Course Outcomes

Semester -5

PHYSICS

PHY- 501- SOLID STATE PHYSICS

After completion of the course students will get-

1. The knowledge in field of crystalline solids and the crystal structures along with the various lattices in two and three dimensions.

2. Further, in this they get to know about the crystal planes and the interplanar spacing of the crystals. They get to understand the structure by using the X-ray diffraction and various methods involved to do experimental X-ray Diffraction.

3. Furthermore, they get to know about the Reciprocal Lattice and its physical significance. Specific Heat of Solids and Einstein's theory is also taught which give the in depth knowledge of the concepts of Solid State Physics.

PHY- 502- QUANTUM MECHANICS

After completion of the course students will be able to

1. General knowledge of the development of physics and the nature of scientific inquiry, particularly the progression from classical physics to the modern physics ideas of quantum mechanics, statistical mechanics, and relativity.

2. The basic laws of Quantum Mechanics, their corollaries, and comprehension of how they can be applied to explain specific natural phenomena.

3. They get to know about Schrodinger wave equation, it's solution for harmonic oscillator in ground and Excited States.

PHY- 503- PRACTICAL

After completion of the course -

1. Students will show that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyse the measurements to draw valid conclusions.

2. In this practical some more optical experiments are done along which the instrumental analysis of various kind of waves which is done electronically.

3. Students will show understanding of the interplay between theory and experiment

4. Laboratory skills and exposure to a variety of important experiments at appropriate levels that illustrate phenomena discussed in the lecture classes. Instrumentation and experimental techniques; methods for quantitative analysis of data and measurement uncertainty.

CHEMISTRY

Inorganic Chemistry (CH501)

On successful completion of this course, students will be able to

1. Describe in detail different models of chemical bonds in transition metal complexes.
2. Set up inorganic reaction mechanisms.
3. Describe kinetic methods for investigating reaction mechanisms.
4. Compare the stability of coordination complexes.
5. Predict about the magnetic behavior of transition metal complexes.
6. Find out ground state term symbol.
7. Interpret the orbital energy diagram and the electronic spectrum.

Physical Chemistry (CH502)

On successful completion of this course, students will be able to

1. Understand the concept of orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules,
2. Explain magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetics.
3. Define electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-oppenheimer approximation, Degrees of freedom.
4. Explain energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.
5. Explain energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra, idea of vibrational frequencies of different functional groups.
6. Understand the concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra.

Organic Chemistry (CH503)

On successful completion of this course, students will be able to

1. Interpret NMR spectroscopy.
2. Explain basic principles of NMR spectroscopy
3. Understand about the chemical shift, position and intensity of signal.
4. Analyze and interpret the PMR spectra of given compounds.
5. Define carbohydrates and describe the structure of monosaccharides.
6. Draw and determine the ring structure of glucose, structure of ribose and deoxyribose.
7. Explain the mechanism of mutarotation.

8. Describe the disaccharides and polysaccharides.
9. Understand the concept of organometallic compounds.
10. Write the methods of preparation and chemical reactions of organometallic compounds.

(Practical) CH-504

(Inorganic)

Student should be able to:

1. Perform semi-micro qualitative analysis of mixture containing not more than four radicals (including interfering, Combinations and excluding insoluables):

(Organic)

Student should be able to:

- Perform Laboratory Techniques; Steam distillation (non-evaluative)
- Separate naphthalene from its suspension in water
- Separate o-and p-nitrophenols

2. Perform Column chromatography (non-evaluative)
   - Separate fluorescein and methylene blue
   - Separate leaf pigments from spinach leaves
3. Perform Thin Layer Chromatography
   - Determine Rf values and identification of organic compounds
   - Separate green leaf pigments (spinach leaves may be used)
   - Separate mixture of colored organic compounds using common organic solvents.

MATHEMATICS
Math 12BSM 351

Upon successful completion of Math BM -351 **Real Analysis** a student will be able to:

1. Determine the Riemann integrability and the Riemann-Stieltjes integrability of a bounded function and prove a selection of theorems concerning integration.
2. Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis.
3. Determine the Improper integrals and their convergence.
4. Understand the concept of Comparison tests, Abel's and Dirichlet's tests,Frullani's integral, Integral as a function of a parameter.
5. Define and illustrate the concept of topological spaces and continuous functions,
6. Define connectedness and compactness, and prove a selection of related theorems.

Math 12BSM 352

Upon successful completion of Math BM -352 **Groups and Rings** a student will be able to:

1. Demonstrate understanding of the idea of a group, a ring and an integral domain, and be

aware of examples of these structures in mathematics.
2. Appreciate and be able to prove the basic results of group theory and ring theory.
3. Understand and be able to apply the fundamental theorem of finite abelian groups.
4. Understand Sylow's theorems and be able to apply them to prove elementary results about finite groups.
5. Appreciate the significance of unique factorization in rings and integral domains.
6. Apply the theory in the course to solve a variety of problems at an appropriate level of difficulty.

Math 12BSM 353

Upon successful completion of Math BM-353 **Dynamics**, a student will be able to:

1. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
2. Understand basic dynamics concepts – force, momentum, work and energy;
3. Understand and be able to apply Newton’s laws of motion;
4. Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution.
5. Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces)
6. Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy

Semester- 6

PHYSICS

PHY- 601- ATOMIC MOLECULAR & LASER PHYSICS

After completion of the course students will be able to get-

1. General knowledge of the development of physics and the nature of scientific inquiry, in the field of Atomic, Molecular and Laser Physics.
2. In this students get to know about the Vector model of an atom with their penetrating and non-penetrating orbits.
3. Also they get to know about various effects that take place like Zeeman's effect, Raman's Effect etc. to get the spectral lines in Sodium atom.
4. Furthermore, they get to know about the production and various phenomenons that are related to LASER which are applicable in the field of medicine and industry.

