Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.

Accredited with A^+ by NAAC - IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

Semester I - IV

POs, PSOs & COs

DEPARTMENT OF PHYSICS

2023-2026

(With effect from the academic year 2024-2025)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Upon completion of M. Sc. Physics Programme, the graduates will be able to:	Mapping with Mission
PEO1	apply scientific and computational technology to solve social and ecological issues and pursue research.	M1, M2
PEO2	continue to learn and advance their career in industry both in private and public sectors.	M4 & M5
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	M2, M5 & M6

PROGRAMME OUTCOMES (POs)

POs	Upon completion of M.Sc. Physics Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	PEO1 &PEO2
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	PEO1, PEO2& PEO3
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	PEO2
PO4	develop innovative initiatives to sustain ecofriendly environment	PEO1, PEO2
PO5	through active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	PEO2
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	PEO1, PEO2& PEO3
PO7	learn independently for lifelong executing professional, social and ethical responsibilities leading to sustainable development.	PEO3

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO	Upon completion of M.Sc. Physics Degree Programme, the graduates of Physics will be able to:	Mapping with POs
PSO1	have well– defined knowledge on theoretical concepts and experimental methods of advanced physics.	PO1 & PO2
PSO2	acquire skills in performing advanced physics experiments and projects using modern technology and numerical simulations.	PO3, PO4 &PO5
PSO3	develop and communicate analytical skills ranging from nuclear to cosmology to progress in the expanding frontiers of physics.	PO6
PSO4	apply and interpret physics principles in various physical observations. Demonstrate proficiency in analyzing, applying and solving Scientific problems.	PO1, PO7
PSO5	use the techniques, skills, and modern technology necessary to communicate effectively with professional and ethical responsibility. Understand the impact of Physics in a global, economic, environmental, and societal context.	PO7

Strong -S (3), Medium – M (2), Low – L (1)

PO-PSO mapping

POs	PSO1	PSO2	PSO3	PSO4	PSO5
PO 1	**S**	**S**	**M**	**S**	**M**
PO 2	**S**	**S**	**S**	**S**	**M**
PO 3	**S**	**S**	**S**	**M**	**S**
PO 4	**M**	**M**	**M**	**M**	**S**
PO 5	**S**	**S**	**M**	**M**	**S**
PO 6	**M**	**M**	**M**	**M**	**M**
PO 7	**S**	**S**	**M**	**M**	**S**

COURSE OUTCOMES

SEMESTER – I

CORE COURSE I: MATHEMATICAL PHYSICS

Course Code: PP231CC1

On the successful completion of the course, student will be able to:		
CO1	understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them.	**K1, K2**
CO2	able to understand analytic functions, do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration.	**K2, K3**
CO3	analyze characteristics of matrices and its different types, and the process of diagonalization.	**K4**
CO4	solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	**K4 , K5**
CO5	to find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's function. Apply special functions in computation of solutions to real world problems	**K2, K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER – I

CORE COURSE II: CLASSICAL MECHANICS AND RELATIVITY

Course Code: PP231CC2

Upon completion of this course the students will be able to:		
CO1	understand the fundamentals of classical mechanics.	**K2**
CO2	apply the principles of Lagrangian mechanics to solve the equations of motion of physical systems.	**K3**
CO3	apply the principles of Hamiltonian mechanics to solve the equations of motion of physical systems.	**K3**
CO4	analyze the small oscillations in systems and determine their normal modes of oscillations.	**K2, K4**
CO5	understand and apply the principles of relativistic kinematics to the mechanical systems.	**K2, K3**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER – I

CORE COURSE III: LINEAR AND DIGITAL ICS AND APPLICATIONS

Course Code: PP231CC3

On the successful completion of the course, student will be able to:		
CO1	remember the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems	**K1 & K2**
CO2	develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits.	**K2 & K3**
CO3	apply knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.	**K2& K5**
CO4	analyze about various techniques to develop A/D and D/A converters.	**K4 & K5**
CO5	evaluate and to create the knowledge about the CMOS logic, combinational and sequential circuits	**K3& K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER – I

