Course Outcomes

Semester -3

PHYSICS

PHY- 301- COMPUTER PROGRAMMING & THERMODYNAMICS

After completion of the course students will be able to-

1. Understand the basics of FORTRAN programing along with the algorithms used to build the program.

2. Further student get to know about the basic laws of Thermodynamics, their corollaries, and comprehension of how they can be applied to explain specific natural phenomena.

3. Also they understand the working of Carnot Engine and various causes of pollutions which internal combustion engine causes.

4. Furthermore, the knowledge of various thermodynamic functions is dealt which helps them to build the concept of thermodynamics stronger.

PHY- 302- OPTICS 1

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

1. The basics of Fourier transforms and Analysis along with its application in mechanical Transverse Waves.

2. The basics of Optics in which they get to know about the effect of translation and refraction. Moreover, chromatic and spherical aberration and distortions are dealt which helps them to understand about the lenses as well as the defects which can occur.

3. Again in optics topic of interference is taught which helps students to understand the division of wavefront in interference. Further Fresnel's Biprism and its application to determine the wavelength of sodium light is dealt which helps the student to find the thickness of very thin objects like Mica practically.

PHY- 303- PRACTICAL

After completion of the course students will be able to

1. Get the practical knowledge of concepts related Optics along with the instruments used for various optical processes.

2. Also along with electronics, students get to know about computer programming and ideas how to make algorithm to simplify the problems.

3. Students will successfully apply computing tools to problems.

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

Physical Chemistry (CH302)

Student should be able to:

1. Define thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.
2. Explain Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.
3. Explain Joule's law – Joule – Thomson coefficient for ideal gass and real gas: and inversion temperature.
4. Calculate w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.
5. Explain the temperature dependence of enthalpy, Kirchoffs equation. Bond energies and applications of bond energies.
6. Explain equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium.
7. Understand temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatetier's principle and its applica tions Clapeyron equation and Clausius – Clapeyron equation its applications.
8. Explain Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination.
9. Understand the applications of distribution law in (i) determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride. (ii) determination of equilibrium constant of potassium tri-iodide complex and process of extraction.

Organic Chemistry (CH303)

Student should be able to:

1. Explain monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters.
2. Define Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4 and HIO4] and pinacol-pinacolone rearrangement.
3. Learn about the synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides
4. Explain nomenclature, structure and bonding of phenols. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols —

electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions.

5. Explain Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones,Woodward- Fieser rules, calculation of max of simple conjugated dienes and , -unsaturated ketones. Applications o f UV Spectroscopy in structure elucidation of simple organic compounds.
6. Explain Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Structure, nomenclature and preparation of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic).

(Practical) CH-304

(Inorganic)

Student should be able to:

1. Quantitatively estimate Cu2+ as copper thiocyanate and Ni2+ as Ni – dimethylglyoxime.

(Organic)

Student should be able to:

2. Systematically identify (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) any of the following simple mono and bifunctional organic compounds:
3. Naphthalene, anthracene, acenaphthene, benzyl chloride, p-dichlorobenzene, m-dinitrobenzene, p-nitrotoluene, resorcinol , hydroquinone, **α** -naphthol, **β** -naphthol, benzophenone, ethyl methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicyclic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide, benzanilide, aniline hydrochloride, p -toluidine, phenyl salicylate (salol), glucose, fructose, s ucrose, o-, m-, pnitroanilines, thiourea.

MATHEMATICS

Math 12BSM 231

Upon successful completion of Math BM -231 **Advanced Calculus** a student will be able to:

1. understand the concept of limit for real functions and be able to calculate limits of standard functions.
2. understand the concept of continuity and be familiar with the statements and proofs of the standard results about continuous real functions.
3. understand the concept of the differentiability of a real valued function and be familiar with the statements and proofs of the standard results about differentiable real function.
4. compute the Taylor expansion for function of two variable.
5. understand the significance of Rolles theorem, Lagrange mean value theorem and their geometrical interperetaion.
6. understand the significance of Schwarz theorem and Youngs theorem
7. find the locus of the centre of curvature , involutes , Envelopes

Math 12BSM 232

Upon successful completion of Math BM -232 **Partial Differential Equation** a student will be able to:

1. Understand how to construct a first order PDE.
2. How to solve a first order and second order PDE using the method of characteristics
3. How to transform a PDE of first order in canonical form.
4. Solve linear partial differential equations of both first and second order.
5. find the solution of Lagrange linear equation, Charpit genral method and Jacobi method to find the solution.
6. understand the classification of linear differential equation of second order.
7. Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions.

Math 12BSM 233

Upon successful completion of Math BM-233 **Statics**, a student will be able to

1. find the composition and resolution of forces.
2. understand the concept of parallel forces.
3. find the virtual work.
4. understand the concept of wrenches , null lines and planes ,stable and unstable equilibrium.
5. find the friction, moment and centre of gravity.

Semester -4

PHYSICS

PHY- 401- STATISTICAL MECHANICS

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

1. The basics of Statistical Physics in which they become capable of calculating the probabilities minimum as well as maximum for the distribution of the particles in two boxes along with the knowledge of Phase space & accessible states of thermodynamic Probability.

2. Furthermore, division of phase space is dealt with evaluation of b- parameter. Bose-Einstein's statistics are dealt along with their application which makes the student understand with depth the concepts of statistics.

