DEPARTMENT OF PHYSICS AND ELECTRONICS
St. Thomas College, Bhilai, Chhattisgarh

PROGRAM: *BACHELOR OF SCIENCE*
(PHYSICS)
(2021-2022)

Program Outcomes (PO)

PO1. The students will enrich their knowledge in Physical Sciences.

PO2. They will be given deep exposure and knowledge about various concepts and methods to solve day to day physical problems.

PO3. They will get knowledge and motivation to compete in national level tests like JAM, NGPE, etc.

PO4. They will be prepared to accept challenges in broad areas of theoretical and experimental physics.

PO5. They will be able to recognize and implement the importance of continuous learning for self learning and develop throughout the academic career.

Program Specific Outcomes (PSO)

PSO1. Students will be familiar with the core concepts and be aware about the recent trends in the scientific community.

PSO2. They will be conceptually and analytically skilled enough to carry out their further studies with an idea and sense of academic and social ethics.

PSO3. They will be capable enough of taking up higher studies of interdisciplinary nature.

Course Outcome (CO)
B.Sc. Part I

Paper - I: Mechanics , Oscillations and Properties of Matter

After successful completion of this course the student will be able to

CO1. Use the idea of different coordinate systems, inertial, non-inertial and rotating frames, central force problems, Keplar's law, concept of Center of mass, collisions and conservation theorems.

CO2. Understand the rigid body dynamics, momentum, harmonic oscillators,

CO3. Understand different mechanical and electric oscillators, Lissajous figure, oscillatory circuits, types of oscillators and resonance,

CO4. Understand the Electric and magnetic fields, CRO, Cyclotron, isotopes, mass spectrography,

CO5. Learn about the elasticity, modulus, viscosity, surface tension and their respective experiments.

Paper - II: Electricity, Magnetism And Electromagnetic Theory

After successful completion of this course the student will be able to

CO1. Understand the gradient, divergence, curl and their geometrical interpretation, line, surface and volume integrals, Flux of a vector field, Gauss's, Green's and Stoke's theorem and their physical significance, analysis of complex network theorems using Kirchoff's law.

CO2. Learn to calculate E for distribution of charges in different arrangements, Gauss's law and its applications.

CO3. Understand dielectrics, polarization of molecules, polarization vector, concept of displacement current, other related terms and equations to understand the mechanism of polarization. Ferroelectric and paraelectric dielectrics, steady and non-steady current and their equations, rise and decay in LR, CR and LCR circuits, AC circuit problems, resonance.

CO4. Understand magnetization, magnetic vectors and their relationships, dia, para and ferromagnetic substances, hysteresis, uses of Biot- Sevart law and Ampere's circuital law in different situations,

CO5. Understand electromagnetic induction and their types, Faraday's law, Maxwell's equations, electromagnetic wave equations and Poynting vectors.

B.Sc. Part II

Paper - I: Thermodynamics, Kinetic Theory and Statistical Physics

After successful completion of this course the student will be able to

CO1. Understand the laws of thermodynamics, Carnot's cycle, concept of entropy and change of entropy in and negative temperature.

CO2. Understand the thermodynamic functions, Maxwell's thermodynamic equations and their applications, TdS equations, Black body spectrum and its analysis, Quantum theory of radiation;

CO3. Learn the Maxwellian distribution of speeds in an ideal gas, Doppler broadening, Transport phenomena in gases, mean free path, behaviour or real gases,

CO4. Understand the statistical basis of thermodynamics, Gibb's ensemble, accessible and inaccessible states, equilibrium conditions, Boltzmann, canonical distribution law and applications transition to quantum statistics;

CO5. Understand the indistinguishability of particles and its consequences, Bose-Einstein, Fermi-Dirac, Maxwell-Boltzmann statistics and their applications.

Paper - II: Waves, Acoustics And Optics

After successful completion of this course the student will be able to

CO1. Understand waves in media, waves over liquid surface, group and phase velocity, production and uses of Ultrasonic and Infrasonic waves, Reflection, refraction and diffraction of sound, Sonar,

CO2. Use of Fermat's principle in understanding reflection, refraction and to derive various formulas in plane as well as curved surfaces using geometrical methods, Aberrations and their reductions, Optical instruments and need of an eyepiece.

CO3. Understand the interference of light, Newton's rings, Michelson interferometer and their application to determine the precise wavelength, and other interferometers;

CO4. Understand the diffraction, phasor diagram and integral calculus methods, Diffraction in different conditions, resolving power of grating, prism and telescope, Concept and production of Polarized light and its mathematical representation;

CO5. Learn the Laser system and basic properties of laser action, Einstein's A and B coefficient, emission mechanisms, Types and applications of laser in various fields.

B.Sc. Part III

Paper - I: Relativity, Quantum Mechanics, Atomic, Molecular And Nuclear Physics

After successful completion of this course the student will be able to

CO1. Understand the reference systems, special theory of relativity, transformations, mass-energy equivalence,

CO2. Learn about Origin of the quantum theory by explaining failure of classical physics in various phenomena,

CO3. Understand Schrodinger's equation, wave function, Orthogonality and normalization,

CO4. Learn Spectral analysis, transition rules vibration and electronic vibration spectra,

CO5. Understand Structure and Basic Properties of Nuclei, Classification of Elementary Particles.

