



**BACHELOR OF SCIENCE IN PHYSICAL SCIENCE
(SC0142)
(B. Sc. PCM)**

Program Outcomes

Program Specific Outcomes

Course Outcomes

B. Sc. (Physics, Chemistry, Mathematics)

PROGRAMME OUTCOMES (POs)

Students graduating with the B.Sc. Physical Science degree should be able to acquire

PO1: Capability of demonstrating comprehensive knowledge of B.Sc. programme.

PO2: Ability to employ critical thinking in understanding the concepts in every area of B.Sc. PCM programme.

PO3: Ability to analyze the results and apply them in various problems.

PO4: Develop a sense of research to predict cause-and-effect relationships.

PO5: Capability to solve problems by using research-based knowledge and research methods.

PO6: Create, select, and apply appropriate techniques, resources, and modern science and IT tools.

PO7: Ability to work independently and do in-depth study of various notions of courses.

PO8: Ability to communicate various concepts of B.Sc. programme effectively using examples and their geometrical visualizations.

PO9: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO10: Self-motivating and inspiring team members to engage with the team objectives by using management skills.

PO11: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

PO12: Ability to identify unethical behavior and adopting objective, unbiased and truthful actions in all aspects of their programme.

PO13: This programme will also help students to enhance their employability for jobs in different sectors.

COURSE OUTCOMES

BSC101: ENGLISH

Course outcomes:

At the end of the course, a student will be able to understand

CO1: The ability to understand English when it is spoken and to understand basic grammar

principles. Be able to transform sentences.

- CO2: Speak intelligibly while making statements, asking question, giving instructions and commands, reporting events. Put ideas in a proper sequence. Show an understanding of opportunities in the field of communication. Use current technology related to the communication field.
- CO3: Recognize poetry from a variety of cultures, languages and historic periods. Understand and appreciate poetry as a literary art form. Analyze the various elements of poetry, such as diction, tone, form, genre, imagery, figures of speech, symbolism, theme, etc.
- CO4: It is to develop the language ability of the students. It is the intensive study of a language. The language ability helps the learners to use English language without any problem.
- CO5: To express ideas in an organized and systematic way. Develop the skills of writing. Learn to use appropriate vocabulary in writing various forms of composition & to develop communicative competence.

BSC102: MECHANICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Understand the role of vectors and coordinate systems in Physics; solve Ordinary Differential Equations, laws of motion and their application to various dynamical situations.
- CO2: Learn the concept of inertial reference frames their transformations. Also, the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
- CO3: Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
- CO4: Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
- CO5: Describe special relativistic effects and their effects on the mass and energy of a moving object.

BSC103: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

Course Outcome

By the end of the course, student will be able to:

- CO1: Students will gain knowledge about atomic structure and behavior, interactions between matter and energy at both the atomic and molecular level.
- CO2: Students will be able to understand about chemical bonding and molecular structure.
- CO3: Students will learn about Stereochemistry
- CO4: Students will gain knowledge about fundamentals of organic chemistry.
- CO5: Understand the physical and chemical properties of Aliphatic Hydrocarbons.

BSC104: DIFFERENTIAL CALCULUS

Course Outcomes: This course will enable the students to:

- CO1: Calculate the limit and examine the continuity of a function at a point,
- CO2: Understand the consequences of various mean value theorems for differentiable Functions,
- CO3: Apply derivative tests in optimization problems appearing in social sciences, physical sciences, life sciences and a host of other disciplines.

BSC105: MECHANICS LAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Understand the use of vernier caliper, screw gauge and travelling microscope.
- CO2: Learn the concept of Moment of Inertia.
- CO3: Understand use of Pendulums.
- CO4: Understand the physical meaning of 'g'.
- CO5: After acquiring knowledge of how to handle measuring instruments student shall embark on verifying various principles learnt in theory.

BSC106: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS LAB

Course Outcomes:

By the end of the course, the students will be able to:

CO1: Experimental practice of quantitative volumetric analysis.

CO2: Understand the separation techniques.

BSC201: ENVIRONMENTAL SCIENCE

Course outcomes:

At the end of the course, the student will be able to:

CO1: Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving. Ecosystem Links between environmental components and their role, types, values and conservation of biodiversity.

CO2: Concept of non Conventional energy resources, types and various applications of renewable resources and current potentials of energy resources.

CO3: Basic Structure of atmosphere and their functions Current problems related issues Students will apply knowledge of the sciences within an interdisciplinary context in solving environmental issues such as environmental health, food and agriculture, energy, waste and pollution, climate change, disaster management.

CO4: Composition of solid waste, sources of generation, collection and disposal methods of solid waste, recycling, reuse of wastes.

CO5: Sustainable development, urban problems related to energy, Water conservation, and Rain water harvesting water shed management, Resettlement and rehabilitation, Public awareness and Environmental Education, various environmental Acts.