CORE LAB COURSE I: ADVANCED PHYSICS LAB I
Course Code: PP231CP1

On the successful completion of the course, students will able to:		
CO1	understand the strength of material using Young's modulus.	**K2**
CO2	acquire knowledge of thermal behaviour of the matetials.	**K1**
CO3	understand theoretical principles of magnetism through the experiments.	**K2**
CO4	acquire knowledge about the applications of laser	**K1**
CO5	improve the analytical and observation ability in Physics experiments	**K4**
CO6	analyze various parameters related to operational amplifiers.	**K4**
CO7	understand the concepts involved in arithmatic and logical circuits using IC's	**K2**
CO8	acquire knowledge about Combinational Logic Circuits and Sequential Logic Circuits	**K3**
CO9	analyze the applications of counters and registers	**K4**
K1 - Remember; **K2** – Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate		

SEMESTER – I

ELECTIVE COURSE I: a) ENERGY PHYSICS
Course Code: PP231EC1

On the successful completion of the course, students will able to:		
CO1	to identify and understand the various forms of renewable and non-renewable energy sources	**K1 & K2**
CO2	understand the principle of utilizing the oceanic energy and apply it for practical applications	**K2** & **K3**
CO3	discuss the working of a windmill and analyze the advantages of wind energy.	**K4**
CO4	evaluate the aerobic digestion process from anaerobic digestion.	**K5**
CO5	understand the components of solar radiation, their measurement and apply them to utilize solar energy	**K2** & **K3**

K1 - Remember; **K2** – Understand; **K3 -** Apply; **K4 -** Analyze; **K5** – Evaluate

SEMESTER – I

ELECTIVE COURSE I: b) CRYSTAL GROWTH AND THIN FILMS
Course Code: PP231EC2

On the successful completion of the course, student will be able to:		
CO1	acquire the Basic Concepts, Nucleation and Kinetics of crystal growth	**K1**
CO2	understand the Crystallization Principles and Growth techniques	**K2, K4**
CO3	study various methods of Crystal growth techniques	**K3**
CO4	understand the Thin film deposition methods	**K2**
CO5	apply the techniques of Thin Film Formation and thickness Measurement	**K3, K4**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER – I

ELECTIVE COURSE I: c) MATERIAL SCIENCE
Course Code: PP231EC3

On the successful completion of the course, students will able to:		
CO1	acquire knowledge on optoelectronic materials	**K1**
CO2	be able to prepare ceramic materials	**K3**
CO3	be able to understand the processing and applications of polymeric materials	**K2& K3**
CO4	be aware of the fabrication of composite materials	**K5**

CO5	be knowledgeable of shape memory alloys, metallic glasses and nanomaterials	**K1**

K1 - Remember; **K2** – Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

SEMESTER I
SPECIFIC VALUE ADDED COURSE

COMPUTER MAINTENANCE
Course Code: PP231V01

COs	**Upon completion of this course, students will be able to:**	
CO- 1	understand the basic components of a computer	**K1**
CO- 2	install different types of operating systems	**K2**
CO- 3	to assemble and disassemble a personal computer	**K3**
CO- 4	to troubleshoot the problems	**K3**

SEMESTER- I
SPECIFIC VALUE-ADDED COURSE: FUNDAMENTALS OF COMMUNICATION
Course Code: PP231V02

Upon completion of this course, students will be able to:		
1.	identify different types of radars.	**K1**
2.	compare the different applications of optical fibres.	**K2**
3.	use the principle of optical fibres for designing and integrating into appliance systems.	**K3**
4.	correlate transmission and reception of radio waves	**K4**
5.	prioritize the working of internet protocol television.	**K5**

K1- Remember- **K2**- Understand- **K3 –** Apply- **K4**- Analyze- **K5**- Evaluate

SEMESTER – II
CORE COURSE IV: STATISTICAL MECHANICS
Course Code : PP232CC1

On the successful completion of the course, student will be able to:		
CO1	examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition	**K1 & K2**
CO2	interpret the macroscopic properties such as pressure, volume, temperature, specific heat, elastic module etc. using microscopic properties like intermolecular forces, chemical bonding, atomicity etc. describe the peculiar behaviour of the entropy by mixing two	**K2& K3**

	gases.Relate the connection between statistics and thermodynamic quantities	
CO3	distinguish canonical and grand canonical ensembles and to interpret the relation between thermodynamical quantities and partition function	**K3 & K4**
CO4	analyze and apply the different statistical concepts to assess the behaviour of ideal Fermi gas and ideal Bose gas and also to compare and distinguish the three types of statistics.	**K4& K5**
CO5	evaluate and generalise the thermodynamical behaviour of gases under fluctuation and also using Ising model	**K5& K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**- Create

