M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Program Outcomes	**M.Sc. (Physics) Program**
PO1.	Scientific knowledge: Apply the knowledge of physics fundamentals with the help of mathematics to the solution of physical problems.
PO2.	Problem analysis: Identify, formulate, research literature, and analyze physical problems using basic principles of Physics.
PO3.	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO4.	Individual and team work: function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO5.	Communication: Communicate effectively on complex activities with the scientific community and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO6.	Modern tool usage: Apply appropriate techniques, resources, and modern scientific & engineering techniques to complex physical activities with an understanding of the limitations.
PO7.	Research Proficiency: Apply various modern techniques for research specific activities/experiments and analysis purpose
PO8.	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes	**PSOs of M.Sc. (Physics) Program**
PO1.	Understand the advanced concepts of Mathematical Physics, Classical Mechanics, Statistical Mechanics, Quantum Mechanics, Electronics, Nuclear & Particle Physics, Atomic and Molecular Physics, Quantum Field Theory, Classical Electrodynamics, Condensed Matter Physics, General Theory of Relativity, Material Science, Renewable Energy Sources, Nano Physics
PO2.	Perform procedures/experiments as per laboratory standards
PO3.	Understand the complex applications of physics in real world problems

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "**PHY-511- Mathematical Physics-I**" describe general understanding of various mathematical tools used for solving various Physical problems. CO1: Describe the vector algebra &vector calculus and solve related problems. CO2: Explain delta, beta and gamma functions and solve related problems. CO3: Describe Fourier series and its properties and solve related problems. CO4: Explain matrices and solve related problems. CO5: Describes tensors and solve related problems.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course **"PHY-512- Classical Mechanics"** describe general understanding of Lagrangian and Hamiltonian Formulation, Canonical Transformations, Rigid Body Motion. CO1: Describe the Mechanics of a system of particles, constraints of motion, generalized coordinates. CO3: Describe Hamilton's principle, Legendre Transformation CO2: Explain D'Alemberts Principle, applications of Lagrangian formulation. CO4: Describe Canonical Transformation and Hamilton–Jacobi Theory CO5: Describe Rigid Body motion such as orthogonal transformations, Euler's theorem CO6: Describe inertia tensor, Small Oscillations
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course **"PHY-513- Condensed Matter Physics–I"** describe general understanding of lattice dynamics, thermal properties, energy band theory, transport theory and liquid crystals. CO1: Develop an understanding of structure, elastic properties and lattice dynamics in solids. CO2: Explain thermal properties, lattice vibrations, normal modes. CO3: Enumerate and explain Electrons in a periodic potential, Bloch theorem, Semiconductor Crystals, superlattices. CO4: Define the transport theory, Boltzmann transport equation, Hall effect, Magnetoresistance.
Credits	03 Theory periods of one hour per week over a semester

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Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course **"PHY-514- Quantum Mechanics–I"** describe general understanding of Basic Quantum Mechanics and related physical problems. CO1: Develop an understanding of the mathematical tools and basic concepts of quantum mechanics. CO2: Develop an understanding of angular momentum and related problems. CO3: Understand stationary state approximation methods and their applications. CO4: Understand time dependent perturbation theory and its applications. CO5: Understand time independent perturbation theory and its applications.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course **"PHY-515-Electronics–I"** describe general understanding of Circuit Analysis, Semiconductor Devices and applications, Communication systems and related problems. CO1: Develop an understanding of circuit analysis such as The venin and Norton theorems, Mesh and Node analysis. CO2: Enumerate and explain the Classification of Feedback amplifiers, Direct and indirect semiconductors, diodes, Solar cell, UJT, Gunn diode, IMPATT devices, Liquid crystal displays, FET. CO3: Enumerate and explain the Differential amplifiers, Analogue computation, oscillator, filters CO4: Clearly define the communication systems in broad aspects such as review of analog modulation techniques, analog pulse modulation techniques, Pulse code modulation, satellite communication and cellular mobile communication.