Paper - II: Solid State Physics, Solid State Devices And Electronics

After successful completion of this course the student will be able to

CO1. Understand the types of crystal structures, their basic properties, theories of Specific heat of solids, Vibrational modes,

CO2. Understand the Free electron model of a metal, Density of states, Fermi Energy, Energy bands, Hall effect, Dia, Para and Ferromagnetism, B-H curve etc.

CO3. Understand the types of semiconductors, Concept of Fermi level, Mobility of electrons and holes, junction diodes and their characteristics, Transistors and their characteristics, FET, MOSFET.

CO4. Understand the different types, features and factors related to the respective rectifiers, h-parameters and its equivalent circuit, Transistor as power amplifier and oscillator, types of oscillators,

CO5. Understand the Analog and Digital Circuits, number systems, various logic gates, their realization using Diodes and Transistors, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuits, D/A and A/D converters.

Master of Science in Physics

Program Outcomes (PO)

PO1. The students will enrich their knowledge in Physical Sciences.

PO2. They will be given exposure and training to compete in national level tests like UGC-CSIR NET, JEST, GATE, etc.

PO3. They will be prepared to accept challenges as globally competitive physicists/researchers in broad areas of theoretical and experimental physics.

PO4. They will be able to recognize and implement the importance of continuous learning for self learning and develop throughout for the professional career.

Program Specific Outcomes (PSO)

PSO1. Students will be familiar with the research oriented works and well aware about the recent trends in the scientific community.

PSO2. They will be analytically and technically skilled enough to carry out their further studies with an idea and sense of academic and social ethics.

PSO3. They will be capable enough of taking up higher studies of interdisciplinary nature.

Course Outcome (CO)

M.Sc. Physics Semester - I

Paper - I: Mathematical Physics

After successful completion of this course the student will be able to:

CO1: Use the idea of vector algebra, vector operators, their physical interpretation and applications in Physics,

CO2: Solve different physical problems with complex variables,

CO3: Familiarized with different special functions like Legendre, Bessel, Hermite and Laguerre functions etc. and their solutions,

CO4: They will get knowledge of Fourier and Laplace Transforms in solving different problems in Mechanics and Electronics etc,

CO5: Use the ideas of matrices to solve linear algebraic equations, linear transformations etc,

CO6: Use the series solution of complex differential equations, probability theory.

Paper - II: Classical Mechanics

After successful completion of this course the student will be able to:

CO1: Understand the development of Classical Mechanics, from Newtonian to Lagrangian Mechanics,

CO2: Understand the Hamiltonian approaches in classical mechanics,

CO3: Understand the transformation equations, Hamilton-Jacobi theory with application,

CO4: Solve the Central force problems, Understand the Kinematics and Dynamics of rigid bodies,

CO5: Understand the theory of oscillations.

Paper - III: Electrodynamics and Plasma Physics

After successful completion of this course the student will be able to:

CO1: Solve problems in electrodynamics, electrostatics and magnetostatics,

CO2: Understand four-vectors and tensor notations, various modes in waveguides,

CO3: Practically verify some of the laws and results of mechanics,

CO4: Understand Maxwell's equations and electromagnetic boundary conditions,

CO5: Understand the complex physical phenomena in plasma.

Paper - IV: Electronics

After successful completion of this course the student will be able to:

CO1: Understand the Basic Op-Amp characteristics, parameters and applications as inverter, integrator, differentiator etc,

CO2: Use basic gates to evaluate the Boolean expressions,

CO3: Understand basic principles of digital electronics and design combinational and sequential circuits,

CO4: Use a microprocessor based system using assembly level language programming,

CO5: Study the Organization and internal architecture of the Intel 8085,

M.Sc. Physics Semester - II

Paper - I: QUANTUM MECHANICS - I

After successful completion of this course the student will be able to:

CO1: Know about the limitations of classical physics and evolution of quantum mechanics,

CO2: Grasp the preliminary concepts of quantum theory of the material particle,

CO3: Know the fundamental rules of quantum mechanics and its application using Schrodinger's wave equations like Harmonic oscillator, Hydrogen Atoms etc,

CO4: Learn various commutation relationships, Pauli's matrices,

CO5: Understand central force problems, 3-D potentials, Perturbation theory, degeneracy, Zeeman effect, Stark effect.

Paper - II: STATISTICAL MECHANICS

After successful completion of this course the student will be able to:

CO1: Understand the foundations of statistical mechanics, states of a system, ensembles, thermodynamic quantities, hypotheses and theorems,

CO2: Formulate quantum statistics - ensemble theory, density matrix,

CO3: Familiare with different statistics such as Maxwell-Boltzmann, Fermi-Dirac and Bose Einstein statistics and their applications,

CO4: Understand theory of Ideal gas and their thermodynamic behaviour,

CO5: Understand non-relativistic and relativistic degenerate electron gas, theory of white dwarf stars,

CO6: Understand Statistical Mechanics of interacting systems, Theory of phase transition, Fluctuations, Brownian motion.