PHY- 602- NUCLEAR PHYSICS

After completion of the course students will be able to get-

1. General knowledge of the development of physics and the nature of scientific inquiry, in the field of Nuclear Physics.
2. In this student gets a detailed knowledge of the Nuclear reaction along with the binding energy and various experimental conclusions related to Nuclear Physics.
3. Furthermore, Students get to know about the Nuclear disintegration which leads to the emission of various radioactive rays which are further used in various Scientific phenomenas.
4. They get to know about instrument abd devices such as Linear Accelerators, Tendem Accelerator, Cyclotron and Betatron Accelerator.

PHY- 603- PRACTICAL

After completion of the course students will be able to

1. Students will show that they have learned laboratory skills, enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusions.

2. Students will be capable of oral and written scientific communication, and will prove that they can think critically and work independently.

3. Laboratory skills and exposure to a variety of important experiments at appropriate levels that illustrate phenomena discussed in the lecture classes. Instrumentation and experimental techniques; methods for quantitative analysis of data and measurement uncertainty.

4. Students will show understanding of the interplay between theory and experiment

CHEMISTRY
Inorganic Chemistry (CH601)

On successful completion of this course, students will be able to

1. Define and name organometallic compounds.
2. Describe properties and bonding of organometallic compounds.
3. Understand the nature of bonding in metal carbonyls.
4. State the definition of an Arrhenius acid and base, a Brønsted-Lowrey acid and base and a Lewis acid and base.
5. Compare the relative strength of acids and bases.
6. Understand the concept of hard and soft acids and bases.
7. Understand the biological role of alkali and alkaline earth metal ions.
8. Define metalloporphyrins and explain the role of haemoglobin and myoglobin.
9. Describe nitrogen fixation, essential and trace elements.
10. Describe the preparation, properties, structure and uses of silicones and phosphazenes.

Physical Chemistry (CH602)

On successful completion of this course, students will be able to

1. Understand the concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck- Condon principle.
2. Qualitatively describe sigma and pie and n molecular orbital (MO) their energy level and respective transitions.
3. Explain interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthus-Drapper law, Stark-Einstein law (law of photochemical equivalence) Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).
4. Understand and define dilute Solutions and Colligative Properties, Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.
5. Explain Raolut's law, relative lowering of vapour pressure, molelcular weight determination, Osmosis law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.
6. Define statement and meaning of the terms – phase component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system –Example – water and Sulpher systems.
7. Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system, desilerisation of lead.

Organic Chemistry (CH603)

On successful completion of this course, students will be able to

1. Explain the reactivity of heteroaromatic compounds.
2. Demonstrate how the aromatic bonding is constituted within an aromatic heterocycle.
3. Show the mechanism for the formation of key heterocycles.
4. Compare of basicity of pyridine, piperidine and pyrrole.
5. Explain the structure, preparation and reactions of condensed hetrocycles.
6. Show the mechanism of electrophilic substitution reactions of quinoline and isoquinoline.
7. Understand structural features, nomenclature and properties of organosulfur compounds.
8. Explain the role of enolates in organic synthesis.
9. Understand the structure, nomenclature, reactions and properties of amino acids and peptides.
10. Write the mechanism for different types of polymerization reactions.
11. Describe various examples of synthetic polymers.

(Practical) CH-604

(Physical)

Student should be able to:

1. Determine the strength of the given acid solution (mono and dibasic acid) conductometrically.
2. Determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
3. Determine the strength of given acid solution (mono and dibasic acid) potentiometrically.
4. Determine the molecular weight of a non-volatile solute by Rast method.
5. Standardize the given acid solution (mono and dibasic acid) pH metrically.

(Organic)

Student should be able to:

6. Synthesize the following organic compounds:
    - o-chlorobenzoic acid from anthranilic acid.
    - p-bromoaniline from p-bromoacetanilide.
    - m-nitroaniline from m-dinitrobenzene.
    - S-Benzyl-iso-thiouronium chloride from thiourea.

MATHEMATICS
Math 12BSM 361

Upon successful completion of Math BM -361 **Real and Complex Analysis** a student will be able to:

1. understand the concept of beta and gamma function.
2. how we change order of integration in double integrals.
3. understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.
4. evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem.
5. compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues.
6. understand the concept of conformal mapping, mobious transformation.
7. Know that any periodic function can be expressed as a Fourier series.
8. Know how to derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
9. Understand the nature of the Fourier series that represent even and odd functions and how derivation of a Fourier series can be simplified in this way.
10. Be able to expand an odd or even function as a half-range cosine or sine Fourier Series

Math 12BSM 362

Upon successful completion of Math BM -362 **Linear Algebra** a student will be able to:

1. Analyze finite and infinite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces,
2. Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism,
3. Compute with the characteristic polynomial, eigenvectors, eigenvalues and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result,
4. Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization, and
5. Identify self-adjoint transformations and apply the spectral theorem and orthogonal decomposition of inner product spaces, the Jordan canonical form to solving systems of ordinary differential equations.

Math 12BSM 363

Upon successful completion of Math BM-363 **Numerical Analysis**, a student will be able to

1. Derive numerical methods for approximating the solution of problems of continuous mathematics.
2. Analyze the error incumbent in any such numerical approximation

3. Solve basic problems in probability theory, including problems involving the binomial, geometric, exponential, Poisson, and normal distributions.
4. Implement a variety of numerical algorithms using appropriate technology, and Compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation and approximation, numerical differentiation and integration, solution of linear systems.
5. Write efficient, well-documented programming in C and present numerical results in an informative way.