

Department of Physics
Bajkul Milani Mahavidyalaya

Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR01T

Course Title: – Mathematical Physics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Apply the mathematical knowledge of limits, continuity, nature of function differentiation in different areas of physics. (Level 3:Apply)
CO-2:	Operate vector calculus: gradient, divergence and curl and their application in physics (level-3)
CO-3:	Apply vector integration and different theorem in physics.(level-3)
CO-4:	Explain the basic knowledge of probability. (level-2)

Course Code: PHSACOR01P

Course Title: Mathematical Physics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Classify and recognize string, list, tuple, loop, input, output, file-operation, user-function in Python programming language. (Level 2: Understand Level)
CO-2:	Sketch 2D and 3D graphs with gnuplot. Compute least square fit, solution of quadratic equation in python programming language. (Level 3: Apply Level)
CO-3:	Compare bisection and NR method in python programming language. (Level 4: Analyze Level)
CO-4:	Estimate root of equation in python programming language. (Level 5: Evaluate Level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR02T

Course Title: Mechanics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Classify basic principles of Mechanics and fundamentals of Dynamics(level-1)
CO-2:	Describe motions involving both translation and rotation(level-2)
CO-3:	Implement Laws of Physics in rotating coordinate systems. Coriolis force and its applications (level-3)
CO-4:	Explain the basic elastic constants in Elasticity and Kinematics of moving fluids(level-2)
CO-5:	Discuss Gravitation and Central Force motion. Apply them to Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS) (level-3)
CO-6:	Identify Special Theory of Relativity, Lorentz Transformations.(level-2)

Course Code: PHSACOR02P

Course Title: Mechanics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Recognize more accurately using slide callipers, screw gauge and travelling microscope(level 2)
CO-2:	Employ the mechanical instruments for different experiment(level 3)
CO-3:	Calculate the value of g in different methods(level 4)
CO-4:	Relate different elastic constants by different methods(level 3)
CO-5:	Estimate precision, accuracy and different errors arises during experiments(level 2)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR03T, PHSACOR03P

Course Title: Electricity and Magnetism

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Definition and properties of Dirac Delta function.(Level 1- Remember)
CO-2:	Understand different magnetic material and their properties (level-1)
CO-3:	Illustrate Biot Savarts' law, Ampere's circuital law to find magnetic field and potential in different cases (level-3: Apply)
CO-4:	Apply Gauss's Law to find electric field and potential in vacuum and in presence of dielectric media in symmetric problems. (Level 3-Apply)
CO-5:	Simplify complex circuits using network theorems experimentally with discrete circuit components. (Level 4: Analyze)
CO-6:	Measure resonance frequency of series and parallel LCR circuit experimentally. (Level 5: Evaluate)

Course Code: PHSACOR04T

Course Title: WAVES AND OPTICS

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Describe the superposition of many oscillations, waves and different physical phenomena of light waves (level-2: understand level)
CO-2:	Apply superposition of two oscillations graphically for different conditions (level-3: Apply Level)
CO-3:	Analyze different physical phenomena of light waves: interference, diffraction and polarisation (level-4: Analyze Level)
CO-4:	Compare single slit, double slit and grating diffraction phenomena (level-5: Evaluate level)

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Name of the Academic Program: B.Sc(H)

Course Code:PHSACOR04P

Course Title: Wave and Optics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Compute the wavelength of sodium light, Hg light by Newton's Rings experiment, Biprism experiment. Grating experiment. (Level 3: Apply Level)
CO-2:	Calculate the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film. (Level 4: Analyze Level)
CO-3:	Illustrate the use and adjustment of spectrometer for analysis prism spectra and grating spectra (Level 4: Analyse Level)
CO-4:	Identify the Lissajous figure and calculate the phase difference of two harmonic waves(Level-4:Analyze Level)

Course Code: PHSACOR05T

Course Title: Mathematical Physics-II

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Describe periodic functions and Fourier series and its application(level-2)
CO-2:	Identify some special integrals: Beta function, Gamma function(level 2)
CO-3:	Analyze Frobenius method to Legendre, Bessel, Hermite and Laguerre Differential Equations. Apply Legendre polynomials to Electrostatics and Optics(level 4)
CO-4:	Describe idea of functionals and Variational calculus in physics(level 2)
CO-5:	Apply Lagrange's equation in simple problems(level 3)
CO-6:	Employ Legendre transformation in mechanics and thermodynamics(level 3)
CO-7:	Solve the partial differential equations, using separation of variables(level 3)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR05P

