

BARASAT COLLEGE ,DEPARTMENT OF PHYSICS, 1,Kalyani Road, Nabapally,Barasat.

B.Sc. Physics (Hons)/General CBCS Program

Programme Specific Outcomes (PSO): After completion of the UG Physics course, the students will be able to learn not only the basic knowledge of the subject but also get knowledge in the working of different scientific as well as engineering instruments, which will help the students in their profession in the future. The very basic nature of Physics is to illuminate a student in the development of analytical mind, who never believes in anything without logic.

PSO 1: The outcome lies in the daily life of human being. Here a person learns basic principles of the properties of matter and the relationship between different principles. To know this the students are exposed to mathematical and analytical physics. The basic properties of matter are unveiled to them in the name of mechanics, general properties of matter, sound, optics, etc.

PSO 2: This activates the students to perform experiments in mechanics, general properties of matter, optics, electronics, etc and compare the values with theoretical results.

PSO 3: This course is designed in such a way that students can learn different Laboratory Experiments on each theoretical concept which may help to built a clear concept on the subject and it helps the students to motivate on experimental physics.

PSO 4: Students are being motivated to study some special topics in Physics such as astrophysics, nuclear and particle physics, communication electronics, etc. They are also motivated to equip themselves for facing competitive examinations.

Course Outcome or Learning Outcome

Three year B.Sc. Course under CBCS semester system

HONOURS COURSE IN PHYSICS

Course Name: Core Course-1

Course Code: PHSACOR01T & PHSACOR01P

Topic Name: Mathematical Physics and LAB

Course Outcome: After successful completion of this course students will be able to learnt about: (1) Study of Calculus brings about a clear understanding and estimation of infinitesimal dynamical variations in Space and Time domain. (2) Knowledge of Vector Calculus refers to direction specific variations in 1D, 2D and 3D Space with time dependent coordinate system. (3) Introduction to Probability basically reflects on the Statistical behaviour for very large data base systems. (4) From this course, students gets enriched in specific Mathematical tools to probe and understand any Physical, Chemical and Biological issues along with Theoretical concepts. (5) Understand the basics of programming in Python, which is a universally accepted open source programming language. (6) Know about the open source advanced

operating system Linux. (7) Operate the Gnuplot for graph plotting which must help the students to analyze different problems graphically. (8) Apply different computational techniques in any branch of theoretical and experimental physics.

Course Name: Core Course-2

Course Code: PHSACOR02T & PHSACOR02P

Topic Name: Mechanics and LAB

Course Outcome: After successful completion of this course students will be able to: (1) Learn about Gravitation and its impact on the dynamic Universe. (2) Learn about elastic properties of matter and its application in construction field, bending of beam and how to measure different types of elastic constant. (3) Learn first that motion and rest are completely relative phenomenon. Speed of light is the highest speed in this universe. (4) Learn how fluid moves and what conservation theorem work. (5) To expose the students to the hands-on experience of classical mechanical domain that they have learnt theoretically. (6) To develop basic skills of students in the future lab experiments. (7) Understand different techniques for measuring different physical properties like (i) flexure method (ii) Searle's method (iii) Poiseuille's method etc (8) Know the uses of different apparatus like (i) Torsion Pendulum (ii) Sextant (iii) Bar Pendulum (iv) Kater's Pendulum (9) Know how to make systematic experimental observation, data collection, recording of data and other basic laboratory practices in this course and also know the technique of plotting the graphs and determine different parameters from the graph. (10) Estimate the errors in experimental data.

