



**THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS),  
SIVAKASI – 626 123.**

(Affiliated to Madurai Kamaraj University, Re-accredited with A+ Grade by NAAC,  
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

**PG & RESEARCH DEPARTMENT OF PHYSICS  
UG DEGREE PROGRAMME IN PHYSICS**

**PROGRAMME EDUCATIONAL OBJECTIVES**

The Graduates will

PEO1.	pursue higher studies in related fields including teaching and management and take up careers as educationalist, researcher, technical specialist
PEO2.	explore physical systems through theoretical models, experiments and communicate findings of the scientific work with moral responsibility, social concern and eco-consciousness.
PEO3.	become self- employed in technical fields and consultancy services.

**PROGRAMME LEARNING OUTCOMES**

By the Completion B.Sc. Chemistry programme, the learners will be able to

PLO1.	Apply the knowledge of Arts, Science and Humanities to address fundamental and complex questions appropriate to their programmes.
PLO2.	Make use of appropriate knowledge and skills to identify, formulate, analyze and solve problems in order to reach substantiated conclusions.
PLO3.	Critically analyze research processes, products and practices with a view of strategic use of data in their field.
PLO4.	Demonstrate skills in oral and written communication and make use of ICT in various learning ambience.
PLO5.	Interact productively with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.
PLO6.	Defend the society against gender and environmental issues with moral and ethical awareness.
PLO7.	Formulate their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC11</b>	<b>Course Title: PROPERTIES OF MATTER AND SOUND</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the basics of elasticity, bending of beams, viscosity, oscillations, acoustics and ultrasonics.
CLO2 [K3]	apply the equations of simple harmonic motion, velocity of ultrasonic waves, Poisson's ratio and fluid dynamics to solve problems.
CLO3 [K4]	analyse various parameters of simple harmonic motion, production and application of ultrasonic waves, liquid flow, surface tension and modulus of elasticity.
CLO4 [K5]	evaluate the parameters related to elasticity/ultrasonic sound/surface tension/viscosity and acoustics of buildings
CLO5 [K6]	predict the concepts of bending of beams, viscosity, elasticity, oscillations, acoustics and ultrasonics.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC1L</b>	<b>Course Title: PROPERTIES OF MATTER LAB</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the physical concepts underlying the experiments.
CLO2 [K3]	construct the experimental set up and perform the experiment by applying the theories behind it.
CLO3 [K4]	analyze the experimental data mathematically and graphically.
CLO4 [K5]	evaluate the experimental results with laboratory ethics.
CLO5 [K6]	elaborate the hypothesis behind the experiments.

<b>FOUNDATION COURSE</b>	
<b>Course Code: 23GPFC11</b>	<b>Course Title: INTRODUCTORY PHYSICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain vectors, forces, surface tension and viscosity
CLO2 [K3]	apply the concepts of vectors and forces to solve different problems
CLO3 [K4]	differentiate types of vectors, waves, forces, momentum, energy, surface tension and viscosity.
CLO4 [K5]	interpret physical phenomena in real life situations.
CLO5 [K6]	create an innovative idea of various properties of matter.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC21</b>	<b>Course Title: HEAT AND THERMODYNAMICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the specific heat capacity, laws of thermodynamics, types of heat transfer, classical and quantum statistics.
CLO2 [K3]	use the laws of thermodynamics and statistical mechanics to determine specific heat capacity, efficiency of various engine, change in entropy, thermal conductivity and energy distribution function.
CLO3 [K4]	analyze the low temperature physics, laws of thermodynamics, entropy changes, modes of heat transfer and different kinds of statistical systems
CLO4 [K5]	interpret $C_p$ and $C_v$ ; first and second laws of thermodynamics; good conductor and bad conductor; three kinds of statistics.
CLO5 [K6]	combine the laws of thermodynamics and statistical mechanics to correlate entropy and probability of various systems.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC2L</b>	<b>Course Title: HEAT AND OSCILLATIONS LAB</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the physical concepts underlying the experiments.
CLO2 [K3]	construct the experimental set up and perform the experiment by applying the theories behind it.
CLO3 [K4]	analyze the experimental data mathematically and graphically.
CLO4 [K5]	evaluate the experimental results with laboratory ethics.
CLO5 [K6]	elaborate the hypothesis behind the experiments.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC31</b>	<b>Course Title: GENERAL AND CLASSICAL MECHANICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe laws of motion, conservation laws, rigid body dynamics, generalised coordinates and Lagrangian mechanics
CLO2 [K3]	apply various concepts of general mechanics and classical mechanics to solve problems.
CLO3 [K4]	investigate the mechanics of rigid bodies, conservation laws, Lagrangian formulations for different systems.
CLO4 [K5]	interpret the forces and path of moving bodies, laws of motion, gravitation and gyroscopic precision.
CLO5 [K6]	formulate equations for different types of motion.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC3L</b>	<b>Course Title: ELECTRICITY LAB</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the principles of the experiment.
CLO2 [K3]	construct the electrical / magnetic circuits and record data
CLO3 [K4]	analyze the experimental data and draw conclusions mathematically and graphically.
CLO4 [K5]	evaluate the results of the experiments in an ethical manner.
CLO5 [K6]	design new electrical and magnetic circuits.

