and Orientational.
6. Landau theory of phase transition: first and second order
7. Semiconductors: Energy bands, Carrier Concentration and Fermi level.
8. Elementary Ideas of nano structure: Properties, Different methods of preparation, applications.
9. Lattice dynamics of linear monoatomic and diatomic lattices, optical and acoustical modes.

10. Phonons.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Understand the different theories of superconductivity and its applications

CO2. Summarize the difference between good conductor, perfect conductor, and superconductor.

CO3. Explain type I and type II superconductivity on the basis of thermodynamic calculations of Gibbs' free energy for a superconductor.

CO4. Show how the London equations and Maxwell's equations lead to the prediction of the Meissner effect.

CO5. Describe the behavior of the carriers in semiconductors, doping, formation of Junctions and their characteristics.

CO6. Gain complete knowledge of different methods to grow nano-structured materials.

CO7. Acquire and assess the scientific value of the state of art related to nanoscience and nanotechnology systematically.

CO8. Comprehend phonons- thermal properties, phonon heat capacity, density of states.

SEMESTER-IV

PAPER- II: NUCLEAR PHYSICS

COURSE CODE: 524-42

- **Broad contents of the course:**

1. α decay: Geiger Nuttal law, α- particle spectra.
2. β decay: β spectrum, neutrino hypothesis, Fermi's theory of β decay.
3. Nuclear Reactions: Conservation laws, Q equation.
4. Theory of compound nucleus, partial wave analysis.
5. Nuclear fission: Chain reactions, Nuclear reactor.
6. Nuclear Fusion, thermonuclear energy, prospect of controlled fusion energy.
7. Counters and Accelerators.
8. Elementary Particles: Classification, Conservation laws, Invariance under parity.
9. Elementary Particle Symmetry [SU (2), SU (3)], Quark theory.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay. Neutrinos and its properties and role in theory of beta decay.

CO2. Have knowledge on the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws, The reaction cross-sections, the types of nuclear reactions, direct and compound nuclear reactions.

CO3. Understand fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.

CO4. Learn about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the photo-multiplier tube, the solid state and semiconductor detectors.

CO5. Demonstrate the principles and basic constructions of particle accelerators such as the cyclotron, betatron and synchrotron. They should know about the accelerator facilities in India.

CO6. Gain knowledge on the basic aspects of particle Physics – the fundamental interactions, elementary and composite particles, the classifications of particles: leptons, hadrons (baryons and mesons), quarks, gauge bosons. The students should know about the quantum numbers of particles: energy, linear momentum, angular momentum, isospin, electric charge, colour charge, strangeness, lepton numbers, baryon number and the conservation laws associated with them.

SEMESTER-IV

PAPER- III: ATOMIC MOLECULAR PHYSICS

COURSE CODE: 524-43

- **Broad contents of the course:**

1. Spectra of hydrogen and hydrogen like atoms. Sommerfeld's elliptic orbit, Relativistic corrections.

2. Pauli's Vector atom model, four quantum numbers, Spectral terms.

3. Spectra of Helium, L-S and J-J coupling.

4. X-ray spectrum: Continuous and Characteristics X-ray; fine structure analysis.

7. Normal and Anamlous Zeeman effect.

8. Types of molecules: Energy levels, Selection rules, Spectra.

9. Rotational energy and spectra of diatomic molecules as rigid rotor and non-rigid rotor.

10. Vibrational energy of diatomic molecule, Energy levels, Spectrum.

11. Isotope effect, Morse potential energy curve, dissociation energy.

12. Vibration rotational spectra of diatomic molecule.

13. Frank Condon principle, Born-Oppenheimer approximation.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Apply the concept of Bohr's Model in analyzing the spectra of H and H-like atoms.

CO2. Explain the key properties of many electron atoms.

CO3. Demonstrate the quantization of space and spin using Vector-atom model.

CO4. Discuss the relativistic corrections for the energy levels of the hydrogen atom and their effect on optical spectra.

CO5. Acquire knowledge about the observed dependence of atomic spectral lines on externally applied magnetic field.

CO6. Understand the theories, explaining the structure of atom and origin of the observed spectra.

CO7. Classify different types of molecules and their corresponding energy levels, spectrum, and selection rules for valid transitions viz. rotational, vibrational etc.

SEMESTER-IV

PAPER- IV: ELECTRONICS-IV

COURSE CODE: 524-44

- **Broad contents of the course:**

1. Evolution of Microprocessor, Microprocessor Architecture.
2. Memory: Semiconductor memories, Magnetic Memories.
3. LAN Topology.
4. Intel 8085: ALU, Timing and Control Unit, Registers, Data and Address Bus, Pin Configuration.
5. Instruction Cycle, Machine Cycle: Time Diagram
6. Addressing Modes, Instruction set of 8085.
6. Assembly Language Programs.
7. Optical Fibers and it's types: Light propagation through and optical fiber.

- **Course learning outcome:**

After going through the course, the student should be able to

CO1. Explain the embedded systems including its generic architecture, design and classifications, embedded processors, and microcontrollers.

CO2. Conceptualize the organization of intel microprocessor 8085, its architecture, pin diagram, timing diagram, instruction set and programming in assembly language.

CO3. Discuss the organization of Intel 8085 microcontroller, its architecture, instruction set, programming and its memory organization, timing diagram.

CO4. Solve input/output operations and manipulation for arithmetic and logical operations.

CO5. Handle programming with and without interrupt service request.

CO6. Understand and implement microprocessor and assembly language programming with special reference to Intel μP 8085.