Shivaji University, Kolhapur

Name of Department: Physics

Name of Programme: M.Sc. Physics

Vision

To Develop the Department as a Centre for Advanced Studies in Material Science and Technology.

To integrate Physics and Engineering Courses

Mission

To Start the Courses in the Emerging Areas (as per UGC guidelines) Like Nanotechnology, Computational Physics so as to develop it as Advanced Centre of Material Science and Engineering.

Program Outcomes (PO)

PO1 To create, apply, and disseminate knowledge of physics in theoretical and experimental domains under different specializations.

PO2 To develop the ability to identify, formulate, analyze and solve problems in in theoretical and experimental domains of physics at both curricular and research level through critical thinking.

PO3 To enable students to apply ICT based skills and making them scientific software literate to use in academics.

PO4 To encourage research culture, provide research ambience and develop related technical proficiency.

PO5 To develop attitude to pursue further research and finding placement avenues through it.

PO6 To inculcate academic and social ethical values among the students

Program Specific Outcomes (PSO)

PSO1

Student are able to apply the knowledge of core concepts of physics in semester exams, in the NET, SET and GATE, national level exams as well as in the research level projects work which is suitable to communicate/present further in workshops and conferences

PSO2

Through assignments, NET-SET coaching workshops and research based project work in both theoretical and experimental domains, students are able to revel analytical skills and critical thinking

PSO3

In day today access to study material, through presentations, students are capable enough to make use of PowerPoint presentations, Moodle (LMS), Web-based academic links and can also get hands on experience of using proprietary software like Matlab, Mathematica under experiential learning.

PSO4

Through the research cultural of the department and skills acquired therein, students are capable of sustaining subsequent academic progression inside the country and overseas as well

PSO5

Regular practice of Self-declaration of the authenticity, uniqueness of project work, plagiarism check, and

departmental scrutiny etc. inculcates the ethics in the research publication.		
Course Outcomes		
Part-I Semester-I		
Course code 59746	Course title Quantum Mechanics-I	1. Students are able to understand fundamental concept and formalism of quantum mechanics. 2. Students are able to understand and solve the problems related to one-dimensional problems and Schrödinger equation for NET-SET exam. 3. Students are able to understand and able to calculate Eigenvalues and Eigenstates of angular momentum. 4. Students are able to analyses Ket and Bra spaces and inner products.
Course code 59747	Course title Condensed Matter Physics	1. Students are able to understand electron and neutron diffraction methods. 2. Students are able to understand types of crystal defects. 3. Students are able to understand theory of diamagnetism. 4. Students are able to understand fundamental dielectric and magnetic properties of the material.
Course code 59748	Course title Classical Mechanics	1. Students are able to understand electron and neutron diffraction methods. 2. Students are able to understand and solve the problems related to Kepler's laws. 3. Students are able to understand fundamental special relativity in classical mechanics. 4. Students are able to understand variation principle and Hamiltonian formulation.
Course code 59749	Course title Mathematical Methods of Physics	1. Students are able to understand and calculate matrix Algebra and Eigenvalue problems. 2. Students are able to understand complex variables like complex numbers, complex algebra etc. 3. Students are able to understand calculus of Residues-Residues Theorem. 4. Students are able to apply Fourier series analysis to solve numerical.
Part-I Semester-II		
Course code 59750	Course title Lab 1	1. Students are able to understand and calculate crystal structure and F.C.C. & B.C.C. 2. Students are able to understand concept of interference from Fabry-Parrot etalon experiment. 3. Students are able to understand Hall Effect and solve problems related to it. 4. Students are able to understand and design experimental setup of heat capacity of material.
Course code	Course title	1. Students are able to understand and design circuits of

59751	Lab II	astable and monostable multivibrators. 2. Students are able to understand concept of thermal and electrical conductivity of copper due to seminar. 3. Students are able to understand fundamental of Mathematica and are able to solve various problem using it. 4. Students are able to understand basics phenomenon of amplifier.
Course code 71428	Course title Methods of Mathematical Physics	1. Students are able to understand the basics of vector spaces and are able to solve special type of matrices that are relevant in physics. 2. Students are able to understand the different ways of solving first and second order differential equations. 3. Students are able to understand and solve the problems based on special functions like Hermite, Bessel, Laguerre and Legendre functions. 4. Students are able to understand fundamentals and applications of Fourier series, Fourier and Laplace transforms, their inverse transforms etc. 5. Students are able to apply statistical numerical methods for performing statistical analysis.
Course code 71429	Course title Classical Mechanics	1. Students are able to understand and solve central force problems and understands the conservation of energy, linear momentum and angular Momentum in system 2. Students are able to understand how to impose constraints on a system in order to simplify the methods used in solving physics problems. 3. Students are able to understand the concept of Poisson brackets and canonical transformations and are able to solve problems on Poisson brackets and canonical transformations. 4. Students are able to understand the concept of special theory of relativity.
Course code 71430	Course title Quantum Mechanics-I	1. Students are able to understand different types of operators used in quantum mechanics and are able to use them to solve different problems. 2. Students are able to understand and solve problems related to different types of potential like, Square-well, Bloch wave, Kroning-Penney square periodic potential. 3. Students are able to understand and solve hydrogen atom problem 4. Students are able to understand the angular momentum operators & their Eigen values 5. Students are able to understand time independent perturbations theory.
Course code	Course title	1. Students are able to understand different crystal

