DEPARTMENT OF PHYSICS

PSO/CO

PROGRAMME SPECIFIC OUTCOMES

AND COURSE OUTCOMES OF

PHYSICS (UG & PG)

VISION

"**The physics department is committed to impart quality education in theoretical as well as in experimental physics with special emphasis on 'learning by doing'** which provides a transformative education to create leaders and innovators, and generates new knowledge for society and industry.

MISSION

- Empower students of diverse backgrounds and varied aspirations through physics education.
- To endow with opportunities towards self-fulfillment and competitiveness in an increasing global society through innovative and flexible learning.
- To effect and sustain a student centric culture that capitalizes on uniqueness of multi-cultural society.
- To enable the effective contribution of students towards sustainable development by inculcation of skills for transforming life's and communities.
- To provide an education that transforms students through different project works and by providing an understanding of the needs of society and industry.
- To collaborate with other academic national level organization to strengthen the education and research ecosystem.

PROGRAMME OUTCOME(PO)

GRADUATION PHYSICS

❖ PO1. Applied Knowledge:

Apply their knowledge of physics across a range of different fields, with in depth knowledge in at least one area of study. It will make student able for demonstrating and understanding the local and global contexts in which physics is practiced.

❖ PO2.Practical Information:

Student will be able to understand and resolve routine problems which they learn during their studies.

❖ PO3. Team work:

In lab work and their undergraduate classes they learn to live in groups .They can work effectively in groups to meet a shared goal with people whose disciplinary and cultural backgrounds differ from their own.

❖ PO4. Communication skill:

Student share their views and science and technology ideas with their friends and teachers during their education. This will be helpful for enhancing their communication skill.

❖ PO5. Professional and ethical behavior:

Demonstrative personal and professional integrity by respecting diverse point of view and intellectual contribution of others.

❖ PO6. Problem solving and critical thinking:

Students can critically evaluate ideas and arguments by gathering relevant information, assessing its credibility and synthesizing evidence to formulate a position.

❖ PO7. Environment Sensitivity :

To aware young ones towards environment and sustainability and sustainable development.

POST GRADUATION PHYSICS

❖ PO1. Knowledge:

After completion of masters in physics student can apply their expertise to solve novel and emerging problems in scientific world.

❖ PO2. Creative researches:

Students will be prepare to solve research problem, apply research methods , tools for data collection, analyze and interpreting it.

❖ PO3. Professional Ethics:

Expected to broaden their professional foundations through activities such as internships, fellowships, teaching ,presentation and project work. They aware about scope and opportunities in the field of different branches of physics.

❖ PO4. Originality:

Student can perform original work in the field of physics or complete a substantial project related to the field of basic and advance physics.

❖ PO5. Skills:

Student can apply analytical models and critical, reasoning propellers to calculate evidence, select among alternatives and generate creative options by using their technical skill.Learn effective communication skills in oral & written form. Communicate their research clearly and professionally in both written and oral forms appropriate to the field through publications, conference, research papers, seminars etc. Investigate, design and apply appropriate methods to solve problems in science, mathematics and tehnology by using their skill.

❖ PO6. Proficiency in technology:

Students will be proficient with modern technologies and aware with its significance in the modern world. They will gain perfection in their field by using technology.

❖ PO7.Communication:

Communicate effectively on scientific achievements, concepts and recent developments with experts and with social environment. Able to prepare and write reports,documents. Perform effective presentations in oral and written form.

❖ PO8: Environment and sustainability:

Understand the impact of the solutions in ethical, societal and environmental contexts and can demonstrate the knowledge for their sustainable development .

❖ PO9: Teamwork:

Recognize the opportunities and contribute positively in collaborative and scientific research. They exchange their ideas with researchers of other disciplines also.

PROGRAMM SPECIFIC OUTCOMES(PSO)

- To provide quality education to the students in a creative and stimulating environment.
- To promote research work and skill with technology.
- To provide a creative atmosphere for the preparation of competitive exams viz.NET/SET/PSC

❖ **PSO1:** Students are expected to acquire basic knowledge of modern physics, including the major premises of classical and quantum mechanics, electrodynamics,electromagnetic theory, and optoelectronics.