<b>SKILL ENHANCEMENT COURSE</b>	
<b>Course Code: 23GPDS3L</b>	<b>Course Title: SCIENTIFIC SKILL DEVELOPMENT LAB</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the principles of the experiment
CLO2 [K3]	construct circuits and identify the problem in the circuits
CLO3 [K4]	examine the reasons for the malfunctioning circuits and perform error analysis
CLO4 [K5]	interpret the ways to rectify the problems in the circuits following laboratory ethics
CLO5 [K6]	develop Power Point presentations on science topics / write a review article following research ethics

<b>SKILL ENHANCEMENT COURSE</b>	
<b>Course Code: 23GPES31</b>	<b>Course Title: ELECTRIC GADGETS MAINTENANCE</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the basic electrical terms, safety precautions, parts and working mechanism of home appliances.
CLO2 [K3]	identify the issues in electrical gadgets and troubleshoot them.
CLO3 [K4]	analyze the possible defects in appliances and compare the types of washers.
CLO4 [K5]	interpret the ways to troubleshoot and appraise the type of washers.
CLO5 [K6]	find alternate methods to troubleshoot.

**CORE COURSE**

**Course Code: 23GPC41**

**Course Title: OPTICS AND  
SPECTROSCOPY**

On successful completion of the course, the learners should be able to

CLO1 [K2]	recapitulate various optical theories, optical parameters, optical devices, optical phenomena, aberrations and spectroscopy.
CLO2 [K3]	solve problems in optics and spectroscopy by applying appropriate equations and formulae
CLO3 [K4]	analyze the optical phenomena, image formation, lens aberrations and spectroscopic techniques
CLO4 [K5]	evaluate IR, UV and Raman spectra, the conditions to produce desired images by different optical phenomena and optical devices
CLO5 [K6]	develop optical devices with desired resolution.

**CORE COURSE**

**Course Code: 23GPC4L**

**Course Title: LIGHT LAB**

On successful completion of the course, the learners should be able to

CLO1 [K2]	explain the principles of the experiment.
CLO2 [K3]	apply the theoretical concepts and determine various parameters.
CLO3 [K4]	analyze the recorded data and draw conclusions mathematically and graphically.
CLO4 [K5]	evaluate the results of the experiments in an ethical manner
CLO5 [K6]	formulate different techniques to find physical parameter in light experiments.

**CORE COURSE****Course Code: 23GPC51****Course Title: ELECTRICITY AND  
ELECTROMAGNETISM**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the types of capacitors, various thermo electric materials and their properties, magnetic effects of currents, electromagnetic induction, alternating currents and electromagnetic waves.
CLO2 [K3]	apply Biot and Savart law, Faraday and Lenz laws, Ampere's Circuital law, Maxwell's equations to solve problems.
CLO3 [K4]	analyse the capacitance of various capacitors, thermo electric materials, time variation of current and potential difference in AC circuits, various laws of electromagnetic induction and Maxwell's equation.
CLO4 [K5]	evaluate various parameters related to electricity, magnetism and electromagnetic induction.
CLO5 [K6]	combine the different physical quantities used to explain electric and magnetic properties of materials.

**CORE COURSE****Course Code: 23GPC52****Course Title: RELATIVITY AND QUANTUM  
MECHANICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the postulates of relativity, four vectors, origin of quantum theory, wave function and quantum mechanical tunneling
CLO2 [K3]	apply the concepts of relativity and quantum mechanics to solve simple problems.
CLO3 [K4]	analyze the consequences of Lorentz transformations, principle of equivalence, difference between phase velocity and group velocity and different commutation relations.
CLO4 [K5]	interpret the variation of mass with velocity, transformation of velocity, mass, energy and momentum, consequences of uncertainty principle, Ehrenfest theorem, barrier penetration problem.
CLO5 [K6]	elaborate the hypothesis behind the relativity and quantum theory.

**CORE COURSE****Course Code: 23GPC5L****Course Title: CORE PRACTICAL**

On successful completion of the course, the learners should be able to

CLO1 [K2]	explain the principles of the experiments.
CLO2 [K3]	determine various physical parameters.
CLO3 [K4]	analyze the recorded data of various experiments.
CLO4 [K5]	evaluate the experimental data and draw conclusions manually and graphically.
CLO5 [K6]	design circuits with laboratory ethics.