71431	Condense Matter Physics	structures, interaction with X-ray and also understands various properties about crystals 2. Students are able to understand different types of crystal defects. 3. Students are able to understand different properties of semiconducting and superconducting properties 4. Students are able to understand theoretical background of dielectric and magnetic properties of material
Course code 71433	Course title Lab -1	1. Students are able to understand and calculate crystal structure of materials 2. Students are able to understand theory behind B-H curve and apply for different materials. 3. Students are able to understand and able to calculate heat capacity of material. 4. Students are able to understand concept of interference from fabry-parrot etalon experiment 5. Students are able to understand Hall effect and solve problems related to it. 6. Students are able to analyses critically statistical data using software.software.
Course code 71434	Course title Lab - II	1. Students are able to understand and design circuits of astable and monostable multivibrators 2. Students are able to understand and calculate thermal and electrical conductivity of copper. 3. Students are able to understand basics of amplifier and design the circuit. 4. Students are able to understand fundamental of mathematica and are able to solve various problems using it. 5. Students are able to understand and identify the different modes lattice dynamics
Course code 74934	Course title Methods of Mathematical Physics	1. Students are able to understand the basics of vector spaces and are able to solve special type of matrices that are relevant in physics. 2. Students are able to understand the different ways of solving first and second order differential equations. 3. Students are able to understand and solve the problems based on special functions like Hermite, Bessel, Laguerre and Legendre functions. 4. Students are able to understand fundamentals and applications of Fourier series, Fourier and Laplace transforms, their inverse transforms etc. 5. Students are able to apply statistical numerical methods for performing statistical analysis.

Course code 74935	Course title Classical Mechanics	1. Students are able to understand and solve central force problems and understands the conservation of energy, linear momentum and angular Momentum in system 1. Students are able to understand how to impose constraints on a system in order to simplify the methods used in solving physics problems. 2. Students are able to understand the concept of Poisson brackets and canonical transformations and are able to solve problems on Poisson brackets and canonical transformations. 3. Students are able to understand the concept of special theory of relativity.
Course code 74936	Course title Quantum Mechanics-I	1. Students are able to understand different types of operators used in quantum mechanics and are able to use them to solve different problems. 2. Students are able to understand and solve problems related to different types of potential like, Square-well, Bloch wave, Kroning-Penney square periodic potential. 3. Students are able to understand and solve hydrogen atom problem 4. Students are able to understand the angular momentum operators & their Eigen values 5. Students are able to understand time independent perturbations theory.
Course code 74937	Course title Condense Matter Physics	1. Students are able to understand different crystal structures, interaction with X-ray and also understands various properties about crystals 2. Students are able to understand different types of crystal defects. 3. Students are able to understand different properties of semiconducting and superconducting properties 4. Students are able to understand theoretical background of dielectric and magnetic properties of material
Course code CP-V (61301)	Course title Quantum Mechanics-II	1. Students are able to understand and calculate Time-dependent potentials and are also able to understand time-dependent potentials 2. Students are able to understand scattering theory. 3. Students are able to understand Spin Angular Momentum and theory of wave function. 4. Students are able to understand and think the concept of radiation and selection rule
Course code CP-VI (61302)	Course title Statistical Mechanics	1. Students are able to understand and think critically Basic concepts, Statistical Equilibrium and thermodynamic Laws and Functions 2. Students are able to understand and solve numerical Statistical Ensembles Theory.

		3. Students are able to understand and apply Quantum distribution functions. 4. Students are able to understand Phase Transitions and Critical Phenomenon. 5. Students are able to understand Entropy and specific heat of a perfect gas, Entropy and probability distribution.
Course code CP-VII (61303)	Course title Electrodynamics	1. Students are able to understand and solve E.M. wave equations in waveguide of the arbitrary cross section: TE and TM modes. 2. Students are able to understand and analyze Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. 3. Students are able to understand the applications to linear and circular motions: cyclotron and synchrotron radiations. 4. Students are able to understand the Cerenkov radiation and Bremsstrahlung. 5. Students are able to understand the Structure of Space time, Relativistic Mechanics. 6. Students are able to understand and solve numerical on Relativistic Energy and Momentum, Relativistic Kinematics, Relativistic Dynamics, Relativistic Electrodynamics, Magnetism as a Relativistic Phenomenon.
Course code CP-VIII (61304)	Course title Atomic and Molecular Physics	1. Students are able to understand and distinguish Atom Model for Two Valence Electrons i. e. l-s coupling, j-j coupling and the Pauli exclusion principle. 2. Students are able to understand and differentiate various Zeeman Effect, Paschen-Back Effect and Stark basic effect 3. Students are able to understand basic phenomenon of microwave spectroscopy and Classification of molecules. 4. Students are able to understand fundamental the simple harmonic oscillator, the anharmonic oscillator instrumentation and chemical analysis by infra-red spectroscopy.
Course code 61305	Course title Practical Course-III	1. Students are able to understand deep knowledge of fourier analysis, passive filters and solar cell. 2. Students are able to understand thermal diffusivity of brass, mutual inductance of coil and series and parallel resonant circuits. 3.Students are able to understand numerical solutions of and plotting of simple functions using python. 4. Students are able to understand fundamental and programming of mathematica includes 2D and 3D plots. 5. Students are able to understand crystal structure. 6. Students are able to understand plank's constant.