SEMESTER – II
CORE COURSE V: QUANTUM MECHANICS - I
Course Code : PP232CC2

On the successful completion of the course, student will be able to:		
CO1	understand the basic postulates of quantum mechanics which serve to formalize the rules of quantum mechanics.	**K1 & K2**
CO2	interpret and relate the Schrodinger equation to solve one dimensional problems and three dimensional problems.	**K2& K3**
CO3	apply and analyze various representations, space time symmetries and formulations of time evolution.	**K3 & K4**
CO4	construct and prioritize the approximation methods for various quantum mechanical problems.	**K4& K5**
CO5	apply and formulate non-commutative algebra for angular and spin angular momentum and assess spectral line splitting.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER – II
CORE LAB COURSE: ADVANCED PHYSICS LAB II
Course Code : PP232CP2

On the successful completion of the course, students will able to:		
1.	understand the strength of material using Young's modulus.	**K2**
2.	acquire knowledge of thermal behaviour of the matetials.	**K1**

3.	understand theoretical principles of magnetism through the experiments.	**K2**
4.	acquire knowledge about the applications of laser	**K1**
5.	improve the analytical and observation ability in Physics Experiments	**K4**
6.	analyze various parameters related to operational amplifiers.	**K4**
7.	understand the concepts involved in arithmatic and logical circuits using IC's	**K2**
8.	acquire knowledge about Combinational Logic Circuits and Sequential Logic Circuits	**K3**
9.	analyze the applications of counters and registers	**K4**

K1 - Remember; **K2** – Understand; **K3 -** Apply; **K4 -** Analyze

SEMESTER – II
ELECTIVE COURSE II: a) ADVANCED OPTICS
Course Code : PP232EC1

On the successful completion of the course, student will be able to**:**		
CO1	discuss the transverse character of light waves and different polarization phenomenon	**K1**
CO2	discriminate all the fundamental processes involved in laser devices and to analyze the design and operation of the devices	**K2**
CO3	demonstrate the basic configuration of a fiber optic – communication system and advantages	**K3, K4**
CO4	identify the properties of nonlinear interactions of light and matter	**K4**
CO5	interpret the group of experiments which depend for their action on an applied magnetics and electric field	**K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

SEMESTER – II
ELECTIVE COURSE II: b) NON-LINEAR DYNAMICS
Course Code : PP232EC2

On the successful completion of the course, student will be able to:		
CO1	gain knowledge about the available analytical and numerical methods to solve various nonlinear systems.	**K1 & K2**
CO2	understand the concepts of different types of coherent structures and their importance in science and technology.	**K2 & K3**
CO3	apply and analyze simple and complex bifurcations and the routes to chaos	**K3 & K4**

CO4	analyze and evaluate the various types of oscillators, chaos and fractals.	**K4 & K5**
CO5	evaluate and create the applications of solitons in telecommunication, applications of chaos in cryptography, computations and that of fractals.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER – II
ELECTIVE COURSE II: C) QUANTUM FIELD THEORY
Course Code : PP232EC3

On the successful completion of the course, student will be able to:		
CO1	understand the interconnection of Quantum Mechanics and Special Relativity	**K1**
CO2	enable the students to understand the method of quantization to various field	**K2**
CO3	employ the creation and annihilation operators for quantization	**K5**
CO4	summarizes the interacting field, in quantum domain, and gives a discussion on how perturbation theory is used here.	**K1 & K3**
CO5	understand the concept of Feynman diagram	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K5** – Evaluate

SEMESTER – II
ELECTIVE COURSE III: a) MEDICAL PHYSICS
Course Code : PP232EC4

On the successful completion of the course, student will be able to:		
CO1	learn the fundamentals, production and applications of X-rays.	**K1 & K2**
CO2	understand the basics of blood pressure measurements. Learn about sphygmomanometer, EGC, ENG and basic principles of MRI.	**K1 & K2**
CO3	apply knowledge on Radiation Physics	**K2 & K3**
CO4	analyze Radiological imaging and filters	**K3 & K5**
CO5	assess the principles of radiation protection	**K5 & K6**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K5** - Evaluate; **K6**– Create