**CORE COURSE****Course Code: 23GPC5P****Course Title: PROJECT WITH VIVA - VOCE**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the principles behind the physics related problem
CLO2 [K3]	implement the basic principles of physics in exploring new avenues
CLO3 [K4]	analyse the physics problems using qualitative and quantitative reasoning including sophisticated mathematical techniques
CLO4 [K5]	assess the results of the study in written form
CLO5 [K6]	develop methods to conduct scientific studies for specific purposes

**DISCIPLINE SPECIFIC ELECTIVE COURSE****Course Code: 23GPDE51****Course Title: COMMUNICATION PHYSICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the concepts of radio transmission and reception, fibre optics, radar system, satellites and cell.
CLO2 [K3]	identify the applications of various types of communications.
CLO3 [K4]	analyze the types of radio receivers, modes of fibers, multiple access communication and features of fax machine.
CLO4 [K5]	evaluate the parameters related to various communication systems.
CLO5 [K6]	compile the applications of fibre optics, radar, satellite and mobile communications in various fields.



**DISCIPLINE SPECIFIC ELECTIVE COURSE****Course Code: 23GPDE52****Course Title: MATHEMATICAL PHYSICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the basics of vector calculus, matrices, orthogonal curvilinear coordinates, partial differential equations, fourier series and fourier transforms.
CLO2 [K3]	apply mathematical Physics concepts to solve problems.
CLO3 [K4]	Simplify the mathematical expression using vectors, matrices, Fourier series, Fourier transform and examine the solutions of PDE.
CLO4 [K5]	evaluate the various parameters related to mathematical physics.
CLO5 [K6]	construct the characteristics equation of a matrix and Fourier analysis.

**CORE COURSE****Course Code: 23GPIN51****Course Title: INTERNSHIP**

On successful completion of the course, the learners should be able to

CLO1 [K2]	relate the class room theory with work place practice.
CLO2 [K3]	apply the practices / procedures observed in real time working environment
CLO3 [K4]	analyze the workflow and communication flow prevailing in the institution/industry
CLO4 [K5]	assess interests and abilities in their field of study
CLO5 [K6]	propose strategies, policies and guidelines for enhancing efficiency of industrial/institutional operations

<b>CORE COURSE</b>	
<b>Course Code: 23GPC61</b>	<b>Course Title: NUCLEAR AND PARTICLE PHYSICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	discuss various models, reactions and rays.
CLO2 [K3]	solve the problems in nuclear and particle physics.
CLO3 [K4]	classify nuclear properties, elementary particles, particle accelerators, detectors and the effect of cosmic rays.
CLO4 [K5]	criticize various properties and models of the nucleus, detectors, accelerators and cosmic rays.
CLO5 [K6]	compile the properties of particles in the nucleus.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC62</b>	<b>Course Title: SOLID STATE PHYSICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain different types of bonding in solids, crystal structure, X- ray diffraction, elementary lattice dynamics, magnetic properties of solids, dielectric properties of materials, ferroelectric, semiconducting and super conducting materials.
CLO2 [K3]	determine the crystal system, structures, different structures based on packing factor, nature of semiconductors, X- ray diffraction, magnetic properties of solids, dielectric properties of materials, ferroelectric effect and superconductors
CLO3 [K4]	analyze various lattices, structures, X- ray diffraction patterns, electrical parameters of different types of conductors, dielectric materials, electrical and thermal properties of materials, classification of magnetic materials.
CLO4 [K5]	evaluate the different parameters of solids, crystals, crystal structure by X-ray diffraction, dielectric behavior of materials, different parameters of magnetic materials, ferroelectric materials, semiconductors and super conductors.
CLO5 [K6]	formulate methodologies to enhance, the conductivity of conductors, semiconductors, super conductors and the usage of ferromagnetic and dielectric materials.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC63</b>	<b>Course Title: ATOMIC PHYSICS AND LASERS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the properties of electrons and positive rays, the photoelectric effect, atomic structure, spectral lines, and the general properties of lasers.
CLO2 [K3]	solve the problems in atomic physics and lasers.
CLO3 [K4]	differentiate between excitation and ionization potentials; analyze the Paschen-Back effect; compare the Zeeman effect, the photoelectric effect, and the Stark effect, the coupling concept and types of lasers.
CLO4 [K5]	criticize various nuclear models, electric effects, and lasers.
CLO5 [K6]	predict the theory behind lasers, atomic structure, electrons, and the photoelectric effect.