BSC202: ELECTRICITY, MAGNETISM AND EMT

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.

CO2: Apply Gauss's law of electrostatics to solve a variety of problems.

CO3: Describe how magnetism is produced and list examples where its effects are observed.

CO4: Describe the magnetic field produced by magnetic dipoles and electric currents.

CO5: Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.

BSC203: CHEMICAL ENERGETIC, EQUILIBRIA & FUNCTIONAL GROUP ORGANIC CHEMISTRY-I

Course Outcomes:

By the end of the course

- CO1: Learners will learn the basic knowledge of chemical energetics and chemical equilibrium.
- CO2: Able to understand ionic equilibria.
- CO3: Students will learn the synthesis, physical and chemical properties of aromatic hydrocarbons.
- CO4: Understand about synthesis, physical and chemical properties of alcohols, phenols and ethers.
- CO5: Learners will be able to synthesize aldehydes & ketones and understand the physical and chemical properties of aldehydes and ketones.

BSC204: DIFFERENTIAL EQUATIONS

Course Outcomes:

The course will enable the students to

- CO:1 Understand the genesis of ordinary differential equations.
- CO2: Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
- CO3: Know Charpit's method to find the solutions of Partial differential equations
- CO4: Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
- CO5: Formulate mathematical models in the form of ordinary and partial differential equations to suggest possible solutions of the day to day problems arising in physical, chemical and biological disciplines.

BSC205: ELECTRICITY, MAGNETISM AND EMTLAB

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Explain the working of Galvanometer.
- CO2: Apply Gauss's law of electrostatics to solve a variety of problems.
- CO3: Describe how magnetism is produced and list examples where its effects are observed.
- CO4: Describe the magnetic field produced by magnetic dipoles and electric currents.
- CO5: The student will get an opportunity to verify all theorems elaborated above, using simple electric circuits.

BSC206: CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY-I LAB

Course Outcomes:

By the end of the course, the students will be able to:

- CO1: Understand the experiments related to thermochemistry so that students can learn through experiments.
- CO2: Understand the experiments related to Ionic equilibria.
- CO3: Get the skills of purification and synthesis of some chemical compounds.

BSC301: THERMAL PHYSICS AND STATISTICAL MECHANICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Learn the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems.
- CO2: Learn the basic concepts of the thermodynamic potentials and their physical interpretations. They are also expected to learn Maxwell's thermodynamic relations.
- CO3: Have a knowledge of the real gas equations, Van der Waal equation of state, the Joule-Thompson effect.
- CO4: Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.
- CO5: Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics.

BSC302: SOLUTIONS, PHASE EQUILIBRIA, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II

Course Outcomes:

At the end of the course

- CO1: Learners will be able to acquire the knowledge of solution and phase equilibrium.
- CO2: Understand the basic concepts of conductance and electrochemistry and their applications.
- CO3: Learners will be competent to understand the synthesis, physical and chemical properties of carboxylic acid and their derivatives.
- CO4: Become skilled at the synthesis, physical and chemical properties of amines and diazonium salts
- CO5: Students will be capable to learn the synthesis, physical and chemical properties of amino acids, peptides, proteins and carbohydrates.

BSC303: REAL ANALYSIS

Course Outcomes: This course will enable the students to:

- CO1: Understand many properties of the real line \mathbb{R} and learn to define sequence in terms of functions from \mathbb{R} to a subset of \mathbb{R} .
- CO2: Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- CO3: Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
- CO4: Learn some of the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.

BSC304A: ANALYTICAL GEOMETRY

Course Outcomes: This course will enable the students to:

- CO1: Explain the properties of three dimensional shapes.
- CO2: Knowledge of direction cosines
- CO3: Techniques for sketching parabola, ellipse and hyperbola
- CO4: Classification of quadratic equations representing lines, parabola, ellipse and hyperbola

BSC304B: INTEGRAL CALCULUS AND APPLIED MATHEMATICS

Course Outcomes: This course will enable the students to:

- CO1: Know to find the length of the curve, area, volume using double and triple integration,
- CO2: Provide Numerical methods to find the solution of algebraic and transcendental

equations

CO3: give the knowledge of Interpolation techniques

CO4: Analyze and solve linear programming models of real life situations.

Provide graphical solutions of linear programming problems with two variables,

Understand the theory of the simplex method.

CO5: Know about the Transportation Problem, Assignment Problem.

BSC304C: PHYSICS WORKSHOP SKILLS

Course outcomes:

At the end of the course, the student will be able to:

CO1: Learn the use of measurement and dimensional analysis.

CO2: Learn basic mechanical skills and use in daily life.

CO3: Have a knowledge of cutting the various metals.

CO4: Learn about the electrical and electronic skills and use in daily life.

CO5: Learn the concept of power generation systems.

BSC304D: COMPUTATIONAL PHYSICS SKILLS

Course outcomes:

At the end of the course, the student will be able to:

CO1: Learn the importance of computers in solving problems in Physics.