❖ **PSO2:** Students are also expected to develop their written and oral communication skills in optical fibre, communicating physics related topics.

❖ **PSO3:** Students would learn how to design and conduct an experiment (or series of experiments),projects demonstrating their understanding of the scientific method and processes.

❖ **PSO4:** Students are expected to understand the analytical methods required to interpret and analyze results and draw conclusions as supported by the experimental data or existing theories.

DEPARTMENT OF PHYSICS | PSO/CO

COURSE PROFILE (B.Sc. PHYSICS)

Class	Paper	Name of the paper
B.Sc. I Year	Paper I	Mechanics, Oscillations and Properties of Matter
	Paper II	Electricity, Magnetism and Electromagnetic Theory
B.Sc. II Year	Paper I	Thermodynamics, Kinetic Theory and Statistical Physics
	Paper II	Waves, Acoustics, and Optics
B.Sc. III Year	Paper I	Relativity, Quantum Mechanics Atomic Molecular and Nuclear Physics
	Paper II	Solid State Physics, Solid State Devices and Electronics

COURSE OUTCOMES

PAPER	PAPER NAME (PAPER CODE)	OUTCOMES
		After completion of the course the student should be able to
B.Sc. I		
PAPER I	MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER	CO1 Understand basic concept of Newtonian Mechanics and apply it on other physical system.
		CO2 Understand Rigid Body Motion, Rotation motion and Simple Harmonic Oscillation.
		CO3 Understand Lissajous figure and its application, derive differential equation and its solution for damped and forced harmonic Oscillator.
		CO4 Understand the basic theory apply in CRO.
		CO5 Understand the theory and application of Elasticity and Viscosity.
PAPER II	ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY	CO1 Able to formulate equation to address force between charged particles.
		CO2 Calculate energy and intensity of electrostatic field for a given charged particles/ group of charges
		CO3 Understand Gauss's law and its implication in problem solving.

		CO4 Explain various phenomenon like Ferromagnetism, anti-ferromagnetism and differentiate among them
		CO5 Confidently apply mathematical methods to solve electromagnetic problems and appreciate the basic concept of magnetism and Maxwell equations and explain various phenomenon considering Maxwell equations.
LAB COURSE	**PHYSICS PRACTICAL**	CO1 Design and resolve circuits for electronic applications.
		CO2 Record data as required by the experimental objectives.
		CO3 Analyse recorded data and formulate it to get desired results.
		CO4 Interpret results and check for attainment of proposed objective.

B.Sc. II		
PAPER I	**THERMODYNAMICS, KINETIC THEORY AND STATISTICAL PHYSICS**	CO1 Associate with different laws of Thermodynamics, compare them and correlate phenomena observed in past. Explain working of Carnot's engine and derive efficiency in different situations.
		CO2 Identify thermodynamic variables and appraise various relations for gaseous system.
		CO3 Acquire a thorough knowledge of Black body radiation and laws associated with it.
		CO4 Describe Maxwellian distribution of speeds and distinguish between mean,r.m.s. and most probable speed values, Compute molecular collisions, mean free path and collision cross sections and estimate molecular diameter and mean free path.
		CO5 Interpret the statistical basis of thermodynamic probability and enlist statistical postulates of Gibb's ensemble. Derive Maxwell Boltzmann statistical laws and describe Bose Einstein and Fermi Dirac statistics through canonical partition function
PAPER II	**WAVES, ACOUSTICS AND OPTICS**	CO1 Express waves in form of equation and interpret the solutions and determine values of parameters.
		CO2 Appreciate the use of Fermat's Principle of extremum path to derive basic laws of optics, Investigate cardinal points for various coaxial lens systems.