<b>CORE COURSE</b>	
<b>Course Code: 23GPC6L</b>	<b>Course Title: ELECTRONICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the principles of the experiment.
CLO2 [K3]	construct the electronics circuits and solve problems using microprocessor.
CLO3 [K4]	analyze the recorded data and draw conclusions mathematically and graphically.
CLO4 [K5]	evaluate the results of the experiments in an ethical manner
CLO5 [K6]	design circuits to obtain desired results and write coding to solve different problems using microprocessor

<b>DISCIPLINE SPECIFIC ELECTIVE COURSE</b>	
<b>Course Code: 23GPDE61</b>	<b>Course Title: DIGITAL ELECTRONICS AND MP 8085</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the basics of number systems, codes, digital systems and microprocessor.
CLO2 [K3]	apply digital principles to solve problems.
CLO3 [K4]	analyze various types of gates, flip flops, registers, counters and multiplexers.
CLO4 [K5]	appraise the features of digital systems, 8085 $\mu$ p architecture & programming and I/O devices.
CLO5 [K6]	design the logic devices and interfaces of 8085 microprocessor.

**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**Course Code: 23GPDE62**

**Course Title: NUMERICAL METHODS AND C PROGRAMMING**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the basic concept involved in numerical methods and in C-programming.
CLO2 [K3]	apply the knowledge gained in computational and numerical methods to solve problems in physics.
CLO3 [K4]	analyse computationally the given problems in physics by various numerical methods.
CLO4 [K5]	evaluate the complex problems in physics based on specific numerical methods and C tools.
CLO5 [K6]	design flowchart, algorithm and program for problems based on Numerical Methods.

**SKILL ENHANCEMENT COURSE**

**Course Code: 23GPNE11**

**Course Title: BASICS OF SOLAR ENERGY**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe solar radiation, solar based devices and systems.
CLO2 [K3]	apply the principles of solar energy to solve problems.
CLO3 [K4]	compare solar water heater, solar cooker, solar air heater, solar stills and solar cells.
CLO4 [K5]	Appraise the types of solar energy and solar energy devices
CLO5 [K6]	Develop any solar device.

**SKILL ENHANCEMENT COURSE****Course Code: 23GPNE21****Course Title: PHYSICS FOR THE NEW  
WORLD**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the applications of lasers, ultrasonics, satellites and global positioning system
CLO2 [K3]	classify the ordinary light and laser beam, single phase supply and three phase supply, ultrasonic scanning methods and different types of satellites
CLO3 [K4]	analyze the characteristics of laser, effects of lightning and electric shock, working of global positioning system
CLO4 [K5]	interpret the functions of ultrasonic flaw detector, sonograms, earthing, satellites and global positioning system
CLO5 [K6]	compile the applications of lasers, ultrasonics, lightning for arrestors and global positioning system

**ELECTIVE GENERIC COURSE****Course Code: 23GPEG11****Course Title: FUNDAMENTAL PHYSICS – I**

On successful completion of the course, the learners should be able to

CLO1 [K2]	outline the basics of waves and oscillations, matter, heat and thermodynamics, electricity and magnetism and electronics.
CLO2 [K3]	apply the Physics concepts in green chemistry, covid, smart appliances and in digital India.
CLO3 [K4]	analyse the nature of physics with practical applications
CLO4 [K5]	evaluate the concepts of waves and oscillations, matter, heat and thermodynamics, electricity, magnetism and electronics.
CLO5 [K6]	compile the Physics facts in different fields

<b>ELECTIVE GENERIC COURSE</b>	
<b>Course Code: 23GPEG21</b>	<b>Course Title: FUNDAMENTAL PHYSICS – II</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	outline the foundation of optics, atomic and nuclear physics, relativity, gravitation and semiconductor physics.
CLO2 [K3]	solve problems on optics, decay rate, half-life and mean-life, relativity and on gravitational field.
CLO3 [K4]	analyse the importance of semiconductors, atomic and nuclear energy, gravitation, optics and semiconductor physics in various fields.
CLO4 [K5]	evaluate the concepts of optics, atomic and nuclear energies, semiconductors, relativity and gravitation.
CLO5 [K6]	compile the Physics facts to different fields.

<b>ELECTIVE GENERIC COURSE</b>	
<b>Course Code: 23GPEG2L</b>	<b>Course Title: FUNDAMENTAL PHYSICS LAB</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the principle of the experiment
CLO2 [K3]	determine the physical parameters by performing the experiments
CLO3 [K4]	analyze the physical parameters both manually and graphically
CLO4 [K5]	evaluate the obtained results following the laboratory ethics
CLO5 [K6]	design circuits using diodes and transistors.