Course Name: Core Course-3

Course Code: PHSACOR03T & PHSACOR03P

Topic Name: Electricity and Magnetism and LAB

Course Outcome: After successful completion of this course, students will acquire knowledge of the following:-

(1) Electrostatics, Gauss Law and Concepts of Capacitance along with application to Capacitors. (2) Dielectric Properties of Materials and concept of Polarization in various media along with their applications. (3) Existence and generation of Magnetic Field and Force, Concepts of Magnetic Dipole formation, Amperes Circuital Law and its applications. (4) Magnetic properties of matter, Magnetization, Magnetic susceptibility and permeability, Ferromagnetism and development of Hysteresis phenomenon. (5) Electromagnetic Induction, Lenz's Law, Reciprocity theorem. (6) Electrical circuits - Their types and applications, Development of Network theorem and their uses. This course helps to develop insights for motors, dynamos, etc. and their design along with fabrication of large and small scale electro-magnetic units. (7) Know about various electrical components, power supply, multimeter and various other measuring instruments like (i) Potentiometer (ii) Carey Foster's Bridge (iii) Anderson's bridge (iv) Galvanometer, etc (8) Perform experiments on various topics of electricity and magnetism associated

with the course. (9) Know about precautions to be taken during performing an experiment and will be able to identify different sources of error.

Course Name: Core Course-4

Course Code: PHSACOR04T & PHSACOR04P

Topic Name: Wave and Optics and LAB

After successful completion of this course students will be able to learn:(1)Basic ideas about waves,rays,etc (2) Huygen's wave theory based Interference and Diffraction phenomena (3) Know about different instruments/parts like (i) Spectrometer (ii) EDF Prism (iii) Sodium source and Sodium Vapour Lamp, Mercury Vapour Lamp (iv) Diffraction Grating (v)wedge-shaped Film etc (4) Understand about different experimental setup like (i) Fresnel Biprism (ii) Newton's Rings (iii) Michelson's interferometer etc

Course Name: Core Course-5

Course Code: PHSACOR05T & PHSACOR05P

Topic Name: Mathematical methods II and LAB

After successful completion of this course students will be able to: (1) Perform the mathematical modeling and then solving the different physical problems. (2) Develop the skills in different mathematical domains (3) Understand some advanced topics of mathematical physics like Fourier series, some special functions, special integrals, integral transforms, partial differential equations and probability. All these topics are very important for studying theoretical aspects of various branches of physic. (4) Know about various numerical analysis techniques like use of array, numerical solution of problems of matrix algebra, numerical integration, interpolation, solution of differential equation and curve fitting.

Course Name: Core Course-6

Course Code: PHSACOR06T & PHSACOR06P

Topic Name: Thermal Physics and LAB

After successful completion of this course the students will be able to learn :(1) Through the study of the law of thermodynamics, students get the idea of work energy equivalence. Such knowledge helps to understand the basic mechanism of thermal engines. (2) Concept of entropy gives the idea of the directionality of the natural processes. (3) Overall concepts of thermodynamics pave the way to understand the thermal properties of the system macroscopically. (4) From the study of kinetic theory, students get the elementary idea of formulating the microscopic theory associated with the thermal properties of matter. Such understandings help students in doing research works related to the

application of kinetic theory in economics and social science. (5) Through this lab course students get the idea of measuring various physical parameters related to the thermal properties of matter. (6) Few practical involve electronic circuits for measuring thermal parameters. This gives the students a unique opportunity to visualize the making of prototype machines.

Course Name: Core Course-7

Course Code: PHSACOR07T & PHSACOR07P

Topic Name: Digital Systems and Applications and LAB

After successful completion of this course the students will be able to: (1) Understand the method of IC construction and also the history of IC formation. (2) Understand the different number systems and Boolean algebra. Students also are able to simplify a digital circuit using simplification method of Boolean expression. (3) Understand the development of different combinational digital circuits (like, Adder, Subtractor, Multiplexer, DeMultiplexer, Encoder, Decoder etc) and how they work. (4) Construct the different application oriented digital circuits by using of Karnaugh Map simplification as per requirement. (5) Understand the differences between synchronous & asynchronous counters and their formation techniques. (6) Understand the use of shift register as random sequence generator. (7) Know about different discrete components/accessories like resistance, breadboard, ICs, Voltmeter, Multimeter, DC power supply etc. (8) Identify the pin-diagram different TTL ICs (like 7400, 7404, 7408, 7410, 7411, 7432, 7473, 7476, 7483, 7486 etc) and make the circuits in bread board.