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course **"PHY-516- Physics Laboratory–I"** ddescribe general understanding physics practical and related problems. CO1: Understanding and determine the coefficient of self-inductance of a coil by Anderson bridge. CO2: Study of Cathode Ray Oscilloscope and its various applications. CO3: Study of characteristics of semi-conductor devices (UJT, FET). CO4: Study of tunnel diode and Zener diode characteristics. CO5: Designing and study of Op-Amp: Characteristics and parameter measurements. CO6: Study of multi vibrators (a) a stable (b) bi-stable (c) mono-stable. CO7: To study Op-Amp as an active filter, its frequency response and basic mathematical operations. CO8: Determination of thickness of mica sheet using Michelson Interferometer. CO9: To determine the velocity of ultrasonic waves in a given liquid.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course **"PHY-517- Computational Physics Laboratory–I"** describe general understanding of MATLAB and its application in mathematical and physical problems. CO1: Develop an understanding of basic commands used for programming in MATLAB. CO2: Develop an understanding of programming in MATLAB for various mathematical problems. CO3: Develop an understanding of programming in MATLAB for various physics problems. CO4: Enumerate and explain programming in MATLAB for various material science problems.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-521-Mathematical Physics-II" describe general understanding of Group Theory, Tensors, Fourier Series and Integral Transforms, integral Equations and related physical problems. CO1: Develop an understanding of Elements of Probability such as Definition and Theorem of total probability, Poisson Law, Binomial, Normal and Poisson distributions CO2: Enumerate and explain Differential Equations such as Linear Equations with variable Coefficients, Equations of the second order and solutions CO3: Enumerate and explain the Basic properties of Bessel, Legendre, Hermite and Laguerre functions. CO4: Clearly define the Cauchy Riemann conditions Taylor & Laurent series; Numerical Techniques, Differentiation, integration by trapezoid and Simpson's rule.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-522- Condensed Matter Physics-II" describe general understanding of optical properties and related theories, magnetism, principal of magnetic resonance, superconductivity and disordered materials and related problems. CO1: Develop an understanding of magnetism in materials, Pauli paramagnetism, Weiss theory, Heisenberg Hamiltonian, and Bloch T3/2 law. CO2: Enumerate and explain Polarization mechanisms, Clausius-Mosotti relation; sources of polarizability, frequency dependence of polarizability. CO3: Explain and understand Experimental Survey, thermodynamics of superconducting transitions, BCS theory of superconductivity, High Tc superconductors CO4: Explain and understand the basic concepts of defects and dislocations; noncrystalline solids such as glasses, Quasi-crystals, amorphous semiconductors and ferromagnets.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-523- Quantum Mechanics -II" describe general understanding of Scattering, Dirac relativistic Hamiltonian, Quantization of wave fields, Quantum Field Theory and related problems CO1: Develop an understanding of Scattering cross-section and scattering amplitude, Born approximation, Yukawa potential and square well potential, CO2: Enumerate and explain Schrodinger equation, Klein- Gordon Equation, Hydrogen-like atom. CO3: Enumerate and explain Dirac relativistic Hamiltonian, elementary idea of hyperfine structure of hydrogen atom and Lamb shift. CO4: Clearly define the Elementary idea of quantization of fields, second quantization, quantum electrodynamics, Feynman diagrams and their applications.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-524-Statistical Mechanics" describe general understanding of Statistical Basis of Thermodynamics, Ensembles and related physical problems. CO1: Develop an understanding of thermodynamic potentials, chemical potential, black body radiation and Plank's distribution law, Gibbs paradox, Liouville's theorem. CO2: Enumerate and explain Maxwell relations, grand-canonical ensembles, a system of quantum harmonic oscillators as canonical ensemble. CO3: Enumerate and explain Bose-Einstein condensation, Pauli paramagnetism etc. CO4: Define the Phase First- and second-order phase transitions, Thermodynamic fluctuations etc
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-525-Electronics-II" describe general understanding of Digital circuits, A/D Converters, Digital logic families, Microprocessor, Semiconductor Memories. CO1: Explain the Boolean algebra, Code convertors. CO2: Describe about the Sequential circuits, A/D Converters. CO3: Able to explain the Digital logic families such as RTL, DTL, ECL, etc. CO4: Explain the concept of Microprocessor & Micro controller.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course **"PHY-526–Physics Laboratory–II"** describe ggeneral understanding of Physics lab experiments and physical problems. CO1: Demonstrate the temperature-dependence of conductivity of a given semiconductor crystal using four probe method. CO2: Determine the band gap of a semiconductor by Four Probe Method. CO3: Demonstrate the temperature dependence of a ceramic capacitor: Verification of Curie-Weiss law for the electrical susceptibility of a ferroelectric material. CO4: Able to determine the Hall voltage, Hall coefficient and the carrier concentration of a given semi-conductor. CO5: Explain the modulation & demodulation of AM and FM wave.