		CO3 Demonstrate different type of interferences and interpret interference results using Michelson interferometer and Fabry-Parot Interferometer.
		CO4 Describe and demonstrate diffraction of light. Compare Fresnel half period zones with, Fraunhoffer diffractions. Evaluate Resolving powers using Rayleigh criterion.
		CO5 Understand and explain working of a Laser system, Assemble various parts for its efficient working. Analyze its application in communication technology
LAB COURSE	**PHYSICS PRACTICAL**	CO1 Design and resolve circuits for electronic applications.
		CO2 Record data as required by the experimental objectives.
		CO3 Analyse recorded data and formulate it to get desired results.
		CO4 Interpret results and check for attainment of proposed objective.

B.Sc. III		
PAPER I	**RELATIVITY, QUANTUM MECHANICS, ATOMIC MOLECULAR AND NUCLEAR PHYSICS.**	CO1 Describe laws of special theory of relativity and deduce its consequences in various situations and apply it for Compton's shift.
		CO2 Enumerate various events leading to Origin of the quantum theory. Appreciate wave particle duality and compute wavelengths using it and develop further understanding for wave packets. Correlate uncertainty.
		CO3 Write Schrodinger wave equation and solve it for obtaining different measurable parameters for a given system.
		CO4 Apply Schrodinger equation for some higher order problems like Spectra of hydrogen, deuteron and alkali atoms and its fine structure. Explain transition rule for pure vibration and electronic vibration spectra. Estimate and evaluate spectral lines from spectroscopy and analysis the theory underlining it.
		CO5 Utilize knowledge of particle interaction with electrostatic field in their detection and discrimination. Understand and describe working of detectors.

PAPER II	SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS	CO1 Characterize and classify Seven Systems, apply Laue's equation/ Bragg'sLaw of X-ray diffraction to identify crystal planes, Associate bonding in solids with specific heat of solids laws related to it.
		CO2 Derive expression for density of states for solids, discuss kronig – penny model and distinguish Metal, Insulator and semiconductors. Classify Dia, Para and ferromagnetism. Investigate Langevin's theory of dia and para-magnetism and description of Curieweiss's law, B-H.curve and Hysteresis loss.
		CO3 Describe and classify Semiconductors, explain working of n-type and p-types, diodes and transistor junction potentials. Apply its knowledge to solve given problems based on its working.
		CO4 Apply knowledge of V-I characteristics of PN junction diode, Zener Diode, Capacitor and Inductor to understand working of half wave and Full wave rectifiers and regulation of voltage. Calculate voltage and current gain for transistor configurations.
		CO5 Construct a number system and formulate conversion mechanism mathematical operations for it. Explore Logical operations by basic gates and express combination of gates using Boolean Algebra. Appreciate Digital Circuits and its use in ICs
LAB COURSE	PHYSICS PRACTICAL	CO1 Design and resolve circuits for electronic applications.
		CO2 Record data as required by the experimental objectives.
		CO3 Analyse recorded data and formulate it to get desired results.
		CO4 Interpret results and check for attainment of proposed objective.

Program-M.Sc.(PHYSICS)

COURSE PROFILE

M.Sc. I St Semester

Paper	Name of Paper
Paper I	Mathematical Physics
Paper II	Classical Mechanics
Paper III	Elecrodynamics and plasma physics
Paper IV	Electronic Devices

COURSE OUTCOME

At the end of this course, a student will have developed ability to:

PAPER NAME	COURSE	OUTCOMES
PAPER I	MATHEMATICAL PHYSICS	CO–1. Students will learn the vector space and matrices
		CO–2. They get basic idea about matrix, Compute eigen values , eigen vectors ,characteristic polynomials and apply to basic digonalization of matrix.
		CO–3. Learn to determine continuity, differentiability of functions, evaluation of Cauchy Riemann condition.
		CO–4. Learn to derive solution by series expansion and Legendre, Bessel's, Hermite and Lagurre equation and physical applications of Legendre, Hermite and Lagurres polynomials.
		CO–5. Distinguish the integral of infinite order into general and singular integrals.
		CO– 6.Solve and apply linear equation of order two and higher LDE using Laplace's Transformation. Perform Transforms like Laplace's Transformation, Fourier series, Fourier Transformations. Get familiar with the modelling assumption and derive the idea to PDE.