Course code 61306	Course title Practical Course-IV	1. Students are able to understand deep knowledge of fourier analysis, passive filters and solar cell. 2. Students are able to understand thermal diffusivity of brass, mutual inductance of coil and series and parallel resonant circuits. 3. Students are able to understand numerical solutions of and plotting of simple functions using python. 4. Students are able to understand fundamental and programming of mathematica includes 2D and 3D plots. 5. Students are able to write seminar reports. 6. Students are able to submit certified seminar reports.
Course code 72950	Course title Quantum Mechanics-II	1. Students are able to understand and apply variational principle, Hellmann-Feynman theorem, WKB method. 2. Students are able to understand fundamentals of time-Dependent perturbation theory. 3. Students are able to understand scattering theory and able to compute scattering cross- section, scattering amplitude, scattering length. 4. Students are able to understand Pauli principle and spin functions for two electrons and also able to calculate spin functions, energy of identical particles.
Course code 72951	Course title Statistical Mechanics	1. Students are able to understand postulate of equilibrium statistical mechanics and able to calculate thermodynamic functions such as entropy, free energy, internal energy, enthalpy. 2. Students are able to understand and differentiate between micro canonical ensemble, canonical ensemble and grand canonical ensemble. 3. Students are able to understand and apply Maxwell Boltzmann, Bose -Einstein and Fermi Dirac distributions in Quantum Statistics. 4. Students are able to understand fundamental of first order and second phase transition and Weiss Molecular theory of paramagnetism.
Course code 72952	Course title Electrodynamics	1. Students are able to understand Maxwell's Equations and E.M. wave equations in waveguide of the arbitrary cross section. 2. Students are able to calculate TE and TM modes of waveguide. 3. Students are able to understand and apply scalar and vector potentials, retarded potentials, Lienard–Wiechert potentials. 4. Students are able to understand radiation from accelerated charges and different radiation reaction. 5. Students are able to understand the different aspects of

		the special theory of relativity in electrodynamics.
Course code 72953	Course title Atomic & Molecular Physics	1. Students are able to understand and apply ll-coupling, ss-coupling, LS coupling in atomic spectra and able to calculate and their selection rules. 2. Students are able to understand Zeeman effect and Paschen-Back of two electrons, Stark effect of hydrogen and Compton effect. 3. Students are able to understand techniques and instrumentation of infra-red spectroscopy. 4. Students are able to understand and apply Frank-Condon principle, Born-Oppenheimer approximation.
Course code 72954	Course title Practical Course-III	1. Students are able to understand deep knowledge of fourier analysis, passive filters and solar cell. 2. Students are able to understand thermal diffusivity of brass, mutual inductance of coil and series and parallel resonant circuits. 3. Students are able to understand numerical solutions of and plotting of simple functions using python. 4. Students are able to understand fundamental and programming of mathematica includes 2D and 3D plots. 5. Students are able to understand crystal structure. 6. Students are able to understand plank's constant.
Course code 72961	Course title Practical Course-IV	1. Students are able to understand deep knowledge of fourier analysis, passive filters and solar cell. 2. Students are able to understand thermal diffusivity of brass, mutual inductance of coil and series and parallel resonant circuits. 3. Students are able to understand numerical solutions of and plotting of simple functions using python. 4. Students are able to understand fundamental and programming of mathematica includes 2D and 3D plots. 5. Students are able to write seminar reports. 6. Students are able to submit certified seminar reports.
Course code 79543	Course title Quantum Mechanics-II	1. Students are able to understand and apply variational principle, Hellmann-Feynman theorem, WKB method. 2. Students are able to understand fundamentals of time-Dependent perturbation theory. 3. Students are able to understand scattering theory and able to compute scattering cross- section, scattering amplitude, scattering length. 4. Students are able to understand Pauli principle and spin functions 5. for two electrons and also able to calculate spin functions, energy of identical particles

Course code 79544	Course title Statistical Mechanics	1. Students are able to understand postulate of equilibrium statistical mechanics and able to calculate thermodynamic functions such as entropy, free energy, internal energy, enthalpy. 2. Students are able to understand and differentiate between micro canonical ensemble, canonical ensemble and grand canonical ensemble. 3. Students are able to understand and apply Maxwell Boltzmann, Bose -Einstein and Fermi Dirac distributions in Quantum Statistics. 4. Students are able to understand fundamental of first order and second phase transition and Weiss Molecular theory of paramagnetism.
Course code 79545	Course title Electrodynamics	1. Students are able to understand Maxwell's Equations and E.M. wave equations in waveguide of the arbitrary cross section. 2. Students are able to calculate TE and TM modes of waveguide. 3. Students are able to understand and apply scalar and vector potentials, retarded potentials, Lienard–Wiechert potentials. 4. Students are able to understand radiation from accelerated charges and different radiation reaction. 5. Students are able to understand the different aspects of the special theory of relativity in electrodynamics.
Course code 79546	Course title Atomic & Molecular Physics	1. Students are able to understand and apply ll-coupling, ss-coupling, LS coupling in atomic spectra and able to calculate and their selection rules. 2. Students are able to understand Zeeman effect and Paschen-Back of two electrons, Stark effect of hydrogen and Compton effect. 3. Students are able to understand techniques and instrumentation of infra-red spectroscopy. 4. Students are able to understand and apply Frank-Condon principle, Born-Oppenheimer approximation.
Course code 79543	Course title Quantum Mechanics-II	1. Students are able to understand and apply variational principle, Hellmann-Feynman theorem, WKB method. 2. Students are able to understand fundamentals of time-Dependent perturbation theory. 3. Students are able to understand scattering theory and able to compute scattering cross- section, scattering amplitude, scattering length. 4. Students are able to understand Pauli principle and spin functions for two electrons and also able to calculate spin functions, energy of identical particles.
Course code	Course title	1. Students are able to understand postulate of equilibrium