Credits	03 Practical periods of two hour per week over a semester

Course Outcomes	COs of the course **"PHY-527–Computational Physics Laboratory–II"** describe general understanding of MATLAB and its application in mathematical and physical problems. CO1: Develop an understanding of programming in MATLAB for various mathematical physics problems. CO2: Develop an understanding of programming in MATLAB for various quantum physics problems. CO3: Develop an understanding of programming in MATLAB for various nuclear physics problems. CO4: Develop an understanding of programming in MATLAB for various material science problems.
Credits	02Practical periods of two hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-528-Project Seminar" describe students' ability to effectively present, defend, and receive constructive feedback on their project proposals, enhancing their communication and critical thinking skills crucial for successful project implementation. CO1: Craft clear and concise project proposals. CO2: Practice presenting proposals to peers and instructors. CO3: Constructive criticism reception and incorporation will be emphasized. CO4: Refine communication and presentation skills. CO5: Foster critical thinking in defending project ideas. CO6: Better prepared for successful project implementation.
Credits	01Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-591-Synopsis Seminar" describe students' ability to succinctly and persuasively present the key components and objectives of their research synopses, demonstrating their mastery of the research topic, methodology, and significance, while also receiving constructive feedback to refine and strengthen their research proposals. CO1: Present concise research synopses including research-gap. CO2: Demonstrate significance of research topics and methodologies. CO3: Constructive feedback will refine and strengthen proposals. CO4: Refine communication and presentation skills. CO5: Foster critical thinking in defending research ideas. CO6: Better prepared to precede with their research projects.
Credits	01Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-531-Nuclear and Particle Physics" describe general understanding of Nuclear Masses and Nucleon-Nucleon Interaction, Nuclear Structure, Nuclear Models, nuclear reactions, Classification of fundamental forces CO1: Develop an understanding of nuclear masses, nuclear mass formula, stability of nuclei, beta decay and double beta decay, deuteron problem, nuclear potential. CO2: Enumerate and explain Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. CO3: Classification of Elementary particles and their quantum numbers, Gellmann-Nishijima formula. Quark model, Standard Model of Particle Physics. CO4: Clearly define the Standard Model of Particle Physics: SU(3) x SU(2) x U(1) gauge theory
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-532-Atomic and Molecular Physics" describe general understanding of many electron atoms and molecular quantum mechanics, various atomic and molecular spectroscopy, interactions of atoms with radiation CO1: Enumerate and explain Molecular Quantum Mechanics: Electron spin. Hydrogen molecular ion, hydrogen molecule, Relativistic corrections Hyperfine structure and isotope shift, width of spectrum lines, LS and JJ couplings. CO2: Develop an understanding Zeeman, Pashchen-Bach-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. CO3: Develop an understanding offine and hyperfine structure of atoms, electronic, vibrational and rotational spectra for diatomic molecules, role of symmetry, selection rules, term schemes, and applications to electronic and vibrational problems. CO4: Explain and understand the basic concepts of atoms in an electromagnetic field, induced absorption and emission, spontaneous emission and line-width, Einstein A and B coefficients, density matrix formalism, two-level atoms in a radiation field, Lasers.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-533-Materials Science" describe general understanding of various type of materials, structural properties of materials, materials preparation and characterization techniques and related topics. CO1: Develop an understanding of material noncrystalline and semi crystalline states, crystal systems, indices of lattice directions and planes, symmetry classes and point groups, space groups, phase transition in materials etc. CO2: Enumerate and explain Classification of Materials: Alloys and composites and optoelectronic materials, Polymer, Liquid crystals and quasi crystals, Ceramics. CO3: Develop an understanding of preparation of materials by different techniques (e.g. zone refining, epitaxial growth. Melt-spinning and quenching methods, Materials Preparation Techniques. CO4: Develop an understanding of various Materials Characterization Techniques (e.g. X-ray Diffraction (XRD), XPS, STM, AFM, TEM, SEM, IR, Ultraviolet (UV) and visible spectroscopy)
