Department of Physics
Sarojini Naidu College for Women

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 Qtiplot. **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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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:Analyse 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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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, wavefunction 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:	**Develope** codes to find numerically the radial probability distribution using different kinds of numerical methods.(Level-Create)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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:	**Ilustrate** 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)

Department of Physics
Sarojini Naidu College for Women

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** canonicality 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)

Department of Physics
Sarojini Naidu College for Women

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)

Department of Physics
Sarojini Naidu College for Women

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:	**Implemen**t 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)

Department of Physics
Sarojini Naidu College for Women

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)