Course Name: Core Course-8

Course Code: PHSACOR08T & PHSACOR08P

Topic Name: Mathematical Physics III and LAB

Course outcome: (1) The course of complex variable helps students to apply it in electrical network theory, quantum mechanics etc. Contour integration allows to evaluate improper integrals, which appear in several problems of physics. (2) From the study of integral transform, students can visualize the correlation of the physical properties of a system in a given space and its reciprocal space. (3) Techniques of solving boundary value problems are very useful in tackling the physical problems in electrostatic, wave mechanics and heat conduction etc. (4) Studies on matrices provide the basic idea of linear operator, which has wide range of applications in theoretical physics. (5) This paper involves several numerical methods which are extremely important for the students to assimilate numerical techniques. (6) The numerical methods are also very useful to visualize some mathematical techniques discussed in the associated theory paper. (7) This paper enhances the ability of writing computer codes. (8) The discussed numerical techniques are very useful for doing advance research

Course Name: Core Course-9

Course Code: PHSACOR09T & PHSACOR09P

Topic Name: Elements of Modern Physics and LAB

After completion of this course, the students will be able to: 1) Get the idea in relativistic dynamics, that is study of dynamics under relativistic view point. They will also know the 4-vectors and their applications. 2) The students will know how the quantum theory has been emerged and why. The students will get the essence how ultraviolet catastrophe was elegantly removed by the famous hypothesis of Planck. The particle and wave-dual nature inherent in quantum theory is the most important as well as interesting part towards understanding the properties of small particles. 3) LASER is an important technology came into existence due to the emergence of quantum theory. The students get the idea of LASER and its applications. 4) After completion of the course the students will also be able to get the basic knowledge in nuclear and particle physics. This is important to understand the fundamental forces existing in nature and also the properties of atomic nucleus (the building block of atom) and the existing particles in the universe. 5) Study of nuclear radiation and the detectors gives knowledge about the existing radiations ( $\alpha$ ,  $\beta$  and  $\gamma$  rays) and the appropriate detectors to contain the radiation. This is useful for medical physics also. 6) Nuclear reaction gives knowledge in harnessing nuclear energy which is one of the green energies. 7) Knowledge in particle physics is needed to know the standard model that gives idea on unification of forces.

Course Name: Core Course-10

Course Code: PHSACOR10T & PHSACOR10P

Topic Name: Analog Systems and Applications and LAB

After successful completion of this course, the students should be able to (1) Understand the basic concepts of semiconductor physics and its application. (2) Understand about the operation, characteristics and various applications of different type of diodes, transistors, field effect transistors, OPAMP and oscillators. (3) Understand the working principle of amplifier, feedback amplifier and oscillator. Students can also be able to differentiate among different amplifiers and can choose a particular amplifier for a particular application/use. (4) Recognize different circuit components like, resistance, capacitor, inductor, diode, transistor, OP-AMP IC (741) etc. (5) Construct the different analog circuits on breadboard (6) Know about the equipments like CRO, Function Generator, Regulated Power Supply etc. (7) Gather handling knowledges on different Trainer Kit like Diode Expt, BJT & FET Characteristics study, CE- Amplifier Expt, OP-AMP Expt. (8) Develop a variety of circuits on breadboard which helps the students to design a unknown hardware circuit.

Course Name: Core Course-11

Course Code: PHSACOR11T & PHSACOR11P

Topic Name: Quantum Mechanics and its Applications and LAB

After successful completion of this course, the students are expected to gain knowledge about the following:-