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-534-Classical Electrodynamics" describe general understanding of Electrostatics, Magnetostatics, Boundary value problems, Electromagnetic Waves and related problems CO1: Develop an understanding of Laplace and Poisson's equations, Electrostatic potential, vector potential CO2: Define Maxwell's equations in vacuum, Coulomb and Lorenz gauges. CO3: Enumerate and explain Dirichlet and Neumann Boundary conditions, Boundary value problems, Magnetostatic boundary value problems. CO4: Define the wave equation, plane waves in free space and isotropic dielectrics, Lienard-Wiechert potentials.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-535-Field Visit and Exploratory Physics" include that students will be proficient in applying theoretical physics concepts to diverse real-world scenarios, fostering interdisciplinary understanding, analytical skills, effective communication, and critical thinking abilities. CO1: Explore traditional/conventional technologies for new innovative ideas. CO2: Understand the working and future possibilities of solar photovoltaic technologies and solar thermal technologies. CO3: Understand about the discoveries led by Noble Prize winners in Physics. CO4: Able to make models related to Physics and collect Physics related news in newspapers or Internet. CO5: Explore Physics job opportunities through printed and electronic media. CO6: Understand about the patents granted in the field of Physics and associated applied sciences. CO7: Able to solve the various questions asked in CSIR-NET/GATE/SET Examinations.
Credits	02 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-536-Physics Laboratory - III" describe general understanding Physics lab experiment and related problems. CO1: Able to determine temperature-dependence of conductivity of a given semiconductor crystal using four probe method. CO2: Calculate the band gap of a semiconductor by Four Probe Method. CO3: Able to verify Curie-Weiss law for the electrical susceptibility of a ferroelectric material. CO4: Determine the Hall voltage, Hall coefficient and the carrier concentration of a given semi-conductor. CO5: Determine the dielectric constant of a liquid by dipole meter. CO6: Understand the modulation & demodulation of AM wave. CO7: Understand the modulation& demodulation of FM wave.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "RM-599- Research Methodology" describe general understanding of some basic concepts of research and its methodologies. CO1: Develop an understanding of need, importance and impact of research, types of research, research process. CO2: Learn about synopsis writing, Selecting research problem; formulation of research projects; survey of literature. CO3: Develop an understanding of formulation and types of hypothesis; collection, maintenance, storage and analysis of data. CO4: Understand compilation and presentation of results, writing of manuscripts; research reports and thesis. CO5: Know about various funding agencies provides financial support for research and writing research proposal for external funding. CO6: Develop an understanding of computer and informatics including word processing, excel, power point presentation etc. CO7: Explain and understand principal and working procedure of various lab instruments.
Credits	03Theory periods and 01 Tutorial of one hour per week over a semester

Course Outcomes	COs of the course "PHY-600- Thesis" describe that student will able to produce an original and rigorous scholarly work demonstrating commend on research methodologies, critical analysis, and synthesis of findings in their chosen field of study. CO1: Conduct in-depth research on a specific topic, applying advanced analytical and critical thinking skills. CO2: Develop ability to formulate clear research questions and hypotheses, guiding their investigation. CO3: Contribute new insights or perspectives to their field of study. CO4: Develop proficiency in writing and communication of research findings. CO5: Develop readiness for independent research and investigation.