PAPER II	CLASSICAL MECHANICS	CO–1. Students will be able to know the effect of forces during static conditions and understand the true nature of Newtonian mechanics, Lagrangian and Hamiltonian approaches in classical mechanics.
		CO–2. Apply Langragian Equation and solve Kinematics and Dynamics of rigid body in detail and ideas regarding Euler's equations of motion.
		CO–3. . Reduce dynamics of many body problem to single body and apply it to solve Planetary Motions .
		CO–4. Understand Principle of least action and transformations from one set to another and implement it to theory of small oscillations .
PAPER III	ELECRODYNAMICS AND PLASMA PHYSICS	CO–1. Students will be able to know review and illustrate Lorentz transformation of space and time and Maxwell's field equations in terms of four vectors, electromagnetic field tensor, Lienard - Wiechert Potential.
		CO–2. Explain Motion of charged particles in E-M field and theories related to Larmour's formula, relativistic generalization of Larmour's formula, Bremrstrahlung radiation, Synchrotron Radiation, Cerenkev radiation, Abraham- Lorentz formula. Get Idea of Plasma Production, theories related to application of EM fields and appreciate the difficulties related to it.
		CO–3. Explain Phase Space for Single particle and many particle phase space ,collisionless Boltzman equation,E and B field.
PAPER IV	ELECTRONICS	CO–1. Students will be able to understand op-amp,transistor and diode characteristics and apply it to design electronic circuits and memory devices of desired configurations. After successful completion of the course the student is expected to know and discuss differential amplifier circuits.
		CO–2. Apply knowledge of OPAMP and analyse its block diagram and different Configurations. Understand and explain Summing Amplifier, Differentiator, Integrator, Clipping Clamping circuits, Multi-vibrators.
		CO-3 Describe and discuss applications of OP-AMP as oscillators in all configurations.

		CO–4. . Able to recognize microprocessor 8085 and its basic working along with familiarization of all type of memory devices.
LAB COURSE I-A	GENERAL AND OPTICS	Students are expected to understand various theory and principles concerned with mechanics, optics and semiconductor electronics and will be able to following in connection of the same.
LAB COURSE I-B	ELECTRONICS	Design and resolve circuits for electronic applications. Record data as required by the experimental objectives. Analyse recorded data and formulate it to get desired results. Interpret results and check for attainment of proposed objective.

SYLLABUS

M.Sc.-2nd Semester

Paper	Name of Paper
Paper I	Quantum Mechanics-I
Paper II	Statistical Mechanics
Paper III	Electronic and Photonic Devices and Optical Modulators
Paper IV	Computational methods and Programming

COURSE OUTCOME

At the end of this course, a student will have developed ability to:

PAPER	PAPER NAME	COURSE OUTCOME
PAPER I	QUANTUM MECHANICS-I	**CO-1.** Students will be able to get familiarize with basic non-relativistic quantum mechanics, old quantum theory, interpretation of wave function, uncertainty principle in quantum mechanics and commutation relations

		CO-2. Appreciate Dirac delta function, box normalization, Hilbert space, matrix mechanics, Schrodinger, Heisenberg and interaction pictures, particle in a box,tunneling through a potential barrier, linear harmonic oscillator.
		CO-3 Develop the idea of symmetry in space and time, spherical harmonics, angular momentum, addition of angular momenta and Clebsch-Gordon coefficients.
		CO-4. Understand the basic concepts of hydrogen atom in quantum mechanics, time independent perturbation theory and its applications to harmonic oscillator,Zeeman effect and Stark effect.
PAPER II	**STATISTICAL MECHANICS**	**CO-1.** Students will be able to classify a system into canonical, micro canonical, Grand Canonical ensembles and write partition function for them.
		CO-2. Describe Gibbs's paradox, Phase space Liouvelle's theorem, Maxwellian distribution from canonical distribution and understand transition to Quantum statistical mechanics.
		CO-3 Derive and discuss Virial equation , cluster expansion for a classical gas, the Ising model in one dimension, exact solution of Ising model in one dimensions and Landau's Phenomenological theory of phase transition.
		CO-4. Summarize and outline thermodynamic fluctuations spatial correlation in a fluid, Langevin's theory of the Brownian motion, Einstein Relation and Expression for mobility(Nernst relation) Fokker – Planck equation and Fluctuation dissipation theorem.
PAPER III	**ELECTRONIC AND PHOTONIC DEVICES AND OPTICAL MODULATORS**	**CO-1.** the student is expected to learn and apply different bipolar devices, thyristers, diac, triac, UJT and SCR.
		CO-2. Students learn to different unipolar devices,JFET, MOSFET,MESFET,MIS and MOS diodes.
		CO-3. Students learn Special microwave ,photonic and power devices.