79544	Statistical Mechanics	statistical mechanics and able to calculate thermodynamic functions such as entropy, free energy, internal energy, enthalpy. 2. Students are able to understand and differentiate between micro canonical ensemble, canonical ensemble and grand canonical ensemble. 3. Students are able to understand and apply Maxwell Boltzmann, Bose -Einstein and Fermi Dirac distributions in Quantum Statistics. 4. Students are able to understand fundamental of first order and second phase transition and Weiss Molecular theory of paramagnetism.
Course code 79545	Course title Electrodynamics	1.Students are able to understand Maxwell's Equations and E.M. wave equations in waveguide of the arbitrary cross section. 2.Students are able to calculate TE and TM modes of waveguide. 3.Students are able to understand and apply scalar and vector potentials, retarded potentials, Lienard–Wiechert potentials. 4.Students are able to understand radiation from accelerated charges and different radiation reaction. 5.Students are able to understand the different aspects of the special theory of relativity in electrodynamics.
Course code 79546	Course title Atomic & Molecular Physics	1.Students are able to understand and apply ll-coupling, ss-coupling, LS coupling in atomic spectra and able to calculate and their selection rules. 2.Students are able to understand Zeeman effect and Paschen-Back of two electrons, Stark effect of hydrogen and Compton effect. 3.Students are able to understand techniques and instrumentation of infra-red spectroscopy. 4.Students are able to understand and apply Frank-Condon principle, Born-Oppenheimer approximation.
Course code 79547	Course title PHYSICS LAB - I	1. Students are able to understand and calculate Stefan's constant. 2. Students are able to understand and apply Mathematica functions for various numerical problem. 3. Students are able to understand and analyse Crystal structure. 4. Students are able to connect circuits.
Course code 79548	Course title PHYSICS LAB - II	1. Students are able to understand and calculate Stefan's constant. 2. Students are able to understand and write Mathematica functions for various numerical problem. 3. Students are able to understand and draw Crystal structure. 4. Students are able to draw circuits diagram.

Part II Sem III		
Course code 64101	Course title Nuclear and Particle Physics	1. Students are able to understand the nuclear forces and their potentials to apply for experiments 2. Students are able to analyze the single particle nuclear shell model and related phenomena 3. Students are able to understand and apply selection rule of elementary particles and fission, fusion reactions 4. Students are able to understand and apply the Gellmann Nishijima formula to solve numerical problems
Course code 64106	Course title Laser Physics	1. Students are able to understand the properties of Laser and pumping processes helpful to apply it during experiments. 2. Students are able to understand optical resonators using combination of plane and spherical mirrors 3. Students are able to understand the Laser behavior required for different applications 4. Students are able to perform the experiments based on Laser properties.
Course code 64107	Course title Windows to the Universe, Solar System, Planetary Atmospheres	1. Students are able to understand the concepts related to various types of astronomy along with various instruments to apply it for practical purposes. 2. Students are able to think about the Antenna, and their related radio telescopes with correlation receiver concept 3. Students are able to study the solar, planetary system along with their orbital and physical properties 4. Students are able to understand the phenomena of interplanetary , interstellar scintillation resonance in plasma and measurements
Course code 64108	Course title Thin Solid Films: Deposition and properties	1. Students are able to acquired knowledge about different physical methods for thin film deposition to improve an experimental skills. 2. Students are able to take up one of the methods (relatively simple and economical) for material synthesis during research. 3. Students are able to get more insight about mechanism of nature, structure, and growth of the crystallographic films. 4.Students are capable of correlating electric, magnetic and optical properties of the thin film with crystalline structure.
Course code 64109	Course title Relativistic quantum mechanics	1. Students are able to understand and calculate problems related to Lorentz Transformation and Concept of Four Vectors 2. Students are able to understand and apply various aspects of Angular Momentum and Relativistic Quantum Numbers 3. Students are able to understand and able to show numerical ability related to Klein-Gordon Equation, Relativistic wave functions, Probabilities and Currents, The fine structure constants, Two component KG equation, Free KG particles-antiparticles, Klein paradox, Spinless Electron atom

		4. Students are able to understand the formal developments of Origin of Dirac equation, Dirac matrices, Lorentz invariance of the Dirac equation, Nonrelativistic 5.Limit of Dirac equation, Probabilities and currents, Forces and fields, Gauge invariance and Dirac equation 6. Students are able to understand and apply Wave functions, Densities, currents, Free particle solutions, Free particle spin, A generalized spin operators, Negative energy states, Antiparticles, Non-Relativistic Spin Projection Operators, Relativistic Energy and spin projection operators, Charge conjugation, Time reversal, Parity, CPT, Angular momentum , non-relativistic limits 7. Students are able to analyses critically Second quantization, field operators, Second quantization.
Course code 64112	Course title Modern optics II (Nonlinear optics and fiber optics)	1 Students are able to understand Maxwell's equations in nonlinear medium, nonlinear polarization and susceptibility and able to solve numerical problems related to it. 2 Students are able to understand nonlinear phenomena and apply them as spectroscopic tools 3 Students are able to understand ray theory and apply them to optical fiber communication 4 Students are able to understand electromagnetic theory of waveguides, telecommunications and Sensor systems and apply different applications.
Course code 64113	Course title Space science II (astrophysics of sun)	1.Students are able to understand History of stars and stellar energy 2. Students are able to understand solar system and their components. 3. Students are able to understand solar system and their components. 4. Students are able to understand various observatory systems
Course code 64115	Course title Theoretical physics II (Quantum field theory I)	1.Students are able to understand Klein Gordon and Dirac Fields. 2 Students are able to understand Interacting Fields and Feynman Diagrams 3 Students are able to understand Elementary Processes of QED. 4 Students are able to understand Ward Takahashi identity
Course code 64123	Course title Lab-I Solid state physics	1 Students are able to understand all the thin film deposition techniques. 2 Students are able to understand different synthesis techniques the thin film. 3 Students are able to study the physical properties of thin film