SEMESTER – II
ELECTIVE COURSE III: b) ADVANCED SPECTROSCOPY
Course Code : PP232EC5

On the successful completion of the course, student will be able to:		
CO1	comprehend set of operations associated with symmetry elements of a molecule, apply mathematical theory while working with symmetry operations. Apply mathematical theory while working with symmetry operations. To use group theory as a tool to characterize molecules.	**K1& K2**
CO2	align with the recent advances in semiconductor laser technology combined sensitive spectroscopic detection techniques.	**K2& K3**
CO3	understand principle behind Mossbauer spectroscopy and apply the concepts of isomer shift and quadrupole splitting to analyse molecules.	**K2& K3**
CO4	assimilate this XPES quantitative technique and the instrumentation associated with this, as applied in understanding surface of materials.	**K4& K5**
CO5	employ IR and Raman spectroscopic data along with other data for structural investigation of molecules. Analyze thermodynamic functions and other parameters to evolve molecular models.	**K3& K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SEMESTER – II
ELECTIVE COURSE III: c) CHARACTERIZATION OF MATERIALS
Course Code : PP232EC6

On the successful completion of the course, students will able to:		
1.	describe the TGA, DTA, DSC and TMA thermal analysis techniques and make interpretation of the results.	**K1, K3**
2.	the concept of image formation in Optical microscope, developments in other specialized microscopes and their applications.	**K2**
3.	the working principle and operation of SEM, TEM, STM and AFM.	**K2, K3**
4.	understood Hall measurement, four –probe resistivity measurement, C-V, I-V, Electrochemical, Photoluminescence and electroluminescence experimental techniques with necessary theory.	**K3, K4**
5.	the theory and experimental procedure for x- ray diffraction and some important spectroscopic techniques and their applications.	**K4,K5**

K1 - Remember; **K2** – Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

SEMESTER – II
SKILL ENHANCEMENT COURSE I : SOLAR ENERGY UTILIZATION
Course Code : PP232SE1

On the successful completion of the course, student will be able to:		
CO1	gained knowledge in fundamental aspects of solar energy utilization	**K1 & K2**
CO2	equipped to take up related job by gaining industry exposure	**K1 & K2**
CO3	develop entrepreneurial skills	**K2 & K3**
CO4	skilled to approach the needy society with different types of solar cells	**K3 & K5**
CO5	gained industrialist mindset by utilizing renewable source of energy	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K5** - Evaluate; **K6**– Create

SEMESTER – I & II
LIFE SKILL TRAINING – I ETHICS
Course Code : PG23LST1

Course Outcomes	**On completion of this course the student will be able to**	
CO1	understand deeper insight of the meaning of their existence.	K1
CO2	recognize the philosophy of life and individual qualities	K2
CO3	acquire the skills required for a successful personal and professional life.	K3
CO4	develop as socially responsible citizens.	K4
CO5	create a peaceful, communal community and embrace unity.	**K3**

K1 - Remember; **K2** – Understand; **K3** - Apply; **K4** - Analyze;

SEMESTER III
CORE COURSE VII: CONDENSED MATTER PHYSICS
Course Code: PP233CC1

On the successful completion of the course, students will be able to:		
1.	identify various crystal structures, symmetry and differentiate different types of bonding.	**K1**
2.	understand the lattice dynamics and apply it to concept of specific heat.	**K2**
3.	articulate different types of magnetic materials and explain the underlying phenomena.	**K3**
4.	relate the concepts of superconductivity, the underlying theories – related to current areas of research.	**K4**

5.	assess various theories of electrons in solids and their impact in distinguishing solids.	**K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyse; **K5** – Evaluate

SEMESTER III

CORE COURSE VIII: ELECTROMAGNETIC THEORY
Course Code: PP233CC2

On the successful completion of the course, students will be able to:		
1.	understand the basic laws of electromagnetism.	**K1**
2.	recognize the behaviour of electric and magnetic fields in simple configurations under different boundary conditions.	**K2**
3.	apply the concepts of electrodynamics and derive the Maxwell's equation.	**K3**
4.	analyse the concept of propagation in linear media.	**K4**
5.	prioritize the magnetic properties of matter.	**K5**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyse; **K5** – Evaluate

SEMESTER – III
CORE LAB COURSE III: ADVANCED PHYSICS LAB-III
PROGRAMMING IN MICROPROCESSOR AND MICROCONTROLLER
Course Code: PP233CP1