Credits	20 periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-541-Science of Renewable Energy Sources" describe general understanding of energy sources, solar energy, hydrogen energy, wind energy, wave energy and oceanic thermal energy conversion and related topics. CO1: Explain and enumerate production alternatives and reserves of energy sources in the world and in India. CO2: Understand the need of renewable energy sources, energy security and energy conservation. CO3: Able to describe energy and its environmental impacts and distributed generation. CO4: Develop an understanding of solar thermal and solar photovoltaic technologies and their applications. CO5: Explain and understand the hydrogen production techniques, importance of hydrogen energy as per environmental concern, storage techniques and safty issues. CO6: Gain an understanding of wind energy, wave energy and OTEC and their implementation criteria.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-542-Optoelectronics" describe general understanding of Injection luminescence, the basic principles of laser actions, optical detectors, junction detectors and related problems. CO1: Develop an understanding of recombination processes, the spectrum of recombination radiations, direct and indirect band gap semiconductors, internal and external quantum efficiency. CO2: Enumerate and explain spontaneous and stimulated emission and absorption, the condition & theory for the laser action, condition for gain, semiconductor Injection Laser. CO3: Explain and understand optical detection, quantum efficiency, responsivity, photoconductive detectors, CO4: Explain characteristics of particular photoconductive materials, solar cell, holography, LCD, optical fibers, free space optics and applications CO4: Develop an understanding of detectors performance parameters, materials and design for p-i-n photodiodes. Avalanche photodiodes detectors (APD), Avalanche photodiodes design, phototransistors.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-543-Particle Accelerator Physics" describe general understanding of charged particle dynamics, radiofrequency accelerators, electrostatic and heavy ion accelerators, synchrotron radiation sources, radioactive ion beams and related problems. CO1: Develop an understanding of Particle motion in electric and magnetic fields, Beam transport system etc. CO2: Enumerate and Radiofrequency Accelerators. CO3: Explain and understand on-Electrostatic and Heavy Ion Accelerators: Van de Graaff voltage generator, Cockcroft Walton voltage generator. CO4: Develop an understanding of time series, lyapunov exponents. Invariant measure, kolmogorov -Sinai entropy. Fractal dimension, Statistical mechanics and thermodynamic formalism. CO5: Explain and understand Synchrotron Radiation Sources: Electromagnetic radiation from relativistic electron beams, Electron synchrotron, dipole magnet.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-544-Nano Physics" describe general understanding regarding types of Nanomaterials and their Properties. CO1: Develop an understanding of nanomaterials and their properties: clusters, metal nanocluster, magic number, theoretical modelling of nanoparticles etc.. CO2: Enumerate and explain Types of Magnetic Materials, Effect of Bulk nanostructuring of Magnetic properties etc. CO3: Explain and understand quantum wells, wires, and dots, Preparation of quantum nanostructures. CO4: Develop an understanding the synthesis of Nanomaterials (Bottom up Approach): Synthesis of Nanomaterials (Top down Approach): Ball milling, and Some special Nanomaterials.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-545-Advanced Computational Physics" describe general understanding of various advances developed in Computational Physics. CO1: Develop an understanding of concepts of deterministic and stochastic simulation methods, limitations of simulational physics. CO2: Enumerate and explain Monte Carlo Method, Random walk on one, two and three dimensional lattices, self-avoiding walk, micro-canonical ensemble, canonical ensemble, classical ideal gas, ising model, grand canonical ensemble. CO3: Explain and understand Molecular Dynamics. CO4: Develop an understanding of symbolic computing systems. CO5: Explain and understand computing hardware basics: memory and CPU, components.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-546-Nuclear Technology" describe general understanding of interaction of radiation with matter :Detectors and Instrumentation :Industrial and Analytical Applications :Nuclear Energy Power from Fission: CO1: Develop an understanding of interaction of radiation with matter. CO2: Enumerate and explain Detectors and Instrumentation. CO3: Explain and understand Industrial and Analytical Applications. CO4: Develop an understanding of Nuclear Energy Power from Fission.