PAPER IV	COMPUTATIONAL METHODS AND PROGRAMMING	**CO-1** After completion of the course, the student is expected to learn and apply different numerical methods such as Newton raphson for physical problems.
		CO-2. Understand and analyze data by interpolation and curve fitting etc.
		CO-3. Learn and solve ODE using Picard's Method, Taylor Series expansion .
		CO-4 Apply Newton's forward and backward difference formula , Stirling's formula for numerical differentiation .
		CO-5 Use trapezoidal and Simpson's rule for numerical Integration.
LAB COURSE II-A	NUMERICAL ANALYSIS & COMPUTER PROGRAMMING	Understand the basics of a structured and object oriented programming language and apply the program for the purpose of numerical computations
LAB COURSE II B	DIGITAL ELECTRONICS & MICROPROCESSOR	Have a thorough understanding of the fundamental concepts and techniques used in digital electronics. To understand and examine the structure of various number systems and its application in digital design. Describe the architecture & organization of 8085 & 8086 Microprocessor. Understand and classify the instruction set of 8085/8086 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.

SYLLABUS

M.Sc.-3rd Semester

Paper	Name of Paper
Paper I	Quantum Mechanics II
Paper II	Atomic and Molecular Physics
Paper III	Solid State Physics
Paper IV	Electronics(Communication-I)

COURSE OUTCOME

At the end of this course, a student will have developed ability to

PAPER	PAPER NAME	COURSE OUTCOME
PAPER I	QUANTUM MECHANICS II	CO-1. Students will be able to familiarize with time independent perturbation theory and Fermi-Golden rule, variation method, WKB approximation as well as adiabatic and sudden approximations.
		CO-2. . Introduce laboratory and centre of mass frames, scattering cross-sections, partial wave analysis, Born approximation. Develop the idea of identical particles in quantum mechanics and their collision, spin angular momentum, Pauli spin matrices, effect of identity and spin.
		CO-3. Understand the basic concepts of semi classical theory of radiation and electric dipole transition, line width, quantization of electromagnetic field, creation and annihilation operators, spontaneous and stimulated emissions.
PAPER II	ATOMIC AND MOLECULAR PHYSICS	CO-1. Student will be able to know about different atomic model and will be able to differentiate different atomic systems, coupling schemes and their interactions with magnetic and electric fields.

		CO-2. They gain ability to apply the techniques of microwave and infrared spectroscopy to elucidate the structure of molecules.
		CO-3 Learn to apply the principle of Raman spectroscopy and its applications in the different field of science & Technology.
		CO-4. Become familiar with different resonance spectroscopic techniques and its applications to find solutions to problems related to spectroscopy.
PAPER III	**SOLID STATE PHYSICS**	CO-1. This course acts as a bridge between a physicist and a material scientist. After completion of the course, the student is expected to have basic knowledge of crystal systems and symmetries.
		CO-2. They study about crystalline materials are studied using diffraction, including concepts like reciprocal lattice and Brillouin zones.
		CO-3. They study about phonons are, and their dispersive and thermal properties, be able to calculate thermal and electrical properties in the free-electron model.
		CO-4. They will know Bloch's theorem and energy bands and their fundamental principles of semiconductors and explain superconductivity using BCS theory and Bloch Theorm.
PAPER IV	**ELECTRONICS (COMMUNICATION-I)**	CO-1. After completion of the course, the student is expected to understand microwave devices, TED working of Optoeelctronic devices and design digital display units.
		CO-2. Analyse Principles microwave communication systems. Discuss and demonstrate principle and arrangements of radar and satellite system.
LABORATORY COURSE III-A	**MATERIALS SCIENCE & GENERAL**	CO-1. Ability to relate properties to microstructure
		CO-2. Understand various crystal structures and relationship to properties