(1) Basics of Quantum Mechanics (QM), formalism of Hamiltonian and necessity of Hermitian operators, development of wavefunction, Eigen values, and critical applications of uncertainty principles. (2) Time - Dependent and Time - Independent Schrodinger Equation, Quantum Mechanical Scattering and Tunnelling in 1D Step Potential, Rectangular Potential barrier and Tunnelling effect in Alpha Decay. Introduction to Scanning Tunnelling Microscopes (STM). (3) Existence of Bound states in an arbitrary Potential and Quantum Theory of Hydrogen-like atom, Helium ions, etc. (4) Applications of Quantization rules in Atomic Physics - Zeeman Effect. It has been observed that this course has attracted special interest of students studying Quantum Mechanical Phenomena and Systems in Physics, Chemistry and specially Nano-materials. (5) Students were given lessons on Quantum Mechanics course related to numerical practicals. (6) They learnt how to cast a time independent Schrodinger equation to ones involving dimensionless variables. For finding energy eigenvalue and wavefunctions two methods were adapted, namely, (a) shooting method, (b) direct matrix method. In the former the resulting Schrodinger equations were numerically solved with RUNGE KUTTA methods in an iterative fashion, whereas in case of latter it was diagonalized and so a single shot method. (7) Except the diagonalization procedure they wrote all the codes of their own using Python computer programming language. (8) The outputs of the numerical procedures were probability distribution and eigenvalues. So they learnt how to use proper boundary conditions specific to a particular quantum mechanical problem. (9) With this capability of solving Schrodinger equations numerically they will be able to explore much more difficult problems of higher physics in their future studies.

Course Name: Core Course-12

Course Code: PHSACOR12T & PHSACOR12P

Topic Name: Solid State Physics and LAB

After successful completion of this course students will be able to: (1) Learn how solid materials could be classified into amorphous and crystallography. Learn about how properties of matter depend on structure as well as electronic configuration. They also learn how structure of matter could be studied by X-ray. (2) Know how lattice oscillate and influence the properties of the matter. (3) know magnetic properties and type of magnetic properties. Dielectric properties of matter, Drude's theory of conduction of electron through matter, drift velocity etc. (4) How band theory develop and fruitfully explain most of the properties of matter. (5) know a newly emerged material properties called superconductivity and its application. (6) Learnt about current carried by charges: negative or positive or by both. So it is important to know which charges are responsible in a particular conductor. Students are able to determine the type of carriers i.e. negative or positive by Hall voltage measurement. (7) In our daily life and industries magnetism is being used widely. But there are various types of magnet means of different properties. So, before use it is important to know our requirement. Somewhere, we use permanent and hard magnet, somewhere soft and temporary magnet etc. So before use we have to know the characteristic of a particular magnet. By the B-H experiment students are able to estimate how B and H vary within the given magnet as well as energy loss by the magnet. (8) Semiconductors are been used vastly in every field of industry and technology. Semiconducting properties mainly depends

on the band gap between valance and conduction band. So to know or measurement of band gap is very important. Students are able to estimate band gap by measuring voltage with temperature.

Course Name: Core Course-13

Course Code: PHSACOR13T & PHSACOR13P

Topic Name: Electromagnetic Theory and LAB

After successful completion of this course, students will be able to learn about the following:-

(1) Maxwell Equations and its behavior in free space & different media, Poynting Theorem & Vector, Energy density & Field Energy Density. (2) Electromagnetic (EM) wave propagation in Bounded & Unbounded media, and Polarization of EM Waves. (3) Wave guides & Optical Fibres - Their concepts and applications. This course gives an opportunity to students, to develop deep insight about Optical Communication and Wave propagation.

Course Name: Core Course-14

Course Code: PHSACOR14T & PHSACOR14P

Topic Name: Statistical Mechanics and LAB

(1) Statistical mechanics provides the way to understand physical systems microscopically and also makes correlations with the macroscopic properties. (2) Quantum statistical mechanics helps the students to understand the low temperature behavior of system. (3) Basic formalism of statistical mechanics allows the students to apply it in a very wide range of physical systems. (4) Knowledge of statistical physics enormously helps the students in doing research works in many advance branches of physics e.g., condensed matter physics, particle physics. (5) This computational lab course gives unique opportunity to the students for testing several statistical mechanics methods. (6) This course also gives the primary ideas of doing numerical research associated with the statistical physics. (7) This course enhances the ability of writing numerical codes.