CO2: Learn how to plan for writing the algorithm for solving a problem by drawing the flowchart of simple problems like roots of quadratic equations etc.

CO3: The students should also learn “Scientific Word Processing”, particularly, how to use the LaTeX software in writing articles and papers which include mathematical equations and diagrams. Similarly, students should learn the basics of Gnuplot.

CO4: To have hands-on experience on computational tools.

CO5: Simulate the motion of a particle in a central force field and plot the output for visualization.

BSC304E: PHARMACEUTICAL CHEMISTRY

Course Outcomes:

At the end of the course

- CO1: Students will learn the basic concepts of drugs & pharmaceuticals and synthesis of analgesics, antipyretic and anti-inflammatory agents
- CO2: Learner will competent to synthesis of antibiotics, antibacterial, antifungal and antiviral agents.
- CO3: Knowledge of synthesis of central nervous system, cardiovascular, antilaprosy, HIV-AIDS related drugs.
- CO4: Able to understand the fermentation process.
- CO5: Able to understand the production of lysine, glutamic acid and some vitamin.

BSC304F: BASIC ANALYTICAL CHEMISTRY

Course Outcome:

At the end of the course, the student will be able to:

- CO1: Understand the basic concepts of analytical chemistry.
- CO2: Students will learn the different parameters of soil analysis.
- CO3: Obtain the knowledge of analysis of water and food products.
- CO4: Learners will understand the chromatography techniques.
- CO5: Achieve the skills for analysis of cosmetics.

BSC305: THERMAL PHYSICS AND STATISTICAL MECHANICSLAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Learn the basic concepts of thermodynamics.
- CO2: Learn the basic concepts of the Thermal Conductivity.
- CO3: Have a knowledge of the real gas equations, Van der Waal equation of state, the Joule-Thompson effect.
- CO4: Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.
- CO5: The students are expected to perform the experiments related to heat transfer.

BSC306: SOLUTIONS, PHASE EQUILIBRIA, CONDUCTANCE, ELECTROCHEMISTRY & CHEMSITRY-II LAB

Course Outcomes:

By the end of the course, the students will be able to:

- CO1: Understand the concept of equilibrium.
- CO2: Know the conductance and affects of different acid-base strength.
- CO3: Learn the potentiometric titrations.
- CO4: Get the knowledge of systematic qualitative organic analysis of organic compounds and separation techniques.

BSC401: WAVES AND OPTICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Apply basic knowledge of principles and theories about the behavior of light and the physical environment to conduct experiments.
- CO2: Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.
- CO3: Use the principles of wave motion and superposition to explain the Physics of polarisation, interference and diffraction.
- CO4: Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.
- CO5: Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems.

BSC402: TRANSITION METAL & COORDINATION CHEMISTRY, STATES AND MATTER CHEMICAL KINETICS

Course Outcomes:

At the end of the course

- CO1: Learner will get the information about the behaviour of transition and inner transition elements.
- CO2: Obtained the knowledge regarding coordination compounds.
- CO3: Occur the understanding of kinetic theory of gases.
- CO4: Arise the knowledge about various states of matter.
- CO5: Understand the kinetics of chemical reactions.

BSC403: ALGEBRA

Course Outcomes:

The course will enable the students to:

- CO1: Recognize the mathematical objects called groups.
- CO2: Link the fundamental concepts of groups and symmetries of geometrical objects.
- CO3: Explain the significance of the notions of cosets, normal subgroups, and factor groups.
- CO4: Analyze consequences of Lagrange's theorem.

BSC404A: VECTOR CALCULUS

Course Outcomes:

This course will enable the students to:

- CO1: Learn the concept of vector functions and vector fields.
- CO2: Apply the concept of ordinary, partial and total derivatives of vector function in real life problems.
- CO3: Apply the concept of Gradient, divergence and curl of vector function fields
- CO4: Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.

BSC404B: THEORY OF EQUATIONS

Course Outcomes: This course will enable the students to:

- CO1: Find the roots/solutions of algebraic equations using the various techniques of Theory of Equations.
- CO2: Analysis and study the symmetric functions .
- CO3: Understand the concept of transformation of equations .

BSC404C: ELECTRICAL CIRCUIT & NETWORK SKILLS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Learn the importance of basic electrical equipment's such as ammeter, voltmeter, galvanometer etc. in daily life.
- CO2: Learn difference between AC and DC circuits.
- CO3: Learn electrical drawing and use of electrical components.

- CO4: To have hands-on experience on electrical tools.
CO5: Know the information about electrical protection.