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-547-Medical Physics" describe general understanding of the observational basis of e interaction of radiation with matter, Biological Effects of radiation, Nuclear Medicine. CO1: Develop an understanding of Introduction, Heavy charged particle interactions, electron interactions. Gamma rays interactions: - photoelectric effect. CO2: Enumerate and explain Initial interactions, Dose, dose rate and dose distribution, Damage to critical tissue, Human exposure to radiation and Risk assessment. CO3: Explain and understand the Positron Emission Tomography (PET), Magnetic resonance Imaging (MRI), Radiation Therapy. Mossbauer Spectroscopy. CO4: Develop an understanding of Nuclear Energy Power from Fission.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-548-Fibre optics and Non-linear Optics" describe general understanding of Optical fibre and its properties, Fiber fabrication and cable design, optics of anisotropic media, Electro-optic and acousto-otpic effects and modulation of light beams, and Non-linear optics/processes. CO1: Develop an understanding of Optical fibre and its properties. CO2: Enumerate and explain Fiber fabrication and cable design. CO3: Explain and understand optics of anisotropic media. CO4: Develop an understanding of Electro-optic and acousto-otpic effects and modulation of light beams, and Non-linear optics/processes. CO5: Explain and understand Non-linear optics/processes.
Credits	03 Theory periods of one hour per week over a semester

M.Sc. (Physics) Program

Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-549-Astrophysics" describe basic concepts of celestial sphere, interstellar medium and molecular clouds, stellar evolution and nucleo-synthesis, cosmology and related topics. CO1: Develop an understanding of right ascension, ecliptic, basic stellar properties; luminosity, estimation of distance using parallax method and cepheid variables, origin of emission and absorption spectra, Doppler effect and its applications etc. CO2: Explain the structure of our galaxy, globular clusters, velocity distribution of stars, fine structure of carbon, origin of spiral arms and its basic features, Interstellar dust and theory of extinction of stellar light etc. CO3: Explain and understand pre-main sequence collapse, origin of the solar system, Jean's criteria, late stage evolution of stars, red giant phase, white dwarf, supernova, neutron star, black hole, stellar nucleo-synthesis etc. CO4: Develop an understanding of simple extragalactic observations, Olber's paradox, Hubble's constant and its implications, the steady state universe, Evolution of the Big Bang, time evolution of the future universe etc.
Credits	03 Theory periods of one hour per week over a semester

Course Outcomes	COs of the course "PHY-550-Project" describe general understanding practical exposure to the students about ongoing research in basic and applied areas of Physics and different research techniques and methods. It will impart skills on planning, performing, analyzing and, data interpretation of experiments. Students will also acquire proficiency in reading research articles, preparing PowerPoint presentations and giving oral presentations. CO1: Design and execute a comprehensive project plan, demonstrating effective project management skills and adherence to timelines. CO2: Apply theoretical knowledge to solve practical problems, fostering critical thinking and problem-solving abilities. CO3: Communicate project findings and outcomes clearly and persuasively through written reports and oral presentations. CO4: Cultivate collaboration and teamwork skills as students engage in group work, fostering a supportive and inclusive learning environment.
Credits	03 Practical periods of two hour per week over a semester

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Program Outcomes, Program Specific Outcomes, Course Outcome

Course Outcomes	COs of the course "PHY-551- Special Seminar" demonstrate advanced understanding and critical analysis of specialized topics within the field, enhancing their ability to engage in scholarly discourse and research. CO1: Analyze and evaluate advanced topics within the field, fostering deeper understanding and intellectual engagement. CO2: Demonstrate effective communication skills in clear complex concepts to peers and instructors. CO3: Broaden scholarly viewpoint and encourage interdisciplinary connections. CO4: Cultivate independent research skills, explore specialized topics and develop insights through guided study.
Credits	01Theory periods of one hour per week over a semester