		by XRD, FTIR and analyses them. 4 Students are able to study the structural properties of thin film by SEM, FESEM and analyses them
Course code 64124	Course title Lab-I Modern Optics	1.Students are able to understand theory behind and apply them to experiments based on it . 2.Students are able to understand theory of optical absorption and apply it to study optical properties of the materials. 3. Students are able to calibrate optical instrument such as the spectrograph, Constant Deviation spectrograph etc. 4. Students are able to record the holograms and their use in different applications
Part-I Semester-III		
Course code 64125	Course title Lab-I- Space science (2014-15)	1. Students are able to understand Proton precession magnetometer 2. Students are able to understand Mesospheric Temperature Measurement from night airglow study. 3. Students are able to understand Variable Attenuator 4. Students are able to understand Beam width of parabolic dish antenna 5. Students are able to understand X-band characteristics of patch antenna.
Course code 64126	Course title Lab-I- Theoretical physics (2014-15)	1. Students are able to understand Mathematica. 2. Students are able to understand Symbolic Manipulations 3. Students are able to understand and apply mathematica functions. 4. Students are able to analyses mathematica plot
Course code 64129	Course title Project work I:- Solid state physics	1. Students are able to understand the all deposition techniques. 2. Students are able to synthesis thin film material. 3. Students are able to characterise thin film material for supercapacitor applications. 4. Students are able to do analysis the FTIR plot.
Course code 64130	Course title Project work I:- Modern optics	1. Students are able to understand the all optical phenomenon. 2. Students are able to synthesis nanoparticles material. 3. Students are able to characterise nanoparticles for holography applications. 4. Students are able to use laser techniques.
Part-I Semester-III		
Course code 64131	Course title Project work I:- Space science	1. Students are able to know about radar system. 2. Students are able to understand IRNSS. 3. Students are able understand the constellations. 4. Students are able to understand structure of ionosphere & magnetoshpere.

Course code 64132	Course title Project work I:- Theoretical physics	1. Students are able to understand different classified instabilities 2. Students are able to understand fundamental of NLS, concept of soliton. 3. Students are able to analyses critically Introductory Nonlinear Theory of plasma. 4. Students are able to understand and applyfluid theory under the action of magnetic fields and different waves in plasma.
Course code 67023	Course title SSP- II (Semiconductor Physics)	1. Student will be able to create, apply, and disseminate the basic properties of semiconductors materials and Physics behind them through solving problems. 2. Student will be able to create the ability to identify, formulate, analyze and solve problems in semiconductors physics. 3. Student will be able to create the quantitative and qualitative understanding of semiconductors. 4. Student will be able to apply quantitative and qualitative studies for designing the electronic devices under various fields
Part-II Semester-III		
Course code 68286	Course title Thin Film Deposition Technology	1. Students are able to understand the various physical deposition technique for thin film preparation 2. Students are able to understand the different chemical methods mechanism and preparation of thin film 3. Students are able to get more insight about mechanism of nature, structure, and growth of the crystallographic films. 4. Students are capable of correlating electric, magnetic and optical properties of the thin film with crystalline structure.
Course code 74658	Course title Space Physics-I (Stellar Evolution: Birth, Evolution and Death of the Stars)	1. Students are able to understand the Formation of the Stars 2. Students are able to understand the Stellar Evolution 3. Students are able to get more insight about Death of the Stars 4. Students are capable of correlating Neutron Stars and Black Holes
Course code 74659	Course title SSP- I (Thin Solid Films: Deposition and properties)	1. Students are able to understand the various physical deposition technique for thin film preparation 2. Students are able to understand the different chemical methods mechanism and preparation of compound thin

		film 3. Students are able to get more insight about mechanism of nature, structure, and growth of the crystallographic films. 4. Students are capable of correlating electric, magnetic and optical properties of the thin film with crystalline structure
Course code 74660	Course title Fundamentals of Plasma Physics	1. Students are able to understand Introduction, Uniform E and B Fields, Non-uniform B Field, Non-uniform E Field 2. Students are able to understand Introduction, Relation of Plasma Physics to Ordinary Electromagnetics, The Fluid Equation of Motion, Fluid Drifts Perpendicular to B 3. Students are able to get more insight about The Meaning of f(v), Equations of Kinetic Theory, Derivation of the Fluid Equations, Plasma Oscillations and Landau Damping, The Meaning of Landau Damping 4. Students are capable of correlating Introduction, Sheaths, Ion Acoustic Shock Waves, The Ponderomotive Force, Parametric Instabilities, Plasma Echoes
Part-II semester-III		
Course code 74663	Course title Space Science - II (Astrophysics of the Sun)	1. Students are able to understand the basic structure of sun and get briefly accounted with Helioseismology. 2. Students are able to understand the various data analysis techniques to drag the information. 3. Students are able understand real environment of the sun with various field at its surface. 4. Students are able to understand the surface structure of sun and various models regarding its theories.
Course code 74664	Course title SSP- II (Semiconductor Physics)	1. Student will be able to create, apply, and disseminate the basic properties of semiconductors materials and Physics behind them through solving problems. 2. Student will be able to create the ability to identify, formulate, analyze and solve problems in semiconductors physics. 3. Student will be able to create the quantitative and qualitative understanding of semiconductors. 4. Student will be able to apply quantitative and qualitative studies for designing the electronic devices under various fields