		CO-3. Ability to select metals and alloys for industrial applications
		CO-4. Understanding metals and their use in industries
		CO-5. Understanding heat treatment procedures and the change of properties
LABORATORY COURSE III-B	**ELECTRONICS (COMMUNICATION) -I**	To implant the capacity to apply the concepts of Electronics, Communications, Signal processing, VLSI, Control systems etc. An ability to isolate and solve complex problems in the domain of Electronics and Communication using latest hardware and software tools, along with analytical and managerial skills to arrive at cost effective and optimum solutions, either independently or as a team.

DEPARTMENT OF PHYSICS | PSO/CO

SYLLABUS

M.Sc.-4rd Semester

Paper	Name of Paper
Paper I	Nuclear Physics
Paper II	Laser Physics & Application of Laser
Paper III	Solid State Physics-II
Paper IV	Electronics(Communication-II)

COURSE OUTCOME

At the end of this course, a student will have developed ability to:

PAPER	PAPER NAME	COURSE OUTCOME
PAPER I	NUCLEAR PHYSICS	**CO-1.** After successful completion of the course the student is expected to acquire clear understanding of nuclear interaction, scattering and correlate data to retrieve information about nuclear structure.
		CO-2. Visualize nuclear models with the help of various experimental evidences.
		CO-3. Acquire knowledge about nuclear decay processes and build idea about nuclear phenomena.
		CO-4. Recognize different nuclear reaction and nuclear interactions of elementary particles and classify them based on their characteristics.
PAPER II	LASER PHYSICS & APPLICATION OF LASER	**CO-1.** After completion of the course, the student is expected to understand and explain basic Laser principles, Laser behaviour, Properties of laser radiations, Different types of Lasers and Laser applications
		CO-2. Explain different types Laser used and make a comparison between them.
		CO-3. Develop familiarity with the vast areas of laser application , especially in spectroscopy..

		CO-4. Explore important connections between theory and application of laser.
PAPER III	**SOLID STATE PHYSICS-II**	**CO-1.** After completion of the course, the student is expected to understand and explain basic nature of phonons in one and two dimensional body.
		CO-2. They know about polaritons and plasmons. Dielectric behavior of materials.
		CO-3 .They study about ferromagnetism and and antiferromagnetic nature of solids.
		CO-4. They learn about optical processes and defects in solids. They understand basic models of dia, para and ferro magnetism and theories of spin waves.
PAPER IV	**ELECTRONICS (COMMUNICATION-II)**	**CO-1.** After successful completion of the course, the student is expected to get familiarized with Pulse modulation ,Amplitude Modulation and its principle and applications.
		CO-2. Present mathematical representation of different modulation techniques.
		CO-3. Learn and apply sampling theorem for Mathematical representation of of FM and PM signal, inter system comparison (FM & AM) generation of FM direct& indirect method.
		CO-4. Understand and compare different computer communication systems viz. LAN, WAN and MAN, Wireless network, Network topology, etc.
PROJECT WORK		In this lab work students make project based on different fields. Students are expected to understand working mechanics and factors governing electrical, semiconductor electronic devices and Optical phenomenon. In connection of the same students are expected to design and resolve circuits for electronic applications. Record data as required by the experimental objectives. Analyse recorded data and formulate it to get desired results.

KALYAN P.G. COLLEGE Sector-7 Dt..... BHILAI NAGAR

PRINCIPAL
Kalyan Post Graduate College
Bhilai Nagar (C.G.)