BSC404D: TECHNICAL DRAWING

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Understanding the concept of a sectional view, what is meant by a cutting plane, how to draw, and learn proper technique for drawing an aligned sections.
- CO2: With above understanding, he will be exposed to n the use of spatial visualization by constructing an orthographic multi view drawing.
- CO3: He / she will be expert in drawing simple curves like ellipse, cycloid and spiral, Orthographic projections of points, lines and of solids like cylinders, cones, prisms and pyramids etc.
- CO4: To have hands-on experience on technical writing on scientific studies.
- CO5: Exposure to Computer Aided Design (CAD) and Auto CAD techniques will make the student technologically savvy.

BSC404E: ANALYTICAL CLINICAL BIOCHEMISTRY

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Build up knowledge of carbohydrates.
- CO2: Learners will understand the role of protein.
- CO3: Understand the role of different enzymes.
- CO4: It gives basics of lipids and lipoproteins.
- CO5: Understand the analysis of urine and blood.

BSC404F: GREEN METHODS IN CHEMISTRY

Course Outcomes:

At the end of the course

- CO1: Develop the basics of green chemistry.
- CO2: Learners will understand the alternative sources of energy and green solvents.

CO3: Students will get the knowledge of alternative methods and solvents.

CO4: Student will able to design the eco-friendly pigments.

CO5: Student will able to green synthesis of plastic.

BSC405: WAVES AND OPTICSLAB

Course outcomes:

At the end of the course, the student will be able to:

CO1: Apply basic knowledge of principles and theories about the behavior of light and the physical environment to conduct experiments.

CO2: Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

CO3: Use the principles of wave motion and superposition to explain the Physics of polarisation, interference and diffraction.

CO4: Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.

CO5: In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt first-hand.

BSC406: TRANSITION METAL & COORDINATION CHEMISTRY LAB

Course Outcomes:

CO1: Get the skills of identification from mixture of two anions and two cations including complexometric titrations.

CO2: Understand the concept and measurement of surface tension, viscosity and chemical kinetics.

CO3: Understand the process of saponification of ethyl acetate.

BSC501A: PROBABILITY AND STATISTICS

Course Outcomes:

This course will enable the students to:

- CO1: Understand the basic concepts of probability.
- CO2: Appreciate the importance of probability distribution of random variables and to know the notion of central tendency.
- CO3: Establish the joint distribution of two random variables in terms their correlation and regression.
- CO4: Understand central limit theorem which shows that the empirical frequencies of so many natural populations exhibit normal distribution.

BSC501B: MATHEMATICAL MODELING

Course Outcomes: This course will enable the students to:

- CO1: Understand the basic concepts of mathematical modeling.
- CO2: Build the mathematical models of real life problems.

BSC501C: RADIOLOGY & SAFETY

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Be aware and understand the hazards of radiation and the safety measures to guard against these hazards..
- CO2: Have a comprehensive knowledge about the nature of interaction of matter with radiations like gamma, beta, alpha rays, neutrons etc. and radiation shielding by appropriate materials.
- CO3: Learn about the devices which apply radiations in medical sciences, such as MRI, PET.
- CO4: To have hands-on experience on radiation and safety.
- CO5: Revise or learn the basic aspects of the atomic and nuclear Physics, specially the radiations that originate from the atom and the nucleus.

BSC501D: WEATHER FORECASTING

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Acquire basic knowledge of the elements of the atmosphere, its composition at

various heights, variation of pressure and temperature with height.

- CO2: To learn basic techniques to measure temperature and its relation with cyclones and anti-cyclones.
- CO3: Knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall. Absorption, emission and scattering of radiations in atmosphere. Radiation laws.
- CO4: Knowledge of global wind systems, jet streams, local thunderstorms, tropical cyclones, tornadoes and hurricanes..
- CO5: Develop skills needed for weather forecasting, mathematical simulations, weather forecasting methods, types of weather forecasting, role of satellite observations in weather forecasting, weather maps etc. Uncertainties in predicting weather based on statistical analysis.

BSC501E: CHEMISTRY OF COSMETICS & PERFUMES

Course Outcomes:

At the end of the course

- CO1: Learners will get the knowledge of hair enrichment items.
- CO2: Students will understand about face glowing objects.
- CO3: Students will able to understand the preparation and uses of creams, antiperspirants and artificial flavours.
- CO4: Understand the essential oils and their importance in cosmetic industries.

BSC501F: PESTICIDE CHEMISTRY

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Understand the basic knowledge of pesticides.
- CO2: Students will learn the structure activity relationship.
- CO3: Learners will become skilled at the synthesis and uses of some important pesticides.

BSC502A: MATRICES

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
- CO2: Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
- CO3: Realise importance of a Translation, Dilation, Rotation, Reflection in a point, line and plane.

BSC502B: MECHANICS

Course Outcomes: This course will enable the students to:

- CO1: Familiarize with subject matter, which has been the single centre, to which were drawn mathematicians, physicists, astronomers, and engineers together.
- CO2: Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.
- CO3: Determine the centre of gravity of some materialistic systems.
- CO4: Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles.
- CO5: Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton.

BSC502C: LINEAR ALGEBRA

Course Outcomes:

This course will enable the students to:

- CO1: Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
- CO2: Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.