Course code 74665	Course title Theoretical Physics - II (Introduction to General Relativity)	1. Students get acquainted with the geometric approach to special relativity. 2. Students learned vectors and tensors and its importance in general relativity 3. Students learned elements of fluid dynamics 4. Students learned the concept of non-Euclidean geomentry 5. Students learned to construct field equations for a given matter distribution. 6. Students learned to solve Einstein's field equations for spherical mass distribution
Course code 74668	Course title Space Science Project Work - I	1. Students are able to understand space is the diverse field of application. 2. Students are able to understand the various kind of data collection methods. 3. Students are able understand how to use trending data interpretation software's like MATLAB, Python etc. 4. Students are able to understand how to write a research article and scientific research.
Course Code 74669	Course title Solid State Physics Project Work- I	1. Students are able to understand how to review literature to decide a research problem 2. Students are able understand synthesis methods and characterization techniques. 3. Students are able to understand and get familiar with operation of various instrument. 4. Students are able to understand how to write a research article and scientific research.
Course Code 74670	Course title Theoretical Physics Project Work- I	1. Students are able understand how to solve a theoretical problem by using Mathematica, 2. Students are able to understand and compute numerical solution to the theoretical problem with help of Python. 3. Students are able to understand need of literature review to decide the research problem. 4. Students are able to understand how to write a research article and scientific research.
Course Code: 74673	Course title Space Science lab-I	1. Students are able to understand and apply programming language such as Python and MatLab 2. Students are able to understand and apply Proton precession magnetometer. 3. Students are able to understand and apply Amplitude Modulation. 4. Students are able to understand and able to compute NavIC-IRNSS: Data Mining and analysis using MatLab. 5. Students are able to understand and apply Total

		electron content by NavIC-IRNSS. 6. Students are able to analyses critically Solar Data Analysis-I and II for Electromagnetic and Energetic particle respectively.
Course Code:74674	Course title Solid State Physics Project Work- I	1. Students are able to understand how to review literature to decide a research problem 2. Students are able understand synthesis methods and characterization techniques. 3. Students are able to understand and get familiar with operation of various instrument. 4. Students are able to understand how to write a research article and scientific research.
Course Code:74675	Course title Theoretical Physics Project Work- I	1. Students are able understand how to solve a theoretical problem by using Mathematica, 2. Students are able to understand and compute numerical solution to the theoretical problem with help of Python. 3. Students are able to understand need of literature review to decide the research problem. 4. Students are able to understand how to write a research article and scientific research.
Course Code: 74677	Course title Nuclear and Particle Physics	1. Students are able to understand the nuclear forces and their potentials to apply for experiments 2. Students are able to analyze the single particle nuclear shell model and related phenomena 3. Students are able to understand and apply selection rule of elementary particles and fission, fusion reactions 4. Students are able to understand and apply the Gellmann Nishijima formula to solve numerical problems.
Course Code: 75053	Course title Thin Film Deposition Technology	1. Students are able to understand the various physical deposition technique for thin film preparation 2. Students are able to understand the different chemical methods mechanism and preparation of thin film 3. Students are able to get more insight about mechanism of nature, structure, and growth of the crystallographic films. 4. Students are capable of correlating electric, magnetic and optical properties of the thin film with crystalline structure.
Course Code: 75072	Course title MO-1. Laser Physics	1. To create, apply, and disseminate theoretical knowledge of laser systems 2. To develop the critical thinking ability to identify and analyze laser behavior

		3. To encourage research in field of lasers 4. To develop related skill through practicals based on laser applications
Course Code: 75073	Course title MO-2. Nonlinear Optics and Fiber Optics	1. To create, apply, and disseminate theoretical knowledge of Nonlinear Effects 2. To develop the critical thinking ability to identify and analyse nonlinear phenomena 3. To encourage research in field of Non-linear optics 4. To develop related skill through practicals based on nonlinear phenomena
Course Code: 75074	Course title Modern optics project work I	1. Students are able to design the research project. 2. Students are able to synthesis the different materials. 3. Students are able to characterize the materials for different applications. 4. Students are able to make conclusions based on results of characterizations.
Course Code: 75075	Course title Modern optics lab I	1. Students are able to understand Michelson Interferometer experiment and apply theory behind it. 2. Students are able to understand optical absorption, theory behind it and application about it. 3. Students are able to calibrate optical instrument such as the spectrograph, Constant Deviation spectrograph etc. 4. Students are able to understand basics of different spectra and hologram as well as recording the same.
Course Code: 65031	Course title EXPERIMENTAL TECHNIQUES	1. Students are able to understand working, measurement of various types of the pumps and simple methods related to detectors. 2. Students are able to understand low temperature and microscopy. 3. Students are able to understand Fundamentals of atomic absorption spectroscopy. 4. Students are able to understand principle of X-Ray Fluorescence spectrometry and Mossbauer spectrometry. 5. Students are able to working on Spectroscopy.
Course Code: 65034	Course title Physical Properties of Solids	1. Students are able to understand electrical conductivity of metals 2. Students are able to understand transport properties of metals 3. Students are able to understand concepts of Phonons, Plasmons, Polaritons, and Polarons 4.Students are able to understand concepts of Point defects and Luminescence
Course Code: 65035	Course title Laser and its	1. Students are able to understand Crystalline solid state Lasers.