On the successful completion of the course, students will able to:		
1.	illustrate the features of microprocessor and microcontroller in different applications.	**K1**
2.	understand the theory and working of Microprocessor, Microcontroller.	**K2**
3.	apply assembly language programming on microprocessor (Data Manipulation, Square of numbers, Counters).	**K3**
4.	devise the interfacing of microprocessor 8085 with I/O devices (A/D& D/A, Stepper motor).	**K4**
5.	evaluate and develop experiments with assembly language programming on 8085 microprocessor and 8051 microcontroller (Addition, Subtraction, Multiplication and Division).	**K5 & K6**

K1 - Remember; **K2 –** Understand; **K3** - Apply; **K4** - Analyze; **K5 –** Evaluate; K6- Create

SEMESTER III
CORE RESEARCH PROJECT
Course Code: PP233RP1

Upon completion of this course, the students will be able to:		
1.	recognise new areas of research in physics.	**K1**
2.	interpret a research problem and construct tools for data collection.	**K2**
3.	apply skills to serve in science related industries and agencies.	**K3**
4.	correlate research reports and results in the scientific community.	**K4**
5.	develop prototypes and publish articles in reputed journals.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER III

ELECTIVE COURSE IV: a) COMMUNICATION ELECTRONICS
Course Code: PP233EC1

On the successful completion of the course, students will be able to:		
1.	identify the use of optical fiber as wave guide and compare the different types of optical fiber.	**K1 & K2**
2.	articulate the principle of radar in detecting locating, tracking, and recognizing objects of various kinds at considerable distances.	**K3**
3.	correlate the methods of generation of microwaves through wave guides.	**K4**
4.	relate the importance of satellite communication in our daily life-distinguish between orbital and geostationary satellites elaborate the linking of satellites with ground station on the earth	**K4**
5.	reframe the energy and power radiated by the different types of antenna and develop a prototype.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER III
ELECTIVE COURSE IV: b): MICROPROCESSOR AND MICROCONTROLLER
Course Code: PP233EC2

On the successful completion of the course, students will be able to:		
1	illustrate the architecture and functionality of the 8085 microprocessor.	**K1**
2	infer the architecture and functionality of the 8051 Microcontroller.	**K2**

3	apply the addressing modes and data transfer scheme for 8085 microprocessor and 8051 microcontroller.	**K3**
4	categorise instructions to develop programs for measuring various electrical and physical quantities.	**K4**
5	evaluate the interfacing of microprocessors and microcontrollers and develop external devices across various applications.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER III
ELECTIVE COURSE IV: c) ADVANCED MATHEMATICAL PHYSICS
Course Code: PP233EC3

On the successful completion of the course, students will be able to:		
1.	identify both discrete and continuous groups.	**K1**
2.	classify group theory and articulate tensors to pursue research.	**K2& K3**
3.	contrast various important theorems in group theory.	**K4**
4.	evaluate group multiplication table, character table relevant to important branches of physics.	**K5**
5.	develop Ricci tensor applications.	**K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

SEMESTER III

SKILL ENHANCEMENT COURSE II: SEWAGE AND WASTE WATER TREATMENT AND REUSE
Course Code: PP233SE1

On the successful completion of the course, students will be able to:		
1.	identify solid waste management methods.	**K1**
2.	interpret factors affecting disinfection.	**K2**
3.	use advanced waste water treatment for removal of suspended solids in the nearby areas.	**K3**
4.	connect to related job by gaining industry exposure.	**K4**
5.	defend managing solid wastes in and around the locality and develop entrepreneurial skills.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** – Evaluate; K6- Create

SEMESTER- III
SPECIFIC VALUE-ADDED COURSE: SENSOR BASED APPLIANCES
Course Code: PP233V01

Upon completion of this course, students will be able to:		
1.	illustrate sensor types, principles, and applications in modern appliances.	**K1**
2.	understand the concepts of Sensor appliances.	**K2**
3.	articulate expertise in designing and integrating sensors into appliance systems.	**K3**
4.	correlate sensor-based appliances with smart home systems for enhanced functionality.	**K4**
5.	defend the accuracy of sensors to detect signals.	**K5**

K1- Remember- **K2-** Understand- **K3 –** Apply- **K4-** Analyze- **K5-** Evaluate