CO3: Learn properties of inner product spaces and determine orthogonality in inner product spaces.

CO4: Realise importance of adjoint of a linear transformation and its canonical form.

BSC503A: ANALYTICAL METHODS IN CHEMISTRY

Course Outcomes:

At the end of the course

CO1: Students will get the knowledge of analysis and spectrometry.

CO2: Understand the flame atomic absorption and emission spectrometry.

CO3: Learn the thermal and electroanalytical methods of analysis.

CO4: Get the comprehension about different separation techniques.

BSC503B: NOVEL INORGANIC SOLIDS

Course Outcomes:

By the end of the course, the student will be able to:

CO1: Understand the mechanism of solid-state synthesis and different characterization techniques and their principle.

CO2: Explain the concept of nanomaterials, their synthesis and properties.

CO3: Gain knowledge of engineering materials for mechanical construction.

CO4: Learn the information of composite materials.

CO5: Explain basics of speciality polymers.

BSC503C: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Course Outcomes:

By the end of the course, the students will be able to:

CO1: Understand the chemistry and applications of 3d elements.

CO2: Get the basics of organometallic compounds.

CO3: Impart the knowledge of bio-inorganic chemistry and role of metal ions present in biological systems.

CO4: Understand the fundamentals of functional group chemistry, polynuclear hydrocarbons

and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism.

CO5: Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.

BSC503D: Chemistry of Main Group Elements, Theories of Acids and Bases

Course Outcomes:

By the end of the course, students will be able to:

CO1: Understand the basics of acids & bases and their inter relations.

CO2: Explain about general principles of metallurgy.

CO3: Know the importance of s- and p-block elements.

CO4: Explain different compounds and their applications in industrial and environmental chemistry, hydrides of groups 13 to 17, interhalogen and pseudohalides compounds.

CO5: Get the basic knowledge of noble gases and inorganic polymers.

BSC504A: DIGITAL, ANALOG AND INSTRUMENTATION

Course outcomes:

At the end of the course, the student will be able to:

CO1: Difference between analog and digital circuits, Number systems, their interconversions, Basic logic gates and combinational circuits to construct half adders, full adders, subtractors, 4 bit binary Adder -Subtractor and synthesis of circuits using Boolean algebra.

CO2: Working of P and N type semiconductors, P-N junctions, Forward and Reverse biased junctions, LEDs, photodiode and solar cells, p-n-p, n-p-n transistors, different characteristics of CB, CE and CC configurations, load line, gain and biasing for CE amplifiers and classification of amplifiers..

CO3: Use the principles of digital electronics to explain the Physics of daily life.

CO4: Understand the working of digital and analog instruments like CRO.

CO5: Recognize and use Operational amplifiers and its characterization, circuits using Op-Amp for making Summing and subtracting circuits, differentiators and integrators.

BSC504B: ELEMENTS OF MODERN PHYSICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.
- CO2: Understanding the properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula.
- CO3: Understand fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.
- CO4: Understand various interactions of electromagnetic radiation with matter. Electron positron pair creation.
- CO5: Understand the spontaneous and stimulated emission of radiation, optical pumping and population inversion. Three level and four level lasers. Ruby laser and He-Ne laser in details. Basic lasing.

BSC504C: MATHEMATICAL PHYSICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Revise the knowledge of calculus, vectors, vector calculus. These basic mathematical structures are essential in solving problems in various branches of Physics as well as in engineering.
- CO2: Learn the Fourier analysis of periodic functions and their applications in physical problems such as vibrating strings etc.
- CO3: Learn the beta, gamma and the error functions and their applications in doing integrations.
- CO4: Know about the basic theory of errors, their analysis, and estimation with examples of simple experiments in Physics.
- CO5: Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics.

BSC504D: SOLID STATE PHYSICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: 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: Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.
- CO3: At knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.
- CO4: Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.
- CO5: Understand the basic idea about superconductors and their classifications.

BSC505A: ANALYTICAL METHODS IN CHEMISTRY LAB

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Get the skills of Chromatography which is a Separation Techniques
- CO2: Get the skills of Solvent Extractions
- CO3: Understand the different parameters of soil analysis.
- CO4: Impart the knowledge of spectrophotometry in different experiments.

BSC505B: NOVEL INORGANIC SOLIDS LAB

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Understand cation exchange method and total difference of solids.
- CO2: Synthesis of hydrogel and understand the process of silver and gold metal nanoparticles synthesis.

BSC505C: ORGANOMETALLICS BIOINORGANIC CHEMISTRY POLYNUCLEAR HYDROCARBONS AND UV IR SPECTROSCOPY LAB

Course Outcomes:

At the end of the course, the student will be able

- CO1: To understand the separation of mixtures by chromatography and measure the R_f value.
- CO2: To know the preparation of complexes and measurement of their conductivity.
- CO3: To understand the systematic qualitative organic analysis of organic compounds and preparation of their derivative.