<b>SKILL ENHANCEMENT COURSE</b>	
<b>Course Code: 23GSE43</b>	<b>Course Title: ELECTRICAL APPLIANCES SERVICING</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the basic electrical parameters, household wiring, types of earthing, electrical devices and appliances
CLO2 [K3]	determine various electrical parameters and identify the value of resistors
CLO3 [K4]	analyze the colour coding of resistors and working of domestic electrical appliances
CLO4 [K5]	interpret the possible defects in household appliances and assess the best way of wiring and earthing
CLO5 [K6]	formulate new ways to service the appliances

<b>SKILL ENHANCEMENT COURSE</b>	
<b>Course Code: 23GSE43L</b>	<b>Course Title: ELECTRICAL APPLIANCES SERVICING LAB</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the working principles of various appliances
CLO2 [K3]	construct circuits and determine the electrical parameters
CLO3 [K4]	examine the basic wiring and troubleshoot the household appliances
CLO4 [K5]	deduct the defects in the electrical appliances
CLO5 [K6]	develop different methods for household wiring



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(Affiliated to Madurai Kamaraj University, Re-accredited with A+ Grade by NAAC,  
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

**PG & RESEARCH DEPARTMENT OF PHYSICS  
PG DEGREE PROGRAMME IN PHYSICS**

**PROGRAMME EDUCATIONAL OBJECTIVES**

The Graduates will

PEO1.	become competent professional in industry, consultancy, education, research and public administration.
PEO2.	excel as Junior Research Fellow, research associates, analyse complex problems and experimental data in physics imbued by ethical, moral and social values leading to highly cultured and civilized physicist.
PEO3.	become tutors, tech or digital entrepreneur and undertake projects.

**PROGRAMME LEARNING OUTCOMES**

By the Completion B.Sc. Chemistry programme, the learners will be able to

PLO1.	Apply the knowledge of Arts, Science and Humanities to address fundamental and complex questions appropriate to their programmes.
PLO2.	Make use of appropriate knowledge and skills to identify, formulate, analyze and solve problems in order to reach substantiated conclusions.
PLO3.	Critically analyze research processes, products and practices with a view of strategic use of data in their field.
PLO4.	Demonstrate skills in oral and written communication and make use of ICT in various learning ambience.
PLO5.	Interact productively with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.
PLO6.	Defend the society against gender and environmental issues with moral and ethical awareness.
PLO7.	Formulate their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.



## COURSE LEARNING OUTCOME

CORE COURSE	
<b>Course Code: 23PPC11</b>	<b>Course Title: MATHEMATICAL PHYSICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain matrices, vectors, complex variables, Fourier transform and Laplace transforms and differential equations
CLO2 [K3]	solve problems in matrices, vectors, complex variables, Fourier transform and Laplace transforms and differential equations
CLO3 [K4]	compare types of matrices / vectors /complex variables/ Fourier transform and Laplace transforms
CLO4 [K5]	evaluate vectors /matrices / Fourier and Laplace transforms.
CLO5 [K6]	predict special functions using differential equations

CORE COURSE	
<b>Course Code: 23PPC12</b>	<b>Course Title: CLASSICAL MECHANICS AND RELATIVITY</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the fundamentals of classical mechanics and relativity
CLO2 [K3]	apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems
CLO3 [K4]	analyze the transformation equations, Hamilton's canonical equations of motion, frequencies of normal modes, Lorentz transformation equations.
CLO4 [K5]	evaluate the types of constraints, Lagrangian equations of motion for conservative, cyclic coordinates, linear triatomic molecule and four vectors
CLO5 [K6]	elaborate the hypothesis behind the classical and relativistic theory

<b>CORE COURSE</b>	
<b>Course Code: 23PPC13</b>	<b>Course Title: LINEAR AND DIGITAL ICs</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the working of an op-amp, filters and combinational logical circuit with necessary diagrams.
CLO2 [K3]	make use of an op-amp /ICs for different applications.
CLO3 [K4]	analyze the parameters of voltage regulators, filters, waveform generators and logical circuits.
CLO4 [K5]	appraise the integrated circuits and digital ICs.
CLO5 [K6]	design combinational and sequential circuits using gates and an op-amp.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC1L</b>	<b>Course Title: PRACTICAL - I</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the principles, working mechanism and applications of the electronics and non-electronics experiments.
CLO2 [K3]	construct electronics / non-electronic set-ups and determine the physical parameters by following the laboratory ethics
CLO3 [K4]	analyze the experimental data both manually and graphically.
CLO4 [K5]	interpret the obtained results
CLO5 [K6]	design circuits to attain a desired output

**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**Course Code: 23PPDE11**

**Course Title: NANO SCIENCE AND TECHNOLOGY**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the basics of nanoscience, types of nanomaterials, mechanism of synthesis and fabrication, characterization and applications of nanomaterials.
CLO2 [K3]	apply the concepts of nanoscience and technology in various fields.
CLO3 [K4]	analyze the properties of Nanomaterials through characterization techniques.
CLO4 [K5]	appraise the properties, fabrication, characterization and applications of nanomaterials
CLO5 [K6]	synthesize and characterize nanomaterials for next generation applications.