SEMESTER- III

SPECIFIC VALUE-ADDED COURSE: RECENT ADVANCES IN ASTROPHYSICS
Course Code: PP233V02

Upon completion of this course, students will be able to:		
1.	remember the different layers of the Sun and its phenomenon.	**K1**
2.	understand the basic concepts of Solar systems.	**K2**
3.	apply the basic principles of astrophysics for recognising total and annular solar and lunar eclipses.	**K3**
4.	contrast the distinct properties of planets revolving around the sun.	**K4**
5.	analyse the principle of planetary motion and evaluate its applications towards science and technology.	**K4 & K5**

K1- Remember; **K2-** Understand**; K3 –** Apply**; K4-** Analyse**; K5-** Evaluate

SEMESTER III
SELF-LEARNING COURSE: NATIONAL ELIGIBILITY TEST: PHYSICS –I
Course Code: PP233SL1

On the successful completion of the course, students will be able to:		
1.	recall the basic concepts of mathematical methods.	**K1**
2.	understand the theoretical aspects of classical mechanics.	**K2**
3.	apply Maxwell's equations in free space and linear isotropic media.	**K3**
4.	devise the variational method in quantum mechanics.	**K4**
5.	evaluate problems in electronics and error analysis.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

SEMESTER IV

CORE COURSE X: NUCLEAR AND PARTICLE PHYSICS

Course Code: PP234CC1

On the successful completion of the course, students will be able to:		
1.	define the concepts of helicity, parity, angular correlation and internal conversion.	**K1**
2.	interpret fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter.	**K2**
3.	articulate the different nuclear models to explain different nuclear phenomena and the concept of resonances through Briet-Weigner single level formula	**K3**
4.	correlate data from nuclear scattering experiments to identify different properties of the nuclear force.	**K4**
5.	appraise the concept of allowed and forbidden nuclear reactions based on conservation laws of the elementary particles.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** – Evaluate

SEMESTER IV

CORE COURSE XI: SPECTROSCOPY

Course Code: PP234CC2

On the successful completion of the course, students will be able to:		
1.	recognise fundamentals of rotational spectroscopy, view molecules as elastic rotors and interpret their behavior.	**K1**
2.	understand the working principles of spectroscopic instruments and theoretical background of IR spectroscopy.	**K2**
3.	apply the resonance spectroscopic techniques for quantitative and qualitative estimation of a substance.	**K3**
4.	analyze the different types of spectrum.	**K4**
5.	evaluate structures and composition of molecules and use their knowledge of Raman Spectroscopy as an important analytical tool.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

SEMESTER – IV
CORE LAB COURSE IV: ADVANCED PHYSICS LAB-IV
NUMERICAL METHODS AND COMPUTER PROGRAMMING C++
Course Code: PP234CP1

On the successful completion of the course, students will able to:		
1.	identify the basic numerical interpolation methods.	**K1**
2.	interpret the numerical methods used in computation and programming using C++.	**K2**
3.	articulate the software tools to explore the concepts of physical science.	**K3**
4.	connect the computational skill using various mathematical tools.	**K4**
5.	reframe mathematical formulations and develop the real time applications using physics.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate; **K6** - Create

SEMESTER IV
ELECTIVE COURSE V: a) NUMERICAL METHODS AND COMPUTER ALGORITHMS
Course Code: PP234EC1

On the successful completion of the course, students will be able to:		
1.	recognize different numerical approaches to solve a problem.	**K1**
2.	compare various numerical methods for differentiation and integration.	**K2**
3.	relate various interpolation methods for finite difference concepts.	**K3**
4.	devise the numerical solutions of linear system of equations.	**K4**
5.	prioritise computational methods and design C++ programs for day-to-day life applications.	**K5 & K6**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** –Analyze; **K5** – Evaluate; **K6**– Create

SEMESTER IV
ELECTIVE COURSE V: b) ANALYSIS OF CRYSTAL STRUCTURES
Course Code: PP234EC2

On the successful completion of the course, students will be able to:		
1.	understand crystal symmetry and reciprocal lattice concept for X-ray diffraction	**K1**
2.	interpret of X-ray generation, X-ray photography with Laue, oscillation and moving film methods, and space group determination	**K2**

3.	apply program packages for predicting the crystal structure.	**K3**
4.	analyse powder diffraction, data collection, data interpretation, and structure refinement using Rietveld method.	**K4**
5.	evaluate methods to solve protein structures and develop the structural aspects of proteins and nucleic acids.	**K5 & K6**