BSC505D: CHEMISTRY OF MAIN GROUP ELEMENTS, THEORIES OF ACIDS AND BASES LAB.

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Estimation of some chemical species.
- CO2: Acquire the skills of preparation of double salt and complex.

BSC506A: DIGITAL, ANALOG AND INSTRUMENTATIONLAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Difference between analog and digital circuits.
- CO2: Working of P and N type semiconductors, P-N junctions, Forward and Reverse biased junctions, LEDs, photodiode and solar cells.
- CO3: Use the principles of digital electronics to explain the Physics of daily life.
- CO4: Understand the working of digital and analog instruments like CRO.
- CO5: Student will gain hands-on experience of using various digital and analog instruments.

BSC506B: ELEMENTS OF MODERN PHYSICSLAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Know main aspects of dual nature of matter.
- CO2: Understanding the properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus.
- CO3: Understand fission and fusion well as nuclear processes to produce nuclear energy in

nuclear reactor and stellar energy in stars.

CO4: Understand the spontaneous and stimulated emission of radiation, optical pumping and population inversion.

CO5: Student will gain hands-on experience of using various phenomena like photo-electric effect, planck's constant, pair production etc.

BSC506C: MATHEMATICAL PHYSICSLAB

Course outcomes:

At the end of the course, the student will be able to:

CO1: Revise the knowledge of calculus, vectors, vector calculus.

CO2: Learn the Fourier analysis of periodic functions and their applications in physical problems such as vibrating strings etc.

CO3: Learn the beta, gamma and the error functions and their applications in doing integrations.

CO4: Know about the basic theory of errors, their analysis, and estimation with examples of simple experiments in Physics.

CO5: Learn the fundamentals of the C and C⁺⁺ programming languages and their applications in solving simple physical problems.

BSC506D: SOLID STATE PHYSICSLAB

Course outcomes:

At the end of the course, the student will be able to:

CO1: A brief idea about crystalline and amorphous substances.

CO2: Knowledge of lattice vibrations, phonons of solids.

CO3: At knowledge of different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss.

CO4: Understand the basic idea about superconductors and their classifications.

CO5: To carry out experiments based on the theory that they have learned to measure the magnetic susceptibility, dielectric constant, trace hysteresis loop.

BSC601A: TRANSPORTATION AND GAME THEORY

Course Outcomes: This course will enable the students to:

CO1: Formulate the transportation problems and to solve them.

CO2: Learn about the job sequencing problem and their solutions,

CO3: Learn about the solutions of Assignment problems.

CO4: Provide knowledge of Game Theory.

BSC601B: GRAPH THEORY

Course Outcomes: This course will enable the students to:

CO1: Appreciate the definition and basics of graphs along with types and their examples.

CO2: Understand the definition of a tree and learn its applications to fundamental circuits.

CO3: Know the applications of graph theory to network flows.

CO4: Understand the notion of planarity and coloring of a graph.

CO5: Relate the graph theory to the real-world problems.

BSC601C: APPLIED OPTICS

Course outcomes:

At the end of the course, the student will be able to:

CO1: Familiar with optical phenomena and technology.

CO2: Qualitative understanding of basic lasing mechanism, types of Lasers, characteristics of Laser Light, types of Lasers, and its applications in developing LED, Holography.

CO3: The idea of propagation of electromagnetic wave in a nonlinear media – Fibre optics as an example will enable the student to practice thinking in a logical process, which is essential in science.

CO4: Experiments in this course will allow the students to discuss in peer groups to develop their cooperative skills and reinforce their understanding of concepts.

CO5: Use the concepts of applied optics in daily life.

BSC601D: BASIC INSTRUMENTATION SKILLS

Course outcomes:

At the end of the course, the student will be able to:

CO1: Develop skills to use basic electrical instruments like multimeter, electronic voltmeter, cathode ray, and oscilloscope.

- CO2: Acquire efficiency in making signal generators and analysis of obtained signals.
- CO3: Learn to understand and use various types of digital instruments.
- CO4: Develop knowledge of making measurements with Impedance Bridges and Q meters.
- CO5: Working knowledge on accuracy, precision, resolution, range and errors/uncertainty in measurements.

BSC601E: CHEMICAL TECHNOLOGY & SOCIETY

Course Outcomes:

By the end of the course, the students will be able to:

- CO1: Understand the use of basic principles of chemical technology.
- CO2: Know the scope of different equipments needed in chemical technology.
- CO3: Develop scientific solutions for societal needs.
- CO4: Learn about energy from natural sources.
- CO5: Acquire the knowledge of proteins and nucleic acids.