Course Name: Discipline Specific Elective-1

Course Code: PHSADSE02T

Topic Name: Advanced Dynamics

Course Outcome: After successful completion of this course students will be able to:

(1) Understand the dynamics and formation of Lagrange's equation

- (2). Solve the related dynamics problems with both time-dependent and time independent constraints.
3. Understand the behavior of rigid body dynamics and fluid dynamics
4. Understand the concept of phase space, Autonomous and non-autonomous systems.
5. Analysis the behavior of an one dimensional autonomous system, two dimensional dynamical systems etc
6. Understand the idea of limit cycle. Discrete time dynamical systems, iterative map, Logistic map
7. Thinking about the Parameter dependence- steady, periodic and chaos states.
8. Understand the Idea of chaos and Lyapunov exponent.

Course Name: Discipline Specific Elective-2

Course Code: PHSADSE03T

Topic Name: Nuclear and Particle Physics

After the completion of course, the students will have ability to:

- (1) Appreciate the basic concepts of nuclear and particle physics.
- (2) Acquire knowledge on advanced nuclear and particle physics.
- (3) Apply the ideas of nuclear and particle physics to the sustainable development of nation.

Course Name: Discipline Specific Elective-3

Course Code: PHSADSE04T

Topic Name: Advanced mathematical physics

After the successful completion of the course, the students will be able to:

- (1) Solve different problems involving modern mathematics, statistics and calculus.
- (2) A good amount of knowledge and skill is expected to be developed in formulation of scientific laws of interdisciplinary subjects.

Course Name: Discipline Specific Elective-4

Course Code: PHSADSE06T & PHSADSE06P

Topic Name: Communication Electronics and LAB

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

- (1) Understand the modern communication system (analog & digital) and its practical use
- (2) Understand different types of modulation technique like AM, FM, PM, FSK, PSK, ASK, BPSK etc which helps the students for higher studies.
- (3) Understand the satellite communication technique.
- (4) Construct the modulator and de-modulator circuit and students know how to calculate different parameters of modulated wave.
- (5) Understand and realize the practical Transmitter circuit.

Course Name: Skill Enhancement Course-1

Course Code: PHSSECO1M

Topic Name: Basic Instrumentation Skills

Course Outcome: After successful completion, students will be able to learn

- (1) get hands-on skill in different instruments which are highly required in physical measurements
- (2) They will also be able to use this knowledge in their future careers.
- (3) Students will understand the basics of cathode ray oscilloscope (CRO), construction of CRT, electron gun, electrostatic focusing and acceleration, brief discussion on screen phosphor, time.
- (4) Understand the principle and working of digital meters, comparison of analog and digital instruments, working principles of digital voltmeter.
- (5) Understand the working of a digital multimeter, measuring of current, voltage, frequency etc by using digital multimeter.

Course Name: Skill Enhancement Course-2

Course Code: PHSSEC02M

Topic Name: Computational Physics

Course Outcome: After learning the course the students will be able to

- (1) Understand applications of some fundamental Linux commands.
- (2) Understand LaTeX word processor, preparing a basic LaTeX file, document, preparing an input file for LaTeX, compiling LaTeX file, LaTeX tags for creating different environments, defining LaTeX commands and environments, changing the type style, equation representation: (formulae and equations), figures and other floating bodies, generating table of contents, bibliography and citation, different fonts, picture environment and colors etc.

(3) Understand graphical analysis and its limitations, importance of visualization of computational and computational data, basic gnuplot commands: simple plots, plotting data from a file, saving and exporting etc.

(4) Some commonly needed Linux commands were taught.

(5) Students were given a course for F90 programming and to write elementary codes. All the course based programming were done by them. They prepared also a Note Book and submitted for evaluation.

(6) They applied their knowledge of F90 programming to some elementary projects works as like numerical solution of central force orbit, projectile motion, simple harmonic motion among some of these.

(7) At the term end they appeared in online examination with the project work codes. They fared well.

(8) They were given lesson to learn and apply GNUPLLOT in 1D and 2D.

(9) I am happy to declare that most of the students grasped the course well and will be able to apply F90 programming in future.