Course Title: Mathematical Physics-II

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Identify numpy arrays, pyplots, scipy constants. (Level 1: Remember)
CO-2:	Classify numpy special arrays, subplots of pyplots. (Level 2: Understand)
CO-3:	Compute Bessel function, Legendre polynomial. (Level 3: Apply)
CO-4:	Evaluate integration, differentiation, Laplace equation. (Level 5: Evaluate)

Course Code: PHSACOR06T

Course Title: Thermal Physics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Apply the first law of thermodynamics to calculate work for different system like hydrostatic system (Level 3: Apply Level)
CO-2:	Explain the function of Engine and Refrigerator and its efficiency(Level 5: evaluate level)
CO-3:	Illustrate the concept of Entropy and calculate entropy (Level 4: Analyse level)
CO-4:	Describe kinetic theory of gases, distribution of Velocities: Maxwell-Boltzmann Law of distribution of velocities(level-2: Understand level)
CO 5:	Classify different transport phenomena in Ideal Gases and understand Brownian Motion and its significance. Illustrate behaviour of Real Gases: deviations from the Ideal Gas Equation.(level-3: Apply level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR06P

Course Title: Thermal Physics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Calculate the thermal conductivity of good and bad conductors (Level 3: Apply Level)
CO-2:	Calculate Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method (Level 3: Apply Level)
CO-3:	Compute calibration of a thermocouple in a specified temperature range by different methods (Level 4: Analyse Level)
CO-4:	Calculate unknown temperature using a diode sensor. (Level 3: Apply Level)

Course Code: PHSACOR07T & PHSACOR07P

Course Title: Digital Systems and Applications

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Define digital and Analog systems. Relate number systems (binary, decimal, octal and hexadecimal). (Level 1: Remember)
CO-2:	Discuss digital circuits for arithmetic operations, storage and counting data. Explain important parts of computer hardware like RAM, ROM, Memory. (Level 2: Understand)
CO-3:	Sketch and fabricate digital circuits using ICs for unknown problems. (Level 3: Apply)
CO-4:	Identify the cause of any error in the experimental result. (Level 4: Analyze)
CO-5:	Justify the output of any experimental result. (Level 5: Evaluate)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR08T

Course Title: Mathematical Physics III

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Describe Complex Variables, Analyticity, Singular functions and Integration of a function of a complex variable. Calculate Definite Integrals.(level 4)
CO-2:	Identify Fourier Transforms with examples and apply to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.(level 3)
CO-3:	Solve Laplaces equation in problems with cylindrically and spherically symmetric boundary conditions. (level 3)
CO-4:	Identify Matrix and its properties, its eigenvalues and eigenvectors, Diagonalization of Matrices. Apply to Solve Coupled Linear Ordinary Differential Equations. (level 3)

Course Code: PHSACOR08P

Course Title: Mathematical Physics III

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Solve Ordinary differential equation with initial value problems using python programming language and Linear system of equations by numerical methods. (level 3)
CO-2:	Compute Inverse of a matrix by Gauss-Seidal iterative method. (level 3)
CO-3:	Evaluate largest eigenvalue by power iterative method for real symmetric matrix and corresponding eigenvector (level 5)
CO-4:	Solve Eigenvector, eigenvalue problems of Matrix (by numpy.linalg)(level 3)
CO-5:	Outline boudary value problems (by finite difference method with fixed grid size) (level 4)
CO-6:	Calculate square roots, cube roots of a complex number using two dimensional Newton-Raphson method. (level 4)
CO-7:	Compute Fourier Integral transform:(level 3)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR09T

Course Title: Elements of Modern Physics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Define space-like, time-like, light-like separation, proper time, relativistic mass, relativistic energy, black body, group and phase velocity, metastable states, spontaneous and stimulated emissions, binding energy, mass defect, fission, fusion. Describe the structure of atomic nucleus, nature of nuclear force, liquid drop model. (Level- Remember)
CO-2:	Discuss the idea of 4-vectors, the idea of averaging over the collection, cavity radiation, ultraviolet catastrophe, wave description of particles, uncertainty principle, wave-particle duality, thermonuclear reactions driving stellar energy. Describe nuclear reactors. (Level- Understand)
CO-3:	Employ equivalence of mass & energy, law of equipartition of energy. Interpret photoelectric effect, Compton scattering, alpha decay, beta decay. (Level- Apply)
CO-4:	Calculate rest energy, de Broglie wavelength of a particle, binding energy. (Level- Analyze)
CO-5:	Interpret wave function as a bridge between wave description and particle description. (Level- Evaluate)