PHY- 402- OPTICS 2

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

1. The basic laws of Optics with its extension to the previous semester. In this student get to know about Newton rings and how to generate them practically in labs which helps them to calculate the wavelength of the waves.

2. Further, students get to know about the Fraunhoffer's diffraction which dealt with single slit diffraction, two slit diffraction and more. Moreover, they get to know the resolution of telescope which can be calculated.

3. Also, the phenomenon of polarisation and it's analysis. Students get to know about the polarised light that can be produced by Nicol's Prism, Quarter wave Plate and Half Wave Plate which are used to produce and detect the plane polarised and circularly polarised light.

4. They get to know about the instruments such as Polarimeter is used to calculate the Specific rotation.

PHY- 403- PRACTICAL-4

After completion of the course students will be able to

1. Get the practical knowledge of concepts related Optics along with the instruments used for various optical processes.

2. Also along with electronics, students get to know about computer programming and ideas how to make algorithm to simplify the problems.

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.

CHEMISTRY

Physical Chemistry (CH402)

Student should be able to:

1. Explain Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorm, Thermodynamics scale of temperature.
2. Understand concept of entropy – entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.
3. Explain Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.
4. Differentiate between Electrolytic and Galvanic cells – reversible & Irreversible cells.
5. Explain conventional representation of electrochemical cells. EMF of cell and its measurement, Weston standard cell, activity and activity coefficients. Calculation of thermodynamic quantities of cell reaction (G, H & K).
6. Define types of reversible electrodes – metal-metal ion gas electrode, metal –insoluble salt- anion and redox electrodes. Electrode reactions, Nernst equations, derivation of cell EMF and single electrode potential. Standard Hydrogen electrode, reference electrodes, standard electrodes potential, sign conventions, electrochemical series and its applications.
7. Explain concentration cells with and without transference, liquid junction potential, application of EMF measurement i.e. valency of ions, solubility product activity coefficient, potentiometric titration (acid- base and redox). Determination of pH using Hydrogen electrode, Quinhydrone electrode and glass electrode by potentiometric methods.

Organic Chemistry (CH403)

Student should be able to:

1. Explain molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.
2. Define applications of IR spectroscopy in structure elucidation of simple organic compounds.
3. Understand structure and nomenclature of amines and its physical properties.
4. Explain the technique of separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines.
5. Explain Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds.

6. Understand various name reactions such as Gabrielphthalimide reaction, Hofmann bromamide reaction.
7. Explain electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.
8. Explain mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO2 and CN groups, reduction of diazonium salts to hyrazines, coupling reaction and its synthetic application.
9. Explain the preparation of nitro alkanes and nitro arenes and their chemical reactions. Mechanism of electrophilic substitution reactions in nitro arenes and their reductions in acidic, neutral and alkaline medium.
10. Explain Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate., Physical properties. Comparison of reactivities of aldehydes and ketones.
11. Explain mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH4 and NaBH4 reductions.

(Practical) CH-404

(Inorganic)

Student should be able to:

1. Verify Beer - Lambert law for $KMnO_4$ /$K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4$ / $K_2Cr_2O_7$ solution.
2. Prepare Cuprous chloride, prussion blue from iron fillings, tetraammine cupric sulpha te, chrome alum, potassium trioxalatochromate(III).

(Physical)

Student should be able to:

1. Determine the CST of phenol – water system.
2. Determine the solubility of benzoic acid at various temperatures and to determine the ΔH of the dissolution process
3. Determine the enthalpy of neutralisation of a weak acid/weak base vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
4. Determine the enthalpy of solution of solid calcium chloride
5. Study the distribution of iodine between water and CCl4 .

MATHEMATICS

Math 12BSM 241

Upon successful completion of Math BM -241 **Sequences and Series,** a student will be able to:

1. Describe the real line as a complete, ordered field
2. Determine the basic topological properties of subsets of the real numbers
3. Use the definitions of convergence as they apply to sequences, series and functions
4. Determine infinite series, if a given series is a geometric series, geometric series converges, calculate the sum of a geometric series.
5. Use the Comparison test, Alternating series test and the Ratio test, Raabes test, Logarithmic test on infinite series and understand the terms absolute and conditional convergence.

Math 12BSM 242

Upon successful completion of Math BM -242 **Special function and Integral Transform,** a student will be able to:

1. Gain a range of techniques employing the Laplace and Fourier Transforms in the solution of ordinary and partial differential equations. They will also have an appreciation of generalized functions, their calculus and applications.
2. Demonstrate a firm understanding of the solution techniques for Linear Properties of Integral Transforms and Special function.
3. Obtain the power series solutions of Legendre's differential equation, Derive Rodrigue's formula for Legendre polynomials.
4. Obtain Legendre polynomials through generating function.
5. Use recurrence relations for Legendre polynomials and its orthogonality property, derive Rodrigue's formula, generating function, recurrence relations and orthogonal property of Hennite and Laguerre polynomials and use them in various application.

Math 12BSM 243

Upon successful completion of Math BM-243 **Programming in C and Numerical Methods**, a student will be able to

1. Use numerical methods for solving a problem,
2. Apply numerical methods to obtain approximate solutions to mathematical problems.
3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
4. Analyze and evaluate the accuracy of common numerical methods.
5. Implement numerical methods in C.
6. Write efficient, well-documented programming in C and present numerical results in an informative way.