**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**Course Code: 23PPDE12**

**Course Title: CRYSTAL GROWTH AND THIN FILMS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the basic concepts of crystal growth and Thin films.
CLO2 [K3]	apply the essential processing for different crystal growth and thin film deposition techniques.
CLO3 [K4]	analyze the different growth techniques and choose an appropriate technique to grow crystals and thin films.
CLO4 [K5]	evaluate the different techniques of crystal growth and thin film.
CLO5 [K6]	prepare new crystals and thin films employing different methods.

**CORE COURSE****Course Code: 23PPC21****Course Title: STATISTICAL MECHANICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	explain the phase equilibrium, phase space, Liouville's theorem, Statistics of ensembles and Ising model
CLO2 [K3]	apply Landau's theory of phase transition, Gibb's Paradox, Partition function, Bose-Einstein condensation and Brownian motion to solve problems.
CLO3 [K4]	categorize the types of statistics based on applications
CLO4 [K5]	evaluate the critical indices, energy and density fluctuations, Plank radiation formula, exact solutions in one dimension.
CLO5 [K6]	predict the proper statistics to explain various phenomena in thermodynamics.

**CORE COURSE****Course Code: 23PPC22****Course Title: QUANTUM MECHANICS – I**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the basic formalism of quantum mechanics, operators, various representations, space time symmetries and formulations of time evolution.
CLO2 [K3]	apply the Schrodinger equation to solve one dimensional and three dimensionaleigen value problems.
CLO3 [K4]	analyze spectral line splitting based on angular and spin angular momentum.
CLO4 [K5]	evaluate eigen value spectrum of angular momentum and equations of motion for different representations.
CLO5 [K6]	construct angular momentum matrices and formulate the suitable approximation methods for various quantum mechanical problems.

**CORE COURSE****Course Code: 23PPC2L****Course Title: PRACTICAL - II**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the principles, working mechanism and applications of the electronics and non-electronics experiments.
CLO2 [K3]	construct electronics / non-electronic set-ups and determine the physical parameters by following the laboratory ethics.
CLO3 [K4]	analyze the experimental data both manually and graphically.
CLO4 [K5]	interpret the obtained results.
CLO5 [K6]	design circuits to attain a desired output.

**DISCIPLINE SPECIFIC ELECTIVE COURSE****Course Code: 23PPDE21****Course Title: ADVANCED  
MATHEMATICAL PHYSICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	explain discrete/ continuous / special unitary groups, tensors and tensor calculus.
CLO2 [K3]	solve problems in tensors / discrete / continuous and special unitary groups
CLO3 [K4]	compare different types of groups / tensors
CLO4 [K5]	interpret discrete, continuous and special unitary groups / tensors
CLO5 [K6]	create an innovative idea to solve problems in tensors and group theory.

**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**Course Code: 23PPDE22**

**Course Title: BIOPHYSICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the structural organization, macromolecular structure, biological membranes, protein structure, radiations and spectroscopy
CLO2 [K3]	apply the general mechanisms of bio physics to solve the problems.
CLO3 [K4]	analyze various categories of bio physics and the characterization techniques.
CLO4 [K5]	assess the various biological structures and its physical methods
CLO5 [K6]	compile the applications of bio physics in real life.

**SKILL ENHANCEMENT COURSE**

**Course Code: 23PPSE21**

**Course Title: ENERGY STORAGE DEVICES**

On successful completion of the course, the learners should be able to

CLO1 [K2]	summarize the fundamentals of energy storage devices like batteries, supercapacitors and fuel cells.
CLO2 [K3]	identify the different energy storage devices based on applications.
CLO3 [K4]	analyze the performance of batteries, supercapacitors and fuel cells.
CLO4 [K5]	interpret the Ragone plot, electrochemical impedance spectra and V-I characteristics of fuel cell.
CLO5 [K6]	create an innovative idea for the upgradation of energy storage devices.

CORE COURSE	
<b>Course Code: 23PPC31</b>	<b>Course Title: QUANTUM MECHANICS – II</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the concept of scattering theory, perturbation theory, relativistic quantum mechanical equations, Dirac equation, Fock states and quantisation of scalar fields.
CLO2 [K3]	apply various approximation methods to find solutions of perturbation problems/scattering problems/ relativistic theories, scattering matrix and to use Feynman graphs for depicting different interactions.
CLO3 [K4]	analyse the concepts of Dirac equation, Creation, Annihilation, Number operators and field quantization.
CLO4 [K5]	evaluate the properties and phenomenon of scattering matrices, Dirac Matrices, gamma matrices and Klein-Gordon equations.
CLO5 [K6]	predict remarkable feature of relativistic theory, all possible bilinear covariant, Feynman diagram, Lagrangian-Hamiltonian canonical formulation, classical fields and second quantization.