Course Title: PHSACOR09P

Course Outcome (COs) : Elements of Modern Physics Lab

After completion of this course successfully, the students will be able to

CO-1:	Determine the wavelength of laser source using single slit diffraction, double slit diffraction and grating diffraction (level-2)
CO-2:	Describe experimentally photoelectric effect and determination of Planck's constant (level-2)
CO-3:	Estimate the tunnelling effect in tunnel diode (Level-2)
CO-4:	Illustrate some modern apparatus for determination of the charge of the electron by Millikan oil drop experiment, specific charge of electron by Bar magnet (level-3)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR10T & PHSACOR10P

Course Title: - Analog Systems and Applications

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Outline of semiconductor devices like, unipolar, bipolar and their applications for different purposes, like rectifier diode, zener diode, amplifier, Oscillator and IC technology (Level 1: Remember)
CO-2:	Classify different types of amplifier according to operating condition, frequency range and active elements (Level 2: Understand)
CO-3:	Apply their understanding to solve the output/result of combination circuits containing different devices and elements (Level 3: Apply)
CO-4:	Calculate the circuit components required to perform Experiment on diodes, transistors, amplifiers, oscillators. (Level 4: Analyze)
CO-5:	Able to Compare and explain the fluctuation of experimental results from the theoretical value. (Level 5: Evaluate)

Course Code: PHSACOR11T, PHSACOR11P

Course Title: Quantum Mechanics and Applications

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Describe microscopic world in the framework of quantum mechanics, wave function as the probability amplitude distribution of a state for the observables with continuous eigenvalues. (Level- Understand)
CO-2:	Determine the probabilities of outcomes of different physical observables of a given system. (Level-Apply)
CO-3:	Evaluate the energy eigen values and energy eigen functions of systems with some simple time independent potentials. (Level-Evaluate)
CO-4:	Determine frequencies of spectral lines of atoms having different coupling schemes and effect of magnetic field on them. (Level-Evaluate)
CO-5:	Develop codes to find numerically the radial probability distribution using different kinds of numerical methods.(Level-Create)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR12T

Course Title: – Solid State Physics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Describe Langevin Theory of dia- and Paramagnetic material and also quantum theory for paramagnetism, ferromagnetism and hysteresis loss for ferromagnetic material (Level 2: understand level)
CO-2:	Describe crystal structure, concept of reciprocal lattice, Brillouin zones and x-ray diffraction by crystal (level-2: understand level)
CO-3:	Explain the lattice vibration and thermal properties of solids, (Level-2: understand level)
CO-4:	Describe superconductivity (level-2: understand level)
CO-5:	Apply band theory to distinguish conductor, semiconductor and insulator using band theory (level-3: Apply level)

Course Code: PHSACOR12P

Course Title: – Solid State Physics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Calculate Hall coefficient of a semiconductor sample (Level 4: Analyse Level)
CO-2:	Experiment hysteresis loss of ferromagnetic material from B-H loop (Level-4: analyze level)
CO-3:	Calculate band gap and temperature coefficient of semiconductor (Level-4: Analyze level)
CO-4:	Determine dielectric constant of dielectric material and susceptibility measurement of paramagnetic material. (Level-4: Analyze level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR13T

Course Title: – Electromagnetic Theory

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Apply Maxwell equation in free space, conducting and dielectric media (Level 3: Apply Level)
CO-2:	Describe the Boundary conditions at a plane interface between interface between two dielectric media and Reflection & Transmission coefficient (Level 2: Understand Level)
CO-3:	Demonstrate the properties of Polarised electromagnetic waves (Level 3: Apply level)
CO-4:	Describe Planar optical and dielectric wave guide, Condition of continuity at interface, Phase and group velocity of guided waves. (Level 2: Understand Level)
CO-5:	Define Numerical Aperture, Step and Graded Indices, Single and Multiple Mode Fibres (Level 1: Remember Level)

Course Code: PHSACOR13P

Course Title: – Electromagnetic Theory Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Compare experimentally Brewster Law and Malus Law, Fresnel's formula with theory (Level 4 : Analyse Level)
CO-2:	Estimate specific rotation of sugar solution (Level 5: Evaluate Level)
CO-3:	Estimate the wavelength and velocity of Ultrasonic wave in kerosine liquid (Level 5: Evaluate Level)
CO-4:	Compute the Boltzmann constant using V-I characteristics of PN junction diode. (Level 3: Apply level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSACOR14T

Course Title: — Statistical Mechanics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Describe the idea of micro and macro state, phase space, density of states, ensemble, entropy and Gibb's paradox. (Level2: Understand Level)
CO-2:	Apply the understanding of canonical ensemble in calculating specific heats of solids, average energy of harmonic oscillator. (Level 4: Analyse Level)
CO-3:	Understand the Bose Einstein and Fermi Dirac statistics. (Level2: Understand Level)
CO-4:	Illustrate theory of Black body radiation. (Level3: Apply Level)
CO-5:	Define chemical potential and chemical equilibrium. (Level1: Remember Level)