BSC601F: FUEL CHEMISTRY

Course Outcomes:

By the end of the course, the students will be able to:

- CO1: Understand the renewable and non-renewable energy sources and some basics of coal.
- CO2: Explain the process of formation of coke from coal.
- CO3: Get the knowledge of petroleum and petrochemical Industry.
- CO4: Learn the reforming of petroleum and non-petroleum fuels, synthesis of fuel from waste, gaseous and liquids synthetic fuels and petrochemical products:
- CO5: Illustrate about lubricants.

BSC602A: NUMERICAL METHODS

Course Outcomes: This course will enable the students to:

- CO1: obtain numerical solutions of algebraic and transcendental equations.
- CO2: find numerical solutions of system of linear equations and check the accuracy of the Solutions.
- CO3: learn about various interpolating and extrapolating methods.

CO4: solve initial and boundary value problems in differential equations using numerical Methods.

CO5: apply various numerical methods in real life problems.

BSC602B: COMPLEX ANALYSIS

Course Outcomes: This course will enable the students to:

CO1: Visualize complex numbers as points of \mathbb{R}^2 and stereographic projection of complex plane on the Riemann sphere.

CO2: Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy-Riemann equations.

CO3: Learn the role of Cauchy-Goursat theorem and Cauchy integral formula in evaluation of contour integrals.

CO4: Apply Liouville's theorem in fundamental theorem of algebra.

CO5: Understand the convergence, term by term integration and differentiation of a power series.

CO6: Learn Taylor and Laurent series expansions of analytic functions, classify the nature of singularity, poles and residues and application of Cauchy Residue theorem.

BSC602C: LINEAR PROGRAMMING

Course Outcomes: This course will enable the students to:

CO1: Analyze and solve linear programming models of real life situations.

CO2: Provide graphical solution of linear programming problems with two variables, and illustrate the concept of convex set and extreme points.

CO3: Solve linear programming problems using simplex method.

CO4: Learn techniques to solve transportation and assignment problems.

CO5: Solve two-person zero sum game problems.

BSC603A : POLYMER CHEMISTRY

Course Outcomes:

By the end of this course, students will be able to:

CO1: Understand about polymeric materials, classification and different mechanisms of

polymerization and polymerization techniques.

- CO2: Learn the kinetics of polymerization.
- CO3: Understand the crystallization & crystallinity, structure property relationships and different methods of finding out average molecular weight of polymers.
- CO4: Explain about glass transition temperature (T_g) and crystalline melting point (T_m) with their determinations.
- CO5: Know the importance and properties of polymers which are useful in our daily life.

BSC603B : GREEN CHEMISTRY

Course Outcomes: By the end of this course, students will be able to:

- CO1: Understand the all principles of green chemistry, toxicity, hazard, risk of chemical substances, atom economy and minimization of toxicity.
- CO2: Know the benefits of catalysts and bio catalyst, green solvents, microwaves and ultrasonic energy.
- CO3: Understand the ISD and know the facts of Bhopal Gas Tragedy, and Flixiborough accident.
- CO4: Know the green synthesis of some compounds, microwave assisted reactions in water, ultrasound assisted reactions and surfactants for carbon dioxide.
- CO5: Get the skills for designing of Environmentally safe marine antifoulant, rightfit pigment, green synthesis of plastic from corn.

BSC603C : INSTRUMENTAL METHODS OF ANALYSIS

Course Outcomes:

By the end of this course, students will be able to:

- CO1: Perform experiment with accuracy and precision and knowledge of infrared spectroscopy.
- CO2: Understand basic principle and instrumentation of UV-Visible spectroscopy.
- CO3: Learn separation of analytes by chromatography and details of Mass spectroscopy.
- CO4: Know the Atomic spectroscopy.
- CO5: Understand NMR spectroscopy, electroanalytical methods: and radiochemical methods and they will help to identify the unknown compound.

BSC603D: QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY

Course Outcomes:

By the end of the course, the students will be able to:

- CO1: Learn about limitations of classical mechanics and solution in terms of quantum mechanics for atomic/molecular systems.
- CO2: Develop an understanding of quantum mechanical operators, quantization, probability distribution, uncertainty principle and application of quantization to spectroscopy.
- CO3: Understand the covalent bonding, valence bond, molecular orbital approaches and LCAO-MO treatment of different chemical species.
- CO4: Interpret various types of spectra and know about their application in structure elucidation.
- CO5: Impart the basic knowledge of photochemistry.

BSC604A: QUANTUM MECHANICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: After an exposition of inadequacies of classical mechanics in explaining microscopic phenomena, quantum theory formulation is introduced through Schrodinger equation.
- CO2: 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: Study of influence of electric and magnetic fields on atoms will help in understanding Stark effect and Zeeman Effect respectively.
- CO4: The experiments using Sci-lab will enable the student to appreciate nuances involved in the theory.
- CO5: This basic course will form a firm basis to understand quantum many body problems.