CORE COURSE	
<b>Course Code: 23PPC32</b>	<b>Course Title: CONDENSED MATTER PHYSICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the crystal systems/ symmetries/ diffraction techniques/ lattices/ thermal / magnetic properties.
CLO2 [K3]	apply the idea of reciprocal spaces, Brillouin Zone to band theory of solids, thermal/ magnetic/ superconductivity of solids.
CLO3 [K4]	analyse the properties of solids
CLO4 [K5]	Interpret the various types of lattices/ magnetism/ superconductivity/thermal properties of solids.
CLO5 [K6]	generalize the condensed matter Physics to current areas of research.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC33</b>	<b>Course Title: ELECTROMAGNETIC THEORY</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe static electric and magnetic fields, propagation of EM waves in different media, associated laws, boundary conditions, Maxwell equations and elementary plasma.
CLO2 [K3]	apply different techniques of vector calculus to solve problems related to EMfield.
CLO3 [K4]	analyze static electric and magnetic fields, boundary conditions, propagationof EM waves and plasma waves.
CLO4 [K5]	evaluate electric and magnetic parameters, electromagnetic wave propagation and plasma confinement.
CLO5 [K6]	frame solutions for different boundary conditions.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC3L</b>	<b>Course Title: PRACTICAL-III</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the numerical problems in programming languages.
CLO2 [K3]	implement the numerical methods and construct the program.
CLO3 [K4]	compare the results both theoretically and analytically.
CLO4 [K5]	interpret the results following laboratory ethics.
CLO5 [K6]	develop C/FORTRAN programs to solve numerical problems.



<b>DISCIPLINE SPECIFIC ELECTIVE COURSE</b>	
<b>Course Code: 22PPDE31</b>	<b>Course Title: MICROPROCESSOR AND MICROCONTROLLER</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the architecture and instruction set, programming, interfaces of microprocessor 8085 and microcontroller 8051.
CLO2 [K3]	implement the features of microprocessor 8085 and microcontroller 8051 to the interfacing applications
CLO3 [K4]	analyse the interfacing parameters, physical and electrical quantities of microprocessor 8085 and microcontroller 8051.
CLO4 [K5]	criticize different programmable devices and methods to interface.
CLO5 [K6]	design simple programs using microprocessor 8085 and microcontroller 8051.

<b>DISCIPLINE SPECIFIC ELECTIVE COURSE</b>	
<b>Course Code: 23PPDE32</b>	<b>Course Title: MATERIALS SCIENCE</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the basics of inter-band and intra-band transitions, powder processing, milling, sintering, polymerization techniques, composite materials and shape memory alloys.
CLO2 [K3]	identify the different materials and their applications.
CLO3 [K4]	analyze the different modulation, ceramic/ polymer /composite materials and Nano crystalline materials processing/ properties/ applications.
CLO4 [K5]	interpret light propagation in materials, glass transition temperature and its parameters.
CLO5 [K6]	create novel materials with innovative ideas.

**PROFESSIONAL COMMUNICATION SKILL ENHANCEMENT COURSE**

**Course Code: 23PPSE31**

**Course Title: RESEARCH METHODOLOGY**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the research methods, research design, data preparation and thesis writing.
CLO2 [K3]	apply the types of research, research design, sampling and data collection procedures to solve the scientific problems.
CLO3 [K4]	analyze the research problems/ data using questionnaires, correlation and regression.
CLO4 [K5]	interpret the research design/ data collection and analysis/ report writing.
CLO5 [K6]	propose the solution for the research problem in written format.

**ADDITIONAL SKILL SUPPORTIVE COURSE**

**Course Code: 23PPSS31**

**Course Title INSTRUMENTATION  
TECHNIQUES**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the principle and working of X-ray diffractometer, scanning electron microscopy and thermal analyzer.
CLO2 [K3]	apply the different characterization techniques to determine the properties of materials.
CLO3 [K4]	analyze the applications of XRD, SEM and thermal analysis.
CLO4 [K5]	interpret the characteristics of materials based on the characterization techniques.
CLO5 [K6]	create a new technique for materials characterization.