K1 - Remember; **K2 -** Understand; **K3 –** Apply; **K4 -** Analyse; **K5 -** Evaluate; **K6 –** Create

SEMESTER IV
ELECTIVE COURSE V: c) PLASMA PHYSICS
Course Code: PP234EC3

On the successful completion of the course, students will be able to:		
1.	identify the collision, cross section of charged particles and to able to correlate the magnetic effect of ion and electrons in plasma state.	**K1**
2.	understand the magneto-hydrodynamics concepts applied to plasma.	**K2**
3.	solve the maxwell's equation to quantitative analysis of plasma.	**K3**
4.	contrast the different principle and techniques to diagnostics of plasma.	**K4**
5.	defend the possible applications of plasma by incorporating various electrical and electronic instruments.	**K4**

K1 - Remember; **K2 –** Understand; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SEMESTER IV

ELECTIVE COURSE VI: a) PHYSICS OF NANOSCIENCE AND TECHNOLOGY
Course Code: PP234EC4

On the successful completion of the course, students will be able to:		
1.	identify the different types of nanomaterials and surface effects of the nanomaterials.	**K1**
2.	understand various physical, mechanical, optical, electrical and magnetic properties nanomaterials.	**K2**
3.	utilise the process and mechanism of synthesis and fabrication of nanomaterials.	**K3**
4.	correlate the various characterizations of Nano-products through diffraction, spectroscopic, microscopic and other techniques.	**K4**
5.	grade the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy sectors and design devices.	**K5 & K6**

K1 - Remember; **K2 -** Understand; **K3** – Apply; **K4 -** Analyse; **K5 -** Evaluate; **K6** – Create

SEMESTER IV
ELECTIVE COURSE VI: b) BIO PHYSICS
Course Code: PP234EC5

On the successful completion of the course, students will be able to:		
1.	identify the physical principles involved in cell function maintenance.	**K1**
2.	understand the fundamentals of macromolecular structures involved in propagation of life.	**K2**
3.	apply the biophysical function of membrane and neuron for nervous systems.	**K3**
4.	categorise various kinds of radiation and their effects on living system and to know the hazards posed by such radiations and the required precautions.	**K4**
5.	reframe the physical principles behind the various techniques available for interrogating biological macromolecules.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

SEMESTER IV
ELECTIVE COURSE VI: c) GENERAL RELATIVITY AND COSMOLOGY
Course Code: PP234EC6

On the successful completion of the course, students will be able to:		
1.	recall the basic concepts of tensors.	**K1**
2.	interpret the theoretical aspects of general relativity and cosmology.	**K2**
3.	apply space time curvature for gravitation.	**K3**
4.	analyse problems using mathematical skills.	**K4**
5.	evaluate the tensor in relativity.	**K5**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyse; **K5** – Evaluate

SEMESTER – IV
SKILL ENHANCEMENT COURSE III: SOLID WASTE MANAGEMENT
Course Code: PP234SE1

On the successful completion of the course, student will be able to:		
1.	illustrate the different types of solid waste management.	**K1**
2.	infer the concept of Solid Waste Management hierarchy.	**K2**
3.	apply entrepreneurial skills for promoting Waste Treatment Systems.	**K3**

4.	conclude the status of the solid wastes in the nearby areas.	**K4**
5.	defend the management of solid wastes in and around the locality.	**K5**

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyse; **K5** – Evaluate

SEMESTER IV
SELF-LEARNING COURSE: NATIONAL ELIGIBILITY TEST: PHYSICS –II
Course Code: PP234SL1

On the successful completion of the course, students will be able to:		
1.	recall the basic concepts of statistical methods.	**K1**
2.	understand the concepts of solid state physics.	**K2**
3.	articulate the theoretical aspects of molecular physics in electronic, rotational, vibrational and Raman spectra of diatomic molecules.	**K3**
4.	correlate the models of nuclear and particle physics.	**K4**
5.	solve problems in experimental techniques.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

SEMESTER – III & IV
LIFE SKILL TRAINING II - VALUES
Course Code:PG23LST2

On completion of this course the student will be able to		
1	recognize the perception of life and lead a positive life	**K1**
2	understand relationship with family, friends and the society	**K2**
3	develop as socially responsible citizens.	**K3**
4	assess goals, fix targets and value life	**K4**
5	create a peaceful, communal community and embrace unity.	**K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse;