Radhey Hari Govt. P. G. College, Kashipur, Uttarakhand
Department of Physics

Programme and Course outcomes

B.Sc. (Physics) NEP:

S. N.	Semester	Paper	Paper title
1.	I	I	Mechanics & Theory of Waves and Oscillations
2.	II	I	Electricity and Magnetism
3.	III	I	Thermodynamics and Statistical Physics
4.	IV	I	Geometrical Optics
5.	V	I	Basic Electronics
6.	V	II	Physical Optics
7.	VI	I	Modern Physics
8.	VI	II	Analog and Digital Electronics

Programme outcomes

Students having Degree in B.Sc. (with Physics) should have knowledge of different concepts and fundamentals of Physics and ability to apply this knowledge in various fields of academics and industry. They may pursue their future career in the field of academics, research and industry.
After completing this certificate course, the student should have

- Acquired the basic knowledge of Mechanics, Electricity and Magnetism.
- Hands-on experience to apply the theoretical knowledge to solve practical problems of basic physical phenomena. He should be able to carry out experiments to understand the laws and concepts of Physics.
- An insight in understanding electrical circuits and in handling electrical instruments.

After completing this diploma course, the student should have
• Knowledge of different concepts in Thermodynamics, and Geometrical Optics.
• Knowledge of different aspects of Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.
• A deeper insight in Ray Optics to understand the Physics of many optical instruments which are widely used in research and Industry, Optoelectronics, IT and communication devices, and in industrial instrumentation.
• Knowledge of basic concepts of optical instruments with their applications in technology.
The course will empower him to apply his theoretical knowledge in various physical phenomena that occur in day-to-day life and he can use this scientific knowledge for the betterment of the society. Understanding of basic concepts related to Electricity and Magnetism. He should be proficient in designing and handling different electrical circuits. Expertise in different aspects of

Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators. Proficient in the field of Optics which will increase his demand in research and industrial establishments engaged in activities involving optical instruments. Basic knowledge in the field of Modern physics, which have utmost importance at both undergraduate and graduate level. Comprehensive knowledge of Analog & Digital Principles and Applications. Learn the integrated approach to analog electronic circuitry and digital electronics for R&D.

After completion of the degree course with B Sc in Physics the students can avail many options depending on the areas of interest and specialization. They can choose to go for

1. B.Ed
2. M.Sc Physics
3. IntergratedM.Sc-PhD
4 .M.Sc Medical Physics
5. M.Sc Biophysics
6. M.Sc Nanoscience and Nanotechnology
7. M.Sc Environmental Science
8. M.Sc Geophysics and Meteorology
9. Competitive examinations (UPSC, Staff selection, Bank PO, etc) etc

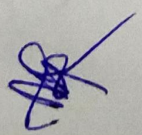
Course Outcome

Mechanics & Theory of Waves and Oscillations

1. Understanding of Vector Algebra and Vector Calculus.
2. Understand the physical interpretation of gradient, divergence and curl.
3. Study of gravitational field and potential and understanding of Kepler's laws of planetary motion.
4. Understanding of different frames of references and conservation laws.
5. Understand the dynamics of rigid body and concept of moment of inertia. Study of moment of inertia of different bodies and its applications.
6. Study the properties of matter, response of the classical systems to external forces and their elastic deformation and its applications.
7. Comprehend the dynamics of Fluid and concept of viscosity and surface tension along with its applications.
8. Comprehensive study of the theory of waves and oscillations.

Electricity and Magnetism

1. Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for different types of charge distributions.
2. Study of Electric and Magnetic Fields in matter. Understand the concept of polarizability, Magnetization and Electric Displacement Vector.
3. Study of Steady and Varying electric currents.
4. Understanding of different aspects of alternating currents and its applications.
5. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.
6. Comprehend the different aspects of Electromagnetic induction and its applications.