Course Code: PHSACOR14P

Course Title: Statistical Mechanics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Identify Black body spectrum, Dulong-Petit law. (Level 1 : Remember level)
CO-2:	Predict molecular dynamics using Python for ideal gas in a container separated by wall. (Level 3 : Apply level)
CO-3:	Calculate partition function for a system of finite number of single particle levels. (Level 4 : Analyze level)
CO-4:	Compare Black body spectrum for different temperatures and different frequency regions. Compare specific solids using Einstein and Debye's model. (Level 5: Evaluate Level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSADSE01T

Course Title: Advanced Mathematical Physics I

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Define Laplace Transform (LT) of Elementary functions and Properties of LTs. Apply LT to 2nd order Differential Equations(level 3)
CO-2:	Express Linear vector space, Groups and Fields, basis and dimensions of a Vector Space, change of basis, algebra and representation of Linear Transformations by Matrices(level 2)
CO-3:	Interpret algebra of tensors, tensorial character of physical quantities(level 3)
CO-4:	Evaluate General Tensors, Minkowski Space, Contravariant & Covariant Vectors, Kronecker Delta and Metric Tensor(level 5)

Course Code: PHSADSE02T

Course Title: Advanced Dynamics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Define continuous dynamical system, autonomous, non-autonomous system, equilibrium and fluid properties. Identify different constraints. Describe flow phenomena, turbulence. (Level- Remember)
CO-2:	Compare the evolution of dynamical systems obtained by stability analysis with that of analytical solutions. (Level- Understand)
CO-3:	Use Poisson brackets, generating functions. (Level- Apply))
CO-4:	Calculate constraint forces. Examine canonicity of transformations, the stability analysis for systems described by different kinds of potentials and normal modes of oscillations. (Level- Analyze)
CO-5:	Evaluate equations of motion for dynamical systems. (Level- Evaluate)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSADSE03T

Course Title: Nuclear and Particle Physics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Define the different nuclear properties (Level- Remember)
CO-2:	Describe nuclear models, radioactive decay modes Classify different types of particles and its families. Recognize different accelerators and detectors. (Level- Understand)
CO-3:	Explain interaction of nuclear radiation with matter, Photoelectric effect, Compton effect, pair production (Level-Understand)
CO-4:	Classify nuclear reaction Kinematics. Solve Q value equations (Level-Apply)
CO-5:	Determine the ground state spin parity of a given nucleus by using nuclear shell model. (Level- Apply))

Course Code: PHSADSE04T

Course Title: Advanced Mathematical Physics II

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Identify sets, binary operations. (Level 1: Remember Level)
CO-2:	Express binomial distribution, Poisson distribution. (Level 2: Understand Level)
CO-3:	Compute Poisson distribution, Gaussian distribution. (Level 3: Apply Level)
CO-4:	Calculate Green's function, least squares. (Level 4: Analyze Level)
CO-5:	Interpret reducible and irreducible matrix representations, homomorphism of groups. (Level 5: Evaluate Level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSADSE05T

Course Title: Astronomy and Astrophysics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Define the units of astrophysical mass, length, time and other astronomical variables. (Level- Remember)
CO-2:	Describe different types of astrophysical coordinate systems. ((Level- Understand)
CO-3:	Implement different physical laws to get knowledge about stellar objects. (Level-Apply)
CO-4:	Evaluate temperature, distance, age of stars from the available information. (Level-Evaluate)

Course Code: PHSADSE06T

Course Title: Communication Electronics

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Outline of the Electronic Communication system. (Level 1: Remember Level)
CO-2:	Classify the Analog and Digital Modulation and demodulation. (Level 2: Understand Level)
CO-3:	Interpret the characteristics of different types of modulation systems (Level 3: Apply Level)
CO-4:	Compare different modes of modulation systems (Level 4: Analyze Level)
CO-5:	Summarize the physics of satellite and Mobile communication systems. (Level 5: Evaluate Level)

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Name of the Academic Program: B.Sc(H)

Course Code: PHSADSE06P

Course Title: Communication Electronics Lab

Course Outcome (COs)

After completion of this course successfully, the students will be able to

CO-1:	Recall the theory of Electronic Communication system (Level 1: Remember Level)
CO-2:	Describe the circuits used for different stages of the modulation system. (Level 2: Understand Level)
CO-3:	Interpret the experimental results with the expected theoretical values (Level 3: Apply Level)
CO-4:	Compare the results (output) with the variation of different input signal and elements used to design the circuits (Level 4: Analyze Level)
CO-5:	Design the circuits required for Modulation and Demodulation for different applications. (Level 5: Evaluate Level)