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Course Outcome or Learning Outcome

Three year B.Sc. degree course Under CBCS semester system

GENERAL COURSE IN PHYSICS

Name: Generic Elective/Department Specific Core Course-1

Course Code: PSHGEC01T & PSHGEC01P / PHSGCOR01T & PHSGCOR01P

Topic Name: Mechanics and LAB

Course Outcome: After successful completion of this course students will be able to Learn about: (1) vector operations, (2) Basic laws of mechanics i.e. Newton's laws of mechanics, about conservation of momentum & Energy, (3) laws satisfy for the motion of particles, even for Earth, Sun and other terrestrial bodies under Gravitation, (4) How fluid moves and knowledge about streamline and turbulent motion, the properties surface tension and viscosity of liquids. (5) knowledge about frame of reference and not existence of absolute rest. and velocity of light is the highest velocity in this universe under special theory of relativity. (6) Understand the applications of slide callipers and screw gauge. Students be able to measure the length, breadth and width of a bar and diameter of a cylinder by slide callipers and diameter of a wire by screw gauge. (7) They also understand the application of a stop watch to determine the time period of a body. Also understand the application of a telescope (e.g. in the experiment to determine Young's experiment). (8) Students able to determine the moment of Inertia of a regular body using another auxiliary body and a cradle suspended by a metallic wire. (9) Understand how to determine the Young's Modulus by flexure method. They understand how to determine the Modulus of Rigidity of a Wire by a torsional pendulum.

Course Name: Generic Elective/Department Specific Core Course-2

Course Code: PSHGEC02T & PSHGEC02P / PHSGCOR02T & PHSGCOR02P

Topic Name: Electricity and Magnetism and LAB

Course Outcome: After successful completion of this course students will be able: (1) To understand the electrostatic field, electric flux, Gauss's theorem and its applications in electrostatics., electric potential due to an electric dipole, capacitance of an isolated spherical conductor, parallel plate condenser, polarization etc. (2) To understand the Biot-Savart's law its applications, Ampere's circuital law, magnetic properties of materials etc. (3) To understand Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. energy stored in magnetic field. (4) To understand Thevenin, Norton's, maximum power transfer, superposition theorems and basics of Anderson's bridge. (5) To understand Maxwell's equations, Poynting's vector, electromagnetic wave (em) propagation through vacuum, transverse nature of em waves, polarization etc. (6) Students understand how to measure the resistance, capacitance, current and voltages by using a multimeter. They also understand the series/parallel connections of ammeter/voltmeter and their applications to measure the currents/voltages. (7) In the laboratory, they able to determine an unknown low resistance using Carey Foster's bridge. (8) They able to verify the Thevenin, Norton, superposition and maximum power transfer theorems (9) They studied the response curve of a series LCR circuit and determine its resonant frequency, impedance at resonance, quality factor Q and band width. (10). They also studied the characteristics of a series RC circuit.

Course Name: Generic Elective/Department Specific Core Course-3

Course Code: PSHGEC03T & PSHGEC03P / PHSGCOR03T & PHSGCOR03P

Topic Name: Thermal Physics and Statistical Mechanics and LAB

Course Outcome: After successful completion of this course students will be able to: (1) Understand different thermodynamical processes, the application of first and second law of thermodynamics, entropy of a system, Carnot cycle. (2) Understand Maxwell's law of distribution of velocities and its application to find out the average, r.m.s. (root mean square) and most probable velocities, different transport phenomena; e.g. viscosity, conduction and diffusion. (3) Understand black body radiation, Planck's law, Wien's distribution law, Rayleigh- Jeans law, Stefan-Boltzmann law and Wien's displacement law etc. (4) Understand basics of Statistical Mechanics (phase space, macro state and micro state, entropy and thermodynamic probability). Also understand basics of Fermi-Dirac and Bose-Einstein statistics. (6) Understand how to use a traveling microscope to determine the width of a disc (in the coefficient of thermal conductivity experiment). They able to know how to use a thermometer to measure temperature. (7) They understand how to verify Stefan's law by using a torch bulb. (8) Students able to determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method. They also understand the Newton's law of cooling in this experiment. (9) They able to study the variation of thermo-emf of a thermocouple with difference of temperature of its two junctions.