Thermodynamics and Statistical Physics

1. Understand First, Second and Third Law of Thermodynamics and concept of Entropy.
2. Understand the physical significance of thermodynamical potentials.
3. Comprehend the kinetic model of gases w.r.t. various gas laws.
4. Study the implementations and limitations of fundamental radiation laws.
5. Understand basics of statistical Physics and concept of thermodynamic probability

Geometrical Optics

1. Study of Fermat's Principle of Extremum Path and understand fundamental physics behind reflection and refraction of light.
2. Understand the theory of image formation by an optical system.
3. Study of different types of optical Aberrations and techniques for their reduction.
4. Study of different types of optical instruments used in industry and research

Physical Optics

1. Study of Interference of light. Interference by division of wavefront and division of amplitude.
2. Understanding Diffraction of Light and concept of Zone Plate.
3. Understand the polarization of light..
4. Study of different types of associated optical instruments based on interference and diffraction of light which are widely used in industry and research.

Basic Electronics

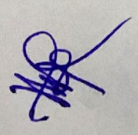
1. Study of different Network Theorems for simplifying complicated electronics circuits.
2. Study of Regulated Power Supply. Understand different types of Rectifiers, Filters and Voltage Regulator.
3. Study of different types of special diodes and their applications
4. Study of Bipolar Junction Transistors.
5. Study of Field Effect Transistor

Modern Physics

1. Study of different atomic models.
2. Study of optical spectra, X- rays and LASERS.
3. Study of structure of atomic nucleus and Elementary Particle Physics.
4. Understanding the concept of Quantum Physics.
5. Study of Special theory of relativity and relativistic physics

Analog and Digital Electronics

1. Study of feedback in amplifiers along with their advantages and disadvantages.
2. Study of different types of oscillators.
3. Understand the concepts of Boolean Algebra and various number systems
4. Study of logic gates and their applications



M.Sc. (Physics) CBCS:

S. N.	Semester	Course code	Course title
1.	1st	LCC1.	Mathematical Physics
2.		LCC2.	Classical Mechanics
3.		LCC3.	Quantum Mechanics
4.		LCC4.	Statistical Physics
5.		LCC5.	Atomic & Molecular Physics
6.	2nd	LCC6.	General Relativity and Cosmology
7.		LCC7.	Advanced Quantum Mechanics
8.		LCC8.	Nuclear Physics
9.		LCC9.	Elementary Particle Physics
10.		LCC10.	Condensed Matter Physics
11.	3rd	LCC11(b).	Advanced Electronics-I
12.		LCC12(b).	Advanced Electronics -II
13.		LCC13.	Electrodynamics
14.		LEC1.	Communication Electronics
15.		LEC2.	Introduction to Nanoscience and Nanotechnology
16.	4th	LCC14(b)	Advanced Electronics-III
17.		LCC15(b)	Advanced Electronics-IV
18.		LEC3	Digital Electronics and Computer Architecture
19.		DC	Dissertation

Programme outcomes

The objectives of the M.Sc. Physics programme are manifold and start with imparting students with an in-depth knowledge and understanding through the core courses which form the basis of Physics namely, Classical Mechanics, Quantum Mechanics, Mathematical 4 Physics, Statistical Physics, Electromagnetic Theory, Solid State Physics, Electronics, Nuclear and Particle Physics along with Atomic and Molecular Physics. Creative thinking and problem-solving capabilities are also aimed to be encouraged through tutorials. The elective and open elective courses are designed for more specialized and/or interdisciplinary content to equip students with a broader knowledge base. The core and elective labs are designed to develop an appreciation for the fundamental concepts and working of devices used in everyday life employing scientific methods/tools of physics. Computational physics course is aimed to equip the students to use computers as a tool for scientific investigations/understanding. The dissertation(s) in both theory and experimental stream are expected to give a flavor of how research leads to new findings. In addition, the M.Sc. course is to lay a solid foundation for a doctorate in Physics/allied subjects later. Course acquire the ability to pursue research careers, careers in academics, in industries in physical science and in allied fields, and also use the knowledge obtained to be trained for competing national level tests like UGC-CSIR NET, JEST, GATE, UPSC Civil Services Examination etc. Have advanced ideas and techniques required in frontier areas of Physics, and develop human resource with specialization in theoretical and experimental techniques required for career in academia and industry.