BSC604B: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLER

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Embedded systems including its generic architecture, design and classifications, Embedded processors and microcontrollers.
- CO2: Organization of intel microprocessor 8085, its architecture, pin diagram, timing diagram, instruction set and programming in assembly language.
- CO3: Programming with and without interrupt service request.
- CO4: Interfacing parallel and serial ADC and DAC.
- CO5: Basics of embedded system development and product development with a brief introduction to Arduino.

BSC604C: NUCLEAR AND PARTICLE PHYSICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Learn the ground state properties of a nucleus – the constituents and their properties, mass number and atomic number, relation between the mass number and the radius and the mass number, average density, range of force, saturation property, stability curve, the concepts of packing fraction and binding energy, binding energy per nucleon vs. mass number graph, explanation of fusion and fission from the nature of the binding energy graph.
- CO2: Learn about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays, the properties of the constituents of these rays and the mechanisms of the emissions of these rays, outlines of Gamow's theory of alpha decay and Pauli's theory of beta decay with the neutrino hypothesis, the electron capture, the fine structure of alpha particle spectrum, the Geiger-Nuttall law, the radioactive series.
- CO3: Learn 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, Rutherford scattering by Coulomb potential.
- CO4: Learn some basic aspects of interaction of nuclear radiation with matter- interaction of gamma ray by photoelectric effect, Compton scattering and pair production, energy loss due to ionization, Cerenkov radiation.

CO5: Learn about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the photo-multiplier tube, the solid state and semiconductor detectors.

BSC604D: MEDICAL PHYSICS

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Focus on the application of Physics to clinical medicine.
- CO2: Gain a broad and fundamental understanding of Physics while developing particular expertise in medical applications.
- CO3: Learn about the human body, its anatomy, physiology and bio Physics, exploring its performance as a physical machine. Other topics include the Physics of the senses.
- CO4: Gain knowledge with reference to working of various diagnostic tools , medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices.
- CO5: Imparts functional knowledge regarding need for radiological protection and the sources of an approximate level of radiation exposure for treatment purposes.

BSC605A: POLYMER CHEMISTRY LAB

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Understand the process of polymer synthesis by using different methods and their purification.
- CO2: Know how the polymers are characterized.
- CO3: Get the knowledge of polymer analysis.

BSC605B: GREEN CHEMISTRY LAB

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Green synthesis of nanoparticles and their characterization.

- CO2: Understand the green synthesis of biodiesel.
- CO3: Learn the principle of atom economy.
- CO4: Know the importance of enzymes, green solvents and alternative sources of energy.

BSC605C: INSTRUMENTAL METHODS AND ANALYSIS LAB

Course Outcome:

At the end of the course, the student will be able to:

- CO1: Learn the working and applications of different instruments.

BSC605D: QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY LAB

Course Outcomes:

At the end of the course, the student will be able to:

- CO1: Know the use of UV/Visible spectroscopy and its applications.
- CO2: Understand the applications of colourimetry.

BSC606A: QUANTUM MECHANICSLAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Understand basic concepts of quantum mechanics.
- CO2: 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: Study of influence of electric and magnetic fields on atoms will help in understanding Stark effect and Zeeman Effect respectively.
- CO4: The experiments using Sci-lab will enable the student to appreciate nuances involved in the theory.
- CO5: In this course, with the exposure in computational programming in the computer lab, the student will be in a position to solve Schrodinger equation for ground state energy and wave functions of various simple quantum mechanical one dimensional and three dimensional potentials.

BSC606B: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLER LAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Embedded systems including its generic architecture, design and classifications, Embedded processors and microcontrollers.
- CO2: Organization of intel microprocessor 8085, its architecture, pin diagram, timing diagram, instruction set and programming in assembly language.
- CO3: Interfacing parallel and serial ADC and DAC.
- CO4: Basics of embedded system development and product development with a brief introduction to Arduino.
- CO5: In the laboratory course, student shall be able to design, fabricate, test and run the programs.

BSC606C: NUCLEAR AND PARTICLE PHYSICS LAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Learn the ground state properties of a nucleus.
- CO2: Learn about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays.
- CO3: Learn the basic aspects of nuclear reactions.
- CO4: Learn about the detectors of nuclear radiations.
- CO5: Gain knowledge on the basic aspects of particle Physics.

BSC606D: MEDICAL PHYSICS LAB

Course outcomes:

At the end of the course, the student will be able to:

- CO1: Focus on the application of Physics to clinical medicine.
- CO2: Gain a broad and fundamental understanding of Physics while developing particular expertise in medical applications.
- CO3: Learn about the human body, its anatomy, physiology and bio Physics, exploring its performance as a physical machine. Other topics include the Physics of the senses.
- CO4: Gain knowledge with reference to working of various diagnostic tools, medical imaging techniques, how ionizing radiation interacts with matter, how it affects

living organisms and how it is used as a therapeutic technique and radiation safety practices.

CO5: In the laboratory course, the student will be exposed to the workings of various medical devices.