Paper - III: ELECTRONIC & PHOTONIC DEVICES AND OPTICAL MODULATORS

After successful completion of this course the student will be able to:

CO1: Study characteristics of Thyristors, diodes and rectifiers,

CO2: Understand basic structure and characteristics of Unipolar devices,

CO3: Understand the CCDs, Microwave devices like Tunnel diode, IMPATT diode, Gunn diode etc,

CO4: Understand the Photonic devices, Lasers, Solar cells,

CO5: Understand basics of Optical Modulators, Luminescence and Display Devices.

Paper - IV: COMPUTATIONAL METHODS & PROGRAMMING

After successful completion of this course the student will be able to:

CO1: Understand concepts of determination of zeroes of algebraic equations, curve fitting error estimations,

CO2: Get elementary information about compilers, interpreters and operating systems, Fortran programming, flow charts,

CO3: Learn Fortran programming where the main emphasis is given to numerical analysis, From series generation, solution of quadratic equations.

M.Sc. Physics Semester - III

Paper - I: QUANTUM MECHANICS - II

After successful completion of this course the student will be able to:

CO1: Understand Variational method, approximations and their solutions, energy levels;

CO2: Understand theory of scattering, Partial wave analysis;

CO3: Understand Time-dependent perturbation theory, Selection rules, wave functions;

CO4: Understand Relativistic quantum mechanics, Dirac equation;

CO5: Explain Dirac particle, negative energy state, spin –orbit energy;

Paper - II: ATOMIC AND MOLECULAR PHYSICS

After successful completion of this course the student will be able to:

CO1: Understand quantum states of one electron atoms, fine structure, intensity rules;

CO2: Understand two electron systems, interaction energy in L-S and J-J Coupling, Hyperfine structure;

CO3: Explain normal and anomalous Zeeman effect, early discoveries and developments, vector models of one electron system, selection rules, weak and strong magnetic effects in Hydrogen atom;

CO4: Understand the types of molecules, Rotational spectra of diatomic molecules, Raman Effect;

CO5: Explain vibrational spectra of diatomic molecules, IR spectrometer.

Paper - III: SOLID STATE PHYSICS - I

After successful completion of this course the student will be able to:

CO1: Understand concepts of electrons present in solids and their electronic properties like, energy bands in solids, various electronic models, theorems, crystal structures, etc;

CO2: Understand the Fermi surfaces and metals, and explain the observed physical properties of solids in terms of the motion of electrons in the periodic lattice space;

CO3: Explain the crystal vibration and thermal properties, lattice dynamics;

CO4: Understand the Electron-Phonon interaction and Superconductivity

CO5: Gain knowledge on Semiconductor crystals, donor-acceptor concept, thermo-electric effects.

Paper - IV: ELECTRONICS (COMMUNICATION) - I

After successful completion of this course the student will be able to:

CO1: Gain knowledge on various Microwave devices;

CO2: Understand the Microwave waveguides their different modes & components;

CO3: Understand the Microwave cavities, Transferred Electrons devices, Gunn diodes, IMPATT diodes, TRAPATT diodes and Microwave communications;

CO4: Understand the Radar system, types of satellites and Satellite communication.

M.Sc. Physics Semester - IV

Paper - I: NUCLEAR & PARTICLE PHYSICS

After successful completion of this course the student will be able to:

CO1: Understand the Nuclear Interactions, structure of the nucleus, its stability and nuclear forces;

CO2: Understand the Nuclear Reactions and related theories;

CO3: Understand the different decay processes of the nucleus and the origin and uses of radioactivity,

CO4: Learn different models of the nucleus, nuclear binding energy, nuclear reactions and energy release processes.

CO5: Learn about elementary particles and their properties.

Paper - II: LASER PHYSICS AND APPLICATIONS

After successful completion of this course the student will be able to:

CO1: Understand the Laser Characteristics;

CO2: Learn about different types of Laser Systems;

CO3: Learn advanced topics in laser Physics;

CO4: Explain multi-photon processes, Laser spectroscopy;

CO5: Understand the applications of Lasers in various fields, Communication by lasers

Paper - III: SOLID STATE PHYSICS - II

After successful completion of this course the student will be able to:

CO1: Understand the Plasmon, Polaritons, Plasma optics, electrostatic screening etc;

CO2: Gain knowledge on Dielectric and ferroelectrics, polarizability, phase transition theories, piezoelectricity;

CO3: Update their knowledge about general ideas of dia- and para- magnetisms, quantum theory of paramagnetism;

CO4: Understand the Ferromagnetism and antiferromagnetism

CO5: Understand the Optical Processes & Excitons and crystal defects.

Paper - IV: ELECTRONICS (COMMUNICATION) - II

After successful completion of this course the student will be able to:

CO1: Learn about fundamentals of Digital communications;

CO2: Learn about different Digital modulation techniques;

CO3: Learn about Mathematical representation of noise;

CO4: Understand the Data Transmission techniques.