Course outcomes

LCC1. Mathematical Physics

Students will learn the required Mathematics techniques that may have not been covered in the courses in B.Sc. CBCS program and which will be useful in many other courses in M Sc. The understanding of the classification of finite groups will be achieved. Upon completion of this course, students should be able to use these concepts in various fields, particularity in crystallography. Students will be able to learn the different analytical techniques for solving integral equations and construct Green's functions for many important boundary value problems.

LCC2. Classical Mechanics

Students will be equipped for advanced and specialized courses.The student learns to deal with particle mechanics at an advanced level and to learn the foundations of the classical theory of fields

LCC3. Quantum Mechanics

Students will learn the mathematical formalism of Hilbert space, hermitian operators, eigen values, eigen states and unitary operators, which form the fundamental basis of quantum theory. Application to simple harmonic oscillators, hydrogen-like atoms and angular momentum operators will teach the students how to obtain eigen values and eigen states for such systems elegantly. The topic of density matrices that plays significant roles in quantum information theory and statistical mechanics will also help the students considerably.

LCC4. Statistical Physics

Understand how a probabilistic description of nature at the microscopic level gives rise to deterministic laws at the macroscopic level. Relate the concepts of entropy and temperature as defined in statistical mechanics to their more familiar versions in thermodynamics. Solve for the thermal properties of classical and quantum gases and other condensed systems from a 25 knowledge of their microscopic Hamiltonians. Appreciate that interactions between particles can explain the various phases of matter observed in nature, as well as the universality of critical exponents characterizing phase transitions.

LCC5. Atomic & Molecular Physics

Students learn to assign the point groups to polyatomic molecules (including diatomic) and to predict the nature of their vibrational spectra depending on their symmetry using group theoretical treatment. The complete picture of rotational, vibrational and electronic spectra of polyatomic molecules will be comprehended. Students will learn the details of atomic and diatomic molecular (diatomic) structures in terms of quantum mechanical treatment elaborately beyond the basic models. It will give the descriptions of fine structure of atoms and rotational, vibrational and electronic energies of molecules manifesting in their respective spectroscopies. The details of these spectroscopies would serve as the fundamentals for various concerned experimental results. The basic principles of light coherence as laser with their types and variants will also be covered exposing the students to the important modern spectroscopic tool.

LCC6. General Relativity and Cosmology

Students will be trained in tensor analysis and tensor calculus. This course will teach the formalism of general relativity (GR). They will learn how to obtain an exact solution of GR, namely, the Scwarzschild solution.

LCC7. Advanced Quantum Mechanics

Students will learn how to use perturbation theory to obtain corrections to energy eigen-states and eigen-values when an external electric or magnetic field is applied to a system. Scattering theory will teach them how to use projectiles to infer details about target quantum system. Relativistic quantum mechanics will provide an exposure to how special relativity in quantum theory leads to intrinsic spin angular momentum as well as anti-particles.

LCC8. Nuclear Physics

Students will gain the basic understanding of the theory behind nuclear experimental technologies to identify particles and radiation, principles of accelerators, beam optics, vacuum technology, nuclear electronics, digital pulse processing, data acquisition and detector technology. After completing this course students will be equipped with advanced skill and understanding required to perform nuclear and particle physics experiment with accelerator facilities exists in the world. It will further provide knowledge of nuclear techniques applied in different field for societal needs. Knowledge of nuclear detectors and the interaction of radiation with matter will also be imparted to the students.

LCC9. Elementary Particle Physics

Students will extend the understanding of fundamental forces by studying nuclear and weak forces. Understanding of nuclear structure and reaction dynamics will provides knowledge of nuclear-nucleon interaction. Students will also understand particle physics through this Course. Relativistic dynamics, esp. in the context of multiparticle interactions. The role of symmetries, both discrete and continuous in understanding particle interactions and their classification. SU(3) and quark model. Based on observables, drawing up a theory of particle interactions. Fermi theory of beta decay.

