PANSKURA BANAMALI COLLEGE(AUTONOMOUS)
DEPT. OF PHYSICS

Programme: *B.Sc. (Physics Hons.)*

PROGRAMME SPECIFIC OUTCOMES (PSO):

The students graduating B. Sc. Honours with Physics should

PSO1 Acquire

(i) a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science, etc.

(ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service;

(iii) skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.

PSO2 Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.

PSO3 Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.

PSO4 Plan and execute Physics-related experiments or investigations, analyse and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.

PSO5 Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent

investigation of Physics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Physics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.

PSO6 Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsi fying or misrepresenting data or committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

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COURSE OUTCOMES (COS): B.Sc. (Physics Hons.)

Semester	Course	Course Title	Course Outcomes (COS)
I	CC - I	Mathematical Physics-I	The emphasis of this course is on applications in solving problems of different physical systems of interest. The students are to be examined entirely on the basis of problems, seen and unseen. Added with this, the students will be taught core concepts of Python Computation which will be applied to numerical solutions of mathematical problems.
	CC - II	Mechanics	The aim of this course is to study various Classical dynamical systems. Students will learn different key concepts involving the description of a mechanical system by go through problem solving and laboratory experiments.
II	CC - III	Electricity & Magnetism	This course offers fundamental concepts of electricity and magnetism. Students learn the ideas through problem solving and laboratory experiments. Applications involve electrical and magnetic properties of matter, electrical networks and devices.
	CC- IV	Waves and Optics	In this course, students learn about the basic concepts over the physical properties of light waves. In laboratory, they get to study various optical phenomena.
III	CC - V	Mathematical Physics–II	This course involves some advanced topics of mathematical methods which are applicable to various branches of physics. They will also learn numerical methods and advanced computing techniques with Python.
	CC - VI	Thermal Physics	Idea of this course is to understand the thermodynamic behaviours of matter and to understand the molecular systems from first principles. Laboratory experiments have been designed to measure some thermal properties
	CC - VII	Digital Systems and Applications	This course is to elucidate the concepts behind digital electronic systems and basic understanding over Computer hardware. Laboratory experiments are designed over various logic based electronic circuits digital devices.
	SEC1	Electrical Circuits and Network Skills	This course is designed to develop necessary skills for practical applications of electrical circuit designs, instruments and real-life machineries.

Semester	Course	Course Title	Course Outcomes (COS)
IV	CC-VIII	Mathematical Physics–III	The idea of this course is to teach some advanced mathematical concepts and applications of them into physics. The numerical methods and algorithms related to the same ideas are developed in order to compute through Python.
	CC-IX	Modern Physics	The idea behind this course is to understand the empirical approach to understand atomic and molecular systems. Some classic and some modern experiments are set to elucidate the ideas behind the quantum properties of matter.
	CC-X	Analog Systems & Applications	Students will learn about the principles and properties of analog electronic systems and their applications. Different laboratory techniques are taught and relevant experiments are performed to supplement the learning.
	SEC2	Computer Applications	This course is designed to impart basic knowledge on computer systems and to develop skills on some computer applications like word processing, system management, data handling and visualization.
V	CC-XI	Quantum Mechanics and Applications	This course introduces the concepts of Quantum theory and calculations over simple physical systems. Special numerical methods are taught to solve simple quantum mechanical problems and visualize.
	CC -XII	Solid State Physics	This course is based on the fundamental ideas over the structures and properties of solid matters. Laboratory experiments are designed to understand the behaviours of solid materials and related things.
	DSE-I	Classical Dynamics	This course is to understand some advanced ideas and methods of Classical Mechanical systems. In addition, this includes the concepts and some simple applications of two other related subjects.
	DSE2- II	Nuclear and Particle Physics	From this course students will learn about the nature of atomic nucleus, their interactions, and the nature of the basic constituents of matter and radiation. Students will learn and aware about nuclear energy and its applications.

Semester	Course	Course Title	*Course Outcomes (COS)*
VI	CC-XIII	Electromagnetic Theory	This course enriches the students about the electromagnetic nature of light and the interaction of light with matter. Students will perform various experiments to determine the behavior of light in a medium. They also determine few fundamental constants in laboratory.
	CCXIV	Statistical Mechanics	Students will learn about the behavior of macroscopic system by studying the statistical and probabilistic theory of large microscopic entities. Students will solve high level scientific problems using Python.
	DSE - III	Communication Electronics	Students learn about the core theories of communication technologies and navigation systems. In laboratory students will acquire hands-on experience on practical communication.
	DSE - IV	Experimental Technique	In this course students will learn about the measurement procedures of hands-on experiments. They will learn to collect data, analysis of data and result finding in laboratory.