Course Name: Generic Elective/Department Specific Core Course-4

Course Code: PSHGEC04T & PSHGEC04P / PHSGCOR04T & PHSGCOR04P

Topic Name: Waves and Optics and LAB

Course Outcome: After successful completion of this course students will be able to:

(1) Understand superposition of two Collinear and perpendicular harmonic oscillations, Lissajous figures with equal and unequal frequency and their uses, transverse waves on a string, traveling and standing waves on a string. (2) Also understand forced vibrations and resonance, intensity and loudness of sound, musical notes, revibration. (3) Understand the Huygens principle, Interference of light (Fresnel's biprism, phase change on reflection: Stokes' treatment, interference in thin films, Newton's rings). (4) Understand diffraction of light (half-period zones, zone plate, single and double slits, plane transmission grating), polarization of light (transverse nature of light waves, plane polarized light – production and analysis, circular and elliptical polarization). (5) Understand the basics and application of Michelson's interferometer (To determine the wavelength, wavelength difference etc.). (6) Understand basics of spectrometer, and microscope and how to apply them for optical measurement. Students understand the use of prism and able to know how to measure the angle of a prism. They are familiarized with the Schuster's focusing for the measurement of the minimum deviation for different colours. (7) Students able to determine the frequency of an electric tuning fork by Melde's experiment and verify  $\lambda^2 \propto T$  law. (8) Students able to determine refractive index of the Material of a prism using sodium source. They also able to determine the dispersive power and Cauchy constants of the material of a prism using mercury source. (9) Students able to form Newton's rings and hence determine the wavelength of sodium light.

Course Name: Department Specific Elective-1

Course Code: PHSGDSE01T & PHSGDSE01P

Topic Name: Digital, Analog Circuits and Instrumentation and LAB

Course Outcome: After successful completion of this course students will be able to: (1) Understand binary to decimal conversion and vice-versa, addition, subtraction, multiplications and division of binary numbers, OR, AND, NOT, NOR, NAND, XOR, XNOR gates, application of De Morgan's theorems, half and full adders/subtractors. (2) Understand biasing of p-n diode and mechanism of operations, the operations and applications of LEDs, photodiodes and solar cells. Also understand characteristics of transistors in different biasing (CB, CE and CC) and their application in implementation of different kinds of amplifiers (A, B, AB and C). (3) Understand characteristics of OPAMPs and their applications in inverting and non-inverting amplifiers, adder, subtractor, differentiator, integrator and oscillators. (4) Understand the applications of CRO, half-wave, full-wave and bridge rectifiers. (5) Students able to know the pin configurations of OPAMP, OR, AND, NOT, NAND, NOR, XOR and XNOR gates. (6) They able to verify and design AND, OR, NOT and XOR gates using NAND gates. They also able to minimize a given

logic circuit, design it and prepare its truth table. Further, they able to verify De Morgan's theorems by implementing circuits with different ICs. (7) They able to verify the outputs of half adder/subtractor, full adder/subtractor and prepare respective truth tables

Course Name: Department Specific Elective-2

Course Code: PHSGDSE03T & PHSGDSE03P

Topic Name: Solid State Physics and LAB

Course Outcome: After successful completion of this course students will be able to: (1) Classification of solid materials into crystal and amorphous; their difference in aspect of structure, electrical, optical etc (2) learn that atoms or molecules of all materials are always oscillating though bulk matter may be in rest. (3) learn about magnetic properties of matters, types of magnetic properties and their uses, (4) learn after the failure of free electron theory to explain the measured/observed properties of matter, how band theory able to explain major measured/observed properties of matter including classification of matter into conductor, semiconductor and insulator. (5) learn about a new emerging material having zero resistivity, a promising material for mankind. (6) To understand the basics and biasing of p-n junction diodes and their characteristics. (7) Understand the variation of resistivity of a semiconductor with temperature. In this purpose, they able to design the required circuit arrangement o measure the resistivity of a Ge-semiconductor with temperature (in the reverse bias) and hence determine its band gap. (8) They able to design the required circuit arrangement for the study of the temperature coefficient of a semiconductor (NTC thermistor).