	application	2. Students are able to understand the construction and working of Gas Lasers. 3. Students are able to understand the Applicability of Lasers. 4. Students are able to understand the Advances in Laser physics.
Course Code: 65036	Course title Solar Wind and its Interaction with Planets and Satellites	1. Students are able to understand Study of Solar Wind and Interaction with Magnetized Planets 2. : Students are able to understand S. W. Interaction with Earth's Magnetosphere 3. Students are able to understand Magnetosphere in the solar system and Effects of Solar activities on Technological Earth Systems 4. : Students are able to understand Physics of space plasma and interaction with unmagnetized celestial bodies
Course Code: 65037	Course title Interaction of Electromagnetic Waves with Electron Beams and Plasmas	1. Students are able to understand and apply fundamental Maxwell`s equations in context of dispersions phenomenon 2. Students are able to understand coupled mode equations and the phenomenon of mode conversion very critically. 3. Students are able to understand basic phenomenon of self-focusing of laser beams in plasmas and successfully completed project work on it. 4. Students are able to understand fundamental of NLS, concept of soliton. 5. Students are able to understand phenomenon of Raman and Brillouin side scattering critically 6. Students are able to understand and apply WKB solution 7. Students are able to analyses critically Introductory Nonlinear Theory of plasma
Course Code: 65038	Course title Quantum Field Theory 2	1. Students are able to understand Renormalization and symmetries in QED. 2. Students are able to understand non-abelian gauge invariance and theories. 3. Students are able to understand scattering, annihilation and collision of the Quarks. 4. Students are able to understand the key points in QFT.
Course Code: 65042	Course title Modern Optics IV (Holography)	1. Students are able to understand basic concepts of optical holography and properties of it. 2. Students are able to distinguish types of holographic images and their formations. 3. Students are able to understand formation of Hologram and its Optical components.

		4. Students are able to apply concepts of Holography and do project based on these concepts
Course Code: 65043	Course title Space Science-IV (Solar Wind and its Interaction with Planets and Satellites)	1. Students are able to understand and study of solar wind properties and interaction with magnetized planets. 2. Students are able to understand S. W. Interaction with Earth's magnetosphere. 3. Students are able to understand nature of magnetosphere in the solar system and study effects of solar activities on technological earth systems. 4. Students are able to imagine physics behind of space plasma and interaction with un-magnetized celestial bodies.
Course Code: 65052	Course title LAB II- Solid State Physics	1. Students are able to perform experiments using Mathematica 5.1 as tool. 2. Students are able to perform Chemical bath deposition and SILAR methods for thin film deposition and project work on it. 3. Students are able to perform Work function experiment. 4. Students are able to calculate I –V characteristics of photovoltaic cell.
Course Code: 65053	Course title Lab II-Modern Optics	1. Students are able to calculate vibrational parameters of CN, AlO, C_2 2. Students are able to understand the theory and apply it to analyze mixtures. 3. Students are able to measure Brewster angle and apply it to measure optical behavior of materials like glass. 4. Students are able to demonstrate optical phenomenon to determine the wavelength of light by grating.
Course Code: 65054	Course title Lab II-Space Science	1. Students are able to calculate analyze brightness of sky using photometer. 2. Students are able to study of atmospheric disturbance using He-Ne laser. 3. Students are able to perform experiment and calculate moisture content in soil by resistivity meter. 4. Students are able to study of ionosphere using GPS like software.
Course Code: 65055	Course title Lab-II- Theoretical physics (2014-15)	1. Students are able to understand Mathematica. 2. Students are able to understand Symbolic Manipulations 3. Students are able to understand and apply Mathematica functions. 4. Students are able to analyses Mathematica plot.

Course code 65057	Course title Project wok – II Solid State Physics	1. Students are able to understand the all deposition techniques. 2. Students are able to synthesis thin film material. 3. Students are able to characterise thin film material for supercapacitor applications. 4. Students are able to do analysis the FTIR plot.
Course code 65059	Course title Project wok – II Modern optics	1. Students are able to understand the all optical phenomenon. 2. Students are able to synthesis nanoparticles material. 3. Students are able to characterise nanoparticles for holography applications. 4. Students are able to use laser techniques
Course code 65060	Course title Project wok – II Space Science	1. Students are able to know about radar system. 2. Students are able to understand and to handle IRNSS. 3. Students are able understand the constellations. 4. Students are able to understand structure of ionosphere & magnetoshpere.
Course code 65061	Course title Project wok – II Theoretical Physics	1. Students are able to understand different classified instabilities 2. Students are able to understand fundamentalof NLS, concept of soliton. 3. Students are able to analyses critically Introductory Nonlinear Theory of plasma. 4. Students are able to understand and applyfluid theory under the action of magnetic fields and different waves in plasma.

Part-II semester-IV (2014-2015)		
Course code 65062	Course title COMPUTATIONAL METHODS AND PROGRAMMING	1. Students are able to understand and calculate ordinary differential equation. 2. Students are able to understand and apply partial differential equations. 3. Students are able to understand and able to compute matrix problems. 4. Students are able to understand Monte Carlo methods and Ising model. 5. Students are able to solve ordinary differential equations numerically.
Part-II semester-IV (2015-2016)		

Course code 66765	Course title Energy conversion and storage device	1. Students are able to understand working of semiconductor junction. 2. Students are able to understand fabrication of solar cells. 3. Students are able to understand working of photochemical convertors. 4. Students are able to understand fundamentals of thermoelectric convertors. 5. Students are able to perform experiments based on solar cells
Part-II semester-IV (2016-2017)		
Course code 68287	Course title Modern analytical techniques	1. Students are able to understand working of XRD and XPS 2. Students are able to understand working of FT-RAMAN 3. Students are able to understand working of IR spectroscopy 4. Students are able to understand working of SEM
Course code 79340	Course Title EXPERIMENTAL TECHNIQUES	1. Students are able to understand working, measurement of various types of the pumps and simple methods related to detectors. 2. Students are able to understand low temperature and microscopy. 3. Students are able to understand Fundamentals of atomic absorption spectroscopy. 4. Students are able to understand principle of X-Ray Fluorescence spectrometry and Mossbauer spectrometry. 5. Students are able to working on Spectroscopy.