Sem.	Course	Course Title	*Course Outcomes (COS)*
I	Generic Elective (GE)	Thermal Physics and Statistical Mechanics	Idea of this course is to understand the thermodynamic behaviours of matter and to understand the molecular systems from first principles. Laboratory experiments have been designed to measure some thermal properties
II	GE	Mechanics	The aim of this course is to study various Classical dynamical systems. Students will learn different key concepts involving the description of a mechanical system by go through problem solving and laboratory experiments.
III	GE	Electricity, Magnetism and EM Theory	This course offers fundamental concepts of electricity and magnetism. Students learn the ideas through problem solving and laboratory experiments. Applications involve electrical and magnetic properties of matter, electrical networks and devices.
IV	GE	Waves and Optics	In this course, students learn about the basic concepts over the physical properties of light waves. In laboratory, they get to study various optical phenomena.
	GE	Modern Physics	The idea behind this course is to understand the empirical approach to understand atomic and molecular systems. Some classic and some modern experiments are set to elucidate the ideas behind the quantum properties of matter.

Programme: *B.Sc. (Physics Gen.)*

PROGRAMME SPECIFIC OUTCOMES (PSO):

The students graduating B. Sc. with Physics should

PSO1 Acquire

(i) The fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics like Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, and its linkages with related disciplinary areas / subjects like Chemistry, Mathematics.

(ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service;

(iii) skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.

PSO2 Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.

PSO3 Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.

PSO4 Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent investigation of Physics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct

technical language related to Physics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.

PSO5 Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii)the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues.

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COURSE OUTCOMES (COS): B.Sc. (Physics Gen.)

Course	**Course Title**	***Course Outcomes (COS)***
Discipline specific core courses (DSC)	Thermal Physics and Statistical Mechanics	Idea of this course is to understand the thermodynamic behaviours of matter and to understand the molecular systems from first principles. Laboratory experiments have been designed to measure some thermal properties
	Mechanics	The aim of this course is to study various Classical dynamical systems. Students will learn different key concepts involving the description of a mechanical system by go through problem solving and laboratory experiments.
	Electricity, Magnetism and EM Theory	This course offers fundamental concepts of electricity and magnetism. Students learn the ideas through problem solving and laboratory experiments. Applications involve electrical and magnetic properties of matter, electrical networks and devices.
	Waves and Optics	In this course, students learn about the basic concepts over the physical properties of light waves. In laboratory, they get to study various optical

Course	**Course Title**	***Course Outcomes (COS)***
Discipline specific elective courses (DSE)	Modern Physics	The idea behind this course is to understand the empirical approach to understand atomic and molecular systems. Some classic and some modern experiments are set to elucidate the ideas behind the quantum properties of matter.
	Digital and Analog circuits and Instrumentation	This course is to elucidate the concepts behind digital electronic systems. Students will learn about the principles and properties of analog electronic systems and their applications. Laboratory experiments are designed over various logic based electronic circuits, analog and digital devices.
	Nuclear and particle Physics	From this course students will learn about the nature of atomic nucleus, their interactions, and the nature of the basic constituents of matter and radiation. Students will learn and aware about nuclear energy and its applications.

Course	**Course Title**	***Course Outcomes (COS)***
Skill Enhancement Courses (SEC)	Electrical Circuits and Network Skills	This course is designed to develop necessary skills for practical applications of electrical circuit designs, instruments and real-life machineries.
	Basic Instrumentation skill	The purpose of this course is to develop the skills to handle and design various electronic and electrical devices.
	Renewable energy and Energy Harvesting	Alternative energy sources are the need of this era. This course aims to provide a fair understanding on the alternative and sustainable energy sources. This will help the students to build up models of energy sources of the future Earth.
	Radiation Safety	The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments listed below the course are to be done in continuation of the topics
	Computer Applications	This course is designed to impart basic knowledge on computer systems and to develop skills on some computer applications like word processing, system management, data handling and visualization.

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Programme: *M.Sc. (Physics)*

COURSE OUTCOMES (COS):

Semester- I		
Course	**Course Title**	***Course Outcomes (COS)***
PHS 101	Methods of Mathematical physics-I	This course is intended to give an exposition over some special mathematical topics that will serve as essential background and knowledge on the advanced theoretical physics course in this semester.
	Classical Mechanics	As the foundation of Classical Mechanics is built up through the UG courses, these special topics in this area are chosen to give a solid understanding and applications over the fields based on classical ideas.
PHS 102	Quantum Mechanics-I	The idea of this course in Quantum Mechanics is to revisit the foundational principles and mathematical tools to treat this subject.
	Solid State Physics-I	The idea of this course in Solid State Physics is to revisit the structure and properties of crystalline solids. The classical ideas of understanding the atomic picture of Solid State matters are revisited.
PHS 103	Electrodynamics	This course is intended to give a fair idea over matter and radiation and their interactions. The course covers some fundamentals of plasma state. The treatments are also given over relativistic ideas for high speed charged particles
	Material Preparation and characterization	The techniques involving the preparations of various forms of solid materials and the measurements to characterize the samples are essential parts of experimental Condensed matter physics. This course deals with the ideas behind all those aspects
PHS 104	Analog Electronics-I	This course serves as the basis of physical principles of electronic circuits, wave propagation and communication through wave signals
	Digital Electronics-I	This course serves the fundamental principles of various digital circuits, electronic processors and logical operations
PHS 105	Electronics Practical-I	These laboratory experiments are set up to supplement the fundamental knowledge behind the digital electronic circuits and principles
PHS 106	Computer Practical	This course serves as the foundation of scientific computation with Python. Fundamentals of Python programming will be taught to write algorithm-based codes. Emphasis will be given on Numerical Methods and Special applications in Physics with Python.