<b>CORE COURSE</b>	
<b>Course Code: 23PPIN31</b>	<b>Course Title: INTERNSHIP</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	relate the class room theory with work place practice.
CLO2 [K3]	apply the practices / procedures observed in real time working environment
CLO3 [K4]	analyze the workflow and communication flow prevailing in the institution/industry
CLO4 [K5]	assess interests and abilities in their field of study
CLO5 [K6]	propose strategies, policies and guidelines for enhancing efficiency of industrial/institutional operations

<b>CORE COURSE</b>	
<b>Course Code: 23PPC41</b>	<b>Course Title: NUCLEAR AND PARTICLE PHYSICS</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain the concepts of nuclear forces, nuclear model, compound nuclear reactions, decay process of particles and Quarks.
CLO2 [K3]	apply the concepts of nuclear and particle Physics to solve problems.
CLO3 [K4]	analyze the types of nuclear forces/ nuclear models/ nuclear reactions/ nuclear decay/ elementary particles.
CLO4 [K5]	evaluate the magic numbers for different nuclei, kinematics of nuclear reactions, decay processes and conservation laws.
CLO5 [K6]	elaborate the hypothesis behind particle Physics, forms of interactions, nuclear decays, nuclear models and elementary particle symmetries.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC42</b>	<b>Course Title: SPECTROSCOPY</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	explain microwave, IR, Raman, Resonance and UV spectroscopy.
CLO2 [K3]	determine different parameters involved in microwave, IR, Raman, resonance and UV spectroscopy.
CLO3 [K4]	analyse the structure and intensity of rotational/ vibrational/resonance and UV spectra of molecules.
CLO4 [K5]	deduce the structure of molecules using spectroscopic data in microwave, IR, Raman, Resonance and UV spectroscopy.
CLO5 [K6]	predict the structure of molecules using Raman, ESR and NMR Spectroscopy.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC43</b>	<b>Course Title: NUMERICAL METHODS WITH PROGRAMMING</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the basic concept involved in root finding methods, linear and algebraic equations, matrix representation, interpolation, numerical differentiation and integration and in C-programming.
CLO2 [K3]	apply the knowledge of computational and numerical methods to solve problems in physics.
CLO3 [K4]	analyse computationally the given problems in physics by various numerical methods.
CLO4 [K5]	evaluate the complex problems in physics based on specific numerical methods and tools.
CLO5 [K6]	predict a computational method to produce accurate results for numerical problems.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC4L</b>	<b>Course Title: PRACTICAL - IV</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the program structure of microprocessor 8085 and microcontroller 8051
CLO2 [K3]	use the microprocessor and microcontroller to perform arithmetic, logic operations and real time applications.
CLO3 [K4]	analyse the interfacing peripherals of microprocessor 8085 with microcontroller 8051.
CLO4 [K5]	interpret the mnemonics of microprocessor 8085 and opcode of microcontroller 8051
CLO5 [K6]	develop program to solve real-world problem using microprocessor 8085 and microcontroller 8051.

<b>CORE COURSE</b>	
<b>Course Code: 23PPC4P</b>	<b>Course Title: PROJECT WITH VIVA-VOCE</b>
On successful completion of the course, the learners should be able to	
CLO1 [K2]	describe the nature of the problems and collect relevant data.
CLO2 [K3]	utilize the collected data and manipulate them to arrive the solution.
CLO3 [K4]	analyze the data with the literature survey.
CLO4 [K5]	justify the results in the project report in an ethical manner.
CLO5 [K6]	defend their dissertations in viva-voce.

**PROFESSIONAL COMPETANCE SKILL ENHANCEMENT COURSE**

**Course Code: 23PPSE41**

**Course Title: TRAINING FOR  
COMPETITIVE  
EXAMINATIONS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	explain the general concepts of Mathematical Physics, Electromagnetic theory, Electronics, Experimental Physics, Classical, Quantum and Statistical Mechanics.
CLO2 [K3]	apply cognitive abilities to solve quantitative and qualitative problems.
CLO3 [K4]	make use of Physics concepts to solve problems.
CLO4 [K5]	analyze the concepts of various branches of Physics theories.
CLO5 [K6]	evaluate the parameters related to Physics problems.

**ADDITIONAL SKILL SUPPORTIVE COURSE**

**Course Code: 23PPSS41**

**Course Title:  
INTELLECTUAL PROPERTY  
RIGHTS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	describe the concepts of IPR, function of Trademarks and patent search.
CLO2 [K3]	identify the differences between IPR, copyrights and patents.
CLO3 [K4]	analyze the types of intellectual property, trademarks and patents.
CLO4 [K5]	appraise the importance of Intellectual Property Rights, fundamentals of copyright and strategies for effective IPR management.
CLO5 [K6]	create an innovative idea to file patents.

**GENERIC ELECTIVE COURSE**

**Course Code: 23PPEG21**

**Course Title: ENERGY  
PHYSICS**

On successful completion of the course, the learners should be able to

CLO1 [K2]	explain about various renewable energy sources.
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CLO2 [K3]	identify the applications of energy sources.
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CLO3 [K4]	compare the different types of energy resources.
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CLO4 [K5]	assess the techniques in energy sources.
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CLO5 [K6]	compile the various kinds of energy sources.
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