Part-II semester-III		
Course code 79341	Course title Numerical Methods and Programming	1. Students are able to understand Numerical Methods. 2. Students are able to understand Numerical approximation methods 3. Students are able to understand Numerical differentiation and integration 4. Students are able to understand Fortran
Part-II semester-IV		

Course code 79348	Course title Molecular Spectroscopy	1. To create, apply, and disseminate theoretical knowledge of spectroscopic techniques 2. To develop the critical thinking ability to identify and analyse properties of Material 3. To encourage research in field of Spectroscopy 4. To develop related skill through practicals based on spectroscopy
Course code 79349	Course title Holography and Its applications	1. To create, apply, and disseminate theoretical knowledge of Holography 2. To develop the critical thinking ability to apply holographic techniques in various fields 3. To encourage research in field of Holography 4. To develop related skill through practicals based on holography
Part-II semester-IV		
Course code 79350	Course title Magnetospheric Plasma Dynamics	1. To understand the earth's magnetic field and magnetosphere 2. To understand reconnection at magnetopause 3. To understand magnetospheric configuration 4. To understand geomagnetic storms

Part-II semester-IV		
Course code 79351	Course title Ionosphere, Space Weather & GNSS	1. To understand the Physical and Chemical process in Atmosphere 2. To understand Ionosphere 3. To understand Implications of Space weather effects 4. To understand Global Navigation Satellite System (GNSS)
Part-II semester-IV		

Course code 79352	Course title Physical Properties of Solids	1. Students acquainted knowledge to apply classical kinetic theories of electron gas by Drude model to physical properties. 2. Thermal, electrical, dielectric properties of metals can be correlated to the structure of metals. 3. Students understood the fact that materials device response to the various quasiparticles viz, photon, phonon, plasmon, polaron, polariton etc. interaction. 4. Discussed the lattice distortion or defects in crystal as well as luminescence mechanism based on light, electron and heat. 5. Studied various key factors to improve charge carriers life time.
Course code 79353	Course title Energy conversion and storage device	1. Students are able to understand working of semiconductor junction. 2. Students are able to understand fabrication of solar cells. 3. Students are able to understand working of photochemical convertors. 4. Students are able to understand fundamentals of thermoelectric convertors. 5 . Students are able to perform experiments based on solar cells.
Course code 79354	Course title Interaction of electromagnetic waves with electron beams and plasmas	1. Students are able to understand and apply fundamental Maxwell`s equations in context of dispersions phenomenon 2. Students are able to understand coupled mode equations and the phenomenon of mode conversion very critically. 3. Students are able to understand basic phenomenon of self-focusing of laser beams in plasmas and successfully completed project work on it. 4. Students are able to understand fundamental of NLS, concept of soliton.

Part-II semester-IV (2019-20)		
Course code 79355	Course title Introduction to Quantum Field Theory	1. Students learned the classical field theory 2. Students leaned the canonical quantization of classical fields for spin-0, spin-1 and spin-½ particles 3. Students leaned to use Feynman diagram tool to solve scattering problems in particle physics 4. Students learned to quantize the electromagnetic field with path integral approach 5. Students learned to do the tree-level computation of cross-sections and decay processes 6. Students learned radiative corrections in QFT, namely vacuum polarization, vert ex correction and self-energy.

Course code 79510	Course title Modern optics project work II	1. Students are able to design the research project. 2. Students are able to synthesis the different materials. 3. Students are able to characterize the materials for different applications. 4. Students are able to make conclusions based on results of characterizations.
Course code 79311	Course title Project work II:- Theoretical physics	1. Students are able to persue further represented in the subject related to project work. 2. Students are able to submit satisfactory prototype and thesis / Dissertation. 3. Students are able think critically to analyse the given problem for getting its solution.
Part-II semester-IV		
Course code 79512	Course title solid state physics project work 2	1. Students are able to do literature survey based on thrust area . 2. Students are able to design research problem and develop hypothesis. 3. Students are able to develop exotic morphologies based on chemical route. 4. Students are able to elaborate their results to the literature.

Part-II semester-IV (2019-20)		
Course code 79513	Course title Project work II:- Space science	1. Students are able to know about radar system. 2. Students are able to understand and to handle IRNSS. 3. Students are able understand the constellations. 4. Students are able to understand structure of ionosphere & magnetoshpere.
Part-II semester-IV (2019-20)		
Course code 79532	Course title Lab II-Modern Optics	1. Students are able to calculate vibrational parameters of CN, AlO, C2 2. Students are able to understand the theory and apply it to analyze mixtures. 3. Students are able to measure Brewster angle and apply it to measure optical behavior of materials like glass. 4. Students are able to demonstrate optical phenomenon to determine the wavelength of light by grating
Part-II semester-IV (2019-20)		

Course code 79533	Lab work II:- Theoretical physics	1. Students are able to set experiential learning of Theoretical aspects. 2. Students are able to modify and design the setup the experiments. 3. Students are able to interpret the experimental findings using existing Theoretical framework.
Part-II semester-IV		
Course code 79534	Course title solid state physics Lab work 2	1. Students are able to do synthesis different metal oxides using different techniques. 2. Students are able to do characterization of thin films. 3. Students are able to analysis results of thin films. 4. Students are expertise in the preparation and characterization of thin film.

Part-II semester-IV		
Course code 79535	Course title Lab work II:- Space science	1. Students are able to know about radar system. 2. Students are able to understand and to handle IRNSS. 3. Students are able understand the constellations. 4. Students are able to understand structure of ionosphere & magnetoshpere.