LCC10. Condensed Matter Physics

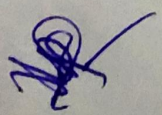
The students should be able to elucidate the important features of solid state physics by covering crystal lattices and binding, lattice dynamics, band theory of solids and semiconductors. Thestudents should able to elucidate the important features of advanced topics in solid state physics by covering dielectric and optical properties, magnetism, and superconductivity.

LCC11(b). Advanced Electronics -I

A student of this course is expected to have enhanced awareness of the constant evolution in the physics of semiconductor devices and materials, the basic device design along-with the standard technological procedures adapted in the semiconductor industry for IC manufacturing and mass production of semiconductor devices. Students are expected to perform & learn through real-time data by using Practical set ups such as Operational Amplifiers, Power Supply, Converters, IC timer 555, Diac/Triac, Fiber optic communication & transistor biasing.

LCC12(b). Advanced Electronics -II

Students will have learnt the basic concepts involved with analog to digital conversion of signals, the coding techniques and basic mathematical tools/techniques used for processing of digital signals, signal transmission and high speed data transfer in modern day 81 communication systems and networks. Students are expected to learn AM, FM and Fiber-Optic Modulation Techniques utilized in electronic and Fiber-optic communication systems



LCC13. Electrodynamics

A student having taken this course is expected to have a fair degree of familiarity with tensors and tensorial formulation of relativity and electrodynamics. In addition, s/he is expected to be 27 able to solve problems of motion of charged particles in various field formations as well as find the radiation patterns from different time varying charge and current densities

LEC1. Communication Electronics

Define various fundamental aspects of the communication systems. Understand various modulation & demodulation techniques used in communication systems. Interpret various radio transmitter & receiver circuits and different types of noise in communication systems. Analyze various parameters such as modulation index, channel capacity, transmission efficiency, S/N ratio etc. used in communication systems. Understand working of various modes such as mono/multi-mode and characteristics like scattering, dispersion, bending etc. of optical communication system.

LEC3. Digital Electronics and Computer Architecture

A student of this course is expected to be able to understand the design and functional performance of electronic circuits using various semiconductor devices. In addition, the student will understand the functional properties and characteristics of semiconductor devices in analog & digital circuits using analog and digital signals.

LCC14(a-e). Advanced Electronics –III

Students are expected to learn about Transmission and Reception of TV signals, working of microprocessor and types of signal noise & its analysis. Students are expected to perform & learn through real-time data by using Practical set ups such as Amplifiers, Flip Flops, Multiplexers, Microwave Trainer, VLSI Trainer & SCR.

LCC15(a-e). Advanced Electronics -IV

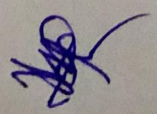
Students will able to solve problems based on different number system such as Binary, octal and Hexa decimal number and their interconversion and basic knowledge of Logic gates, Adders, Multiplexer and Demultiplexer, Encoders and Decoders. Students will be able to understand the basic electronic equipment such as FLIP-FLOPS, Shift, Counters and combination of modular counters. They will get depth knowledge about the Differential Amplifier: DC and AC analysis, CMRR Inverting and Non-inverting, Block Diagram of operational amplifier, Operational amplifiers with negative feedback.

LEC2 . Introduction to Nanoscience and Nanotechnology

The learner will be able to comprehend the significance of nanoscience and nanotechnology and its applications in various fields. The students will have in-depth knowledge on the behavior of various class of materials in reduced dimensions. The students will get a better understanding of the concepts studied by them in the theory course and correlate with experimental observations. In addition, the students are exposed with thermal, microscopic, electrical and spectroscopic methods of characterization of nanomaterials.

DC. Dissertation

After the completion of the course the students will be able to –



1. Demonstrate knowledge and understanding of physics across topic boundaries
2. Able to effectively communicate scientific information through written reports, research papers and oral presentation to other scientific audiences.
3. Students will be prepared for continuous learning and professional development, staying update with advancements in botanical science and related fields.
4. Demonstrate appropriate tools, references and writing skills for report writing.
5. Evaluate the methods and knowledge to solve the specific research problem.
6. Engage with current research at the forefront of the discipline
7. Produce a clear and coherent report of a standard suitable for distribution to stakeholders

Head of the Department

Principal