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Semester- II		
Course	**Course Title**	***Course Outcomes (COS)***
PHS 201	Quantum Mechanics-II	This part deals with some advanced topics in Quantum Mechanics such as perturbation theory and Relativistic applications
	Methods of Mathematical physics-II	This course includes some advanced topics in Mathematical Methods. The applications of these topics will serve as the advanced theoretical topics that are planned to be taught.
PHS 202	Solid State Physics-II	This is an advanced course on Solid State Physics. The theoretical understanding of Superconductivity and the dielectric properties will be taught in this.
	Semiconductor Physics	This course on the basic principles of Semiconductor physics serves as the foundation of Electronics and Solid state matters.
PHS 203	Analog Electronics-II	This course is on the applications of Analog electronics. The principles of Network analysis and Transmission lines are taught in this.
	Digital Electronics-II	This part of digital electronics serves the foundations and workings of digital processors, computer chips and the modern computer organizations.
PHS 204	Concepts of Physics: Inventions and applications (CBCS)	The idea of this course is to give an idea of History of science and Practical applications of physics in daily life from Kitchen to Health Industry. The syllabus traces some important inventions, entertains the common and fundamental questions on the world around us
PHS 205	Electronics Practical-II	The lab experiments are to deal with microprocessors and other electronic circuitry based on various chips.
PHS 206	Advance Practical-I	Some advanced level experiments are set up based on the ideas of Modern Physics, Solid state and Nuclear Physics.

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Semester- III		
Course	**Course Title**	***Course Outcomes (COS)***
PHS 301	Quantum Mechanics-III	This course deals with some advanced topics in the theory and applications of Quantum Mechanics.
	Statistical Mechanics-I	This course first introduces the essential ideas of Classical Statistical Mechanics. Then the last module deals with the foundations of Quantum Statistical Mechanics, density matrix approach and its applications.
PHS 302	Molecular Spectroscopy and Laser Physics	This course is intended to provide the fundamental ideas behind various spectroscopy. The origins and physical aspects of Microwave, Infra-red, Visible and Ultraviolet spectroscopy will be well explained. The last part deals with principles and techniques of Laser.
	Nuclear Physics-I	This course deals with fundamental aspects of Nuclear Physics. Stability and Nuclear decay will be discussed through the modules.
PHS 303	Applied electronics-Analog (Special Paper-I)	This course deals with some special applications of Analog Electronics and devices.
	Applied electronics-Digital (Special Paper-I)	This course deals with some special applications of Digital Electronics and devices, converters and communications.
PHS 304	Science of Universe (CBCS)	This special course is designed to give a fair idea about the fundamental ideas of Astrophysics. The question of the existence of the Universe that we observe, from planets and stars to galaxies, are well addressed through the modules.
PHS 305	Advance Practical - II	Some advanced level experimental settings are designed in the areas of Condensed Matter and Nuclear Physics.
PHS 306	Applied electronics Practical (Special Paper-I)	This course is on the design and construction of various electronic circuits and applications

Semester- IV		
Course	**Course Title**	***Course Outcomes (COS)***
PHS 401	Particle Physics	This course is introduced to give fundamental ideas of Particle physics and phenomenology.
	Statistical Mechanics-II	This advanced course deals with the foundation of Quantum Statistical Mechanics and applications. Emphasis is given on the theory of Phase transition and critical phenomena.
PHS 402	Nuclear Physics-II	One part of this advanced course on Nuclear Physics deals with the nuclear models and nuclear reactions. The other part is on the practical applications on Neutron physics and Reactor Physics. Some fundamentals of High energy particle physics will also be discussed.
	Quantum Field Theory	This course is intended to give an idea of Field theoretic approach to understand High energy physics and deals with some essential theorems and aspects of Standard model.
PHS 403	Semiconductor Devices	This course deals with the principles of semiconductor devices that are essential part of modern-day experiments and measurements
	Applied Optics	Ideas behind some advanced areas and applications like Fibre optics, Holography techniques, Non-linear Optics and Photonics will be dealt in this course.
PHS 404	Applied electronics-Analog (Special Paper-II)	Advanced electronics on Practical applications in devices and instruments and in modern technology
	Applied electronics-Digital (Special Paper-II)	Modulation, demodulation, communication through signals, Signal and Data processing - all these are part of this special course in Electronics. Also, the usage of Microprocessors and the logical programming are part of this course
PHS 405	Applied electronics Practical (Special Paper-II)	This course is on the design and construction of various electronic circuits which have various applications.
PHS 406	Project, Seminar and Grand viva	Students learn to formulate problems, design a framework to solve it in laboratory and to analyse the outputs. They will gain exposure on seminar presentation, will interact with the subject experts through viva vocation. This course will help the students to prepare them in future research