Chanda Shikshan Prasarak Mandal's
Janata Mahavidyalaya, Chandrapur
Learning Outcomes for Physics Undergraduate Program

PSO'S

(B.Sc. with Physics as one subject)

Upon successful completion of B.Sc. with Physics as one of the subjects, graduates are expected to:

PSO1: Develop a conceptual understanding of principles in physics. They will be able to demonstrate knowledge on selected topics of Newtonian mechanics, Electricity and Magnetism, Wave mechanics, Thermodynamics and Statistical Mechanics, Solid State Physics, Optics, Quantum Mechanics, Relativity, Nuclear Physics, Nanoscience and Technology and Biophysics, and be able to apply this knowledge to analyze a broad range of physical phenomena.

PSO2: The student will demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems in physics.

PSO3: Students will develop state-of-the-art laboratory skills. Students will be able to design and conduct experiment (or series of experiments) demonstrating their understanding of the scientific method and processes. They will be able to demonstrate an understanding of the analytical methods required to interpret and analyze results and draw valid conclusions as supported by their data.

PSO4: Graduates in physics will be able to demonstrate written and oral communication skills in communicating physics-related topics and will prove that they can think critically and work independently.

PSO5: Students will develop an understanding of the impact of physics and science on society.

COURSES

Semester I

Code USPHT01 **Contents: Mechanics and Relativity**

Code USPHT02 **Contents: Gravitation, Oscillation and Properties of Matter**

Code USPHP01 **Contents: 10 experiments**

Semester II

Code USPHT03 **Contents: Vector Analysis and Electrostatics**

Code USPHT04 **Contents: Magneto statics and Electromagnetic Waves**

Code USPHP02 **Contents: 10 experiments**

Semester III

Code USPHT05 **Contents: Thermal Physics**

Code USPHT06 **Contents: Radiation and Statistical Mechanics**

Code USPHP03 **Contents: 10 experiments**

Semester IV

Code USPHT07 **Contents: Wave, Acoustics and LASER**

Code USPHT08 **Contents: Optical Physics**

Code USPHP04 **Contents: 10 experiments**

Old Semester system

Semester V: Paper I (5S-PHY 501): Statistical Physics and Relativity
Paper II (5S-PHY 502): X-rays and Solid State Physics,
Practical (5S- PHY 503)
Semester VI: Paper I (6S-PHY 601): Nuclear Physics, Nanotechnology and Biophysics
Paper II (6S-PHY 602): Fibre Optics, Communication and Digital Electronics
Practical (6S- PHY 603)

Semester V (CBCS)

Code USDSEPHT09 Contents: Elements of Modern Physics

Code USDSEPHT10 Contents: Solid State Physics

Code USDSEPHT11 Contents: Medical Physics

Code USDSEPHT12 Contents: Mathematical Physics

Code USDSEPHP05 Contents: 10 Experiments

Code USSECPH01 Contents: Physics Workshop Skill

Code USSECPH02 Contents: Electrical Circuits and Network Skills

Semester VI (CBCS)

Code USDSEPHT13 Contents: Nuclear and Particle Physics

Code USDSEPHT14 Contents: Digital & Analog Circuits and Instrumentation

Code USDSEPHT15 Contents: Embedded system: Introduction to Microcontrollers

Code USDSEPHT16 Contents: Quantum Mechanics

Code USDSEPHP06 Contents: 10 experiments

Code USSECPH03 Contents: Basic Instrumentation Skills

Code USSECPH04 Contents: Renewable Energy and Energy Harvesting

COURSE OUTCOMES

Semester I Paper I Code USPHT01 Contents: Mechanics and Relativity

After completion of this course students will gain -

CO1: an understanding of Newton's Laws of motion and its applications and in general a core idea about Newtonian mechanics.

CO2: an understanding in momentum, energy, collision and its applications.

CO3: an understanding in dynamics of rigid body and rotational motion.

CO4: an understanding in special theory of relativity, negative results of Michelson Morley experiments and its impact.

CO5: problem solving skills, improve mathematical proficiency and logical reasoning.

Semester I paper II Code USPHT02 Contents: Gravitation, Oscillation and Properties of Matter

After completion of this course students will gain -

CO1: an understanding of Gravitation and related laws, motion of satellite and its applications and GPS.

CO2: an understanding of Oscillations and types of Oscillations and their related terms.

CO3: an understanding of Elastic behavior of substances and working of Torsional Pendulum.

CO4: an understanding of different properties of matter like Viscosity and surface tension and their applications to phenomenon like lift of airplane and rise of water in plants.

CO5: Learn problem solving skills; improve mathematical proficiency and logical reasoning.

Semester I Practical Code USPHP01 Contents: 10 experiments

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on mechanics, properties of matter and gravitation.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester II Paper I Code USPHT03 Contents: Vector Analysis and Electrostatics

After completion of this course students will gain -

CO1: an understanding of vectors and their application in studying electrostatics.

CO2: an understanding of static electricity, its origin and phenomenon related to it.

CO3: an understanding of Gauss's theorem and its applications and electric potential.

CO4: an understanding of Dielectrics, capacitors and their applications.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester II Paper II Code USPHT04 Contents: Magneto statics and Electromagnetic Waves

After completion of this course students will gain -

CO1: an understanding of magneto statics, related laws and magnetic properties of materials.

CO2: an understanding of laws of electromagnetic induction, construction and working of transformer and its applications.

CO3: an understanding of Maxwell's equations and Electromagnetic wave propagation, formula for speed of light.

CO4: an understanding of steady and alternating electric currents and different types of circuits.

CO5: Students will gain logical and mathematical problem solving skills through the numerical on all the topics.

Semester II Practical: Code USPHP02 Contents: 10 experiments

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on electricity and magnetism.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester III Paper I Code USPHT05 Contents: Thermal Physics

After completion of this course students will gain -

CO1: an understanding of kinetic theory of gases and transport phenomena in physics and their applications.

CO2: an understanding of basic concepts in thermodynamics i.e. flow of heat and energy, zeroth law and internal energy and specific heat.

CO3: an understanding of 2^{nd} and 3^{rd} law of thermodynamics, the usefulness of these laws in explaining the physical behavior of a system when it responds to the flow of heat or thermal energy and concept of entropy and its usefulness. Students will get to know about heat engines and their applications.

CO4: an understanding of thermodynamic potentials, concept of latent heat, Joule-Thomson effect and its applications.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester III Paper II Code USPHT06 Contents: Radiation and Statistical Mechanics

After completion of this course students will gain -

CO1: an understanding of radiation as a mode of heat transfer, black body radiation and radiation laws.

CO2: an understanding of use of probability theory in physics and statistical basis of thermodynamics.

CO3: an understanding of fundamental concepts in statistical mechanics and theory of Maxwell-Boltzmann statistics and its application.

CO4: an understanding of theory of BE and FD statistics and their applications.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester III Practical Code USPHP03 Contents: 10 experiments

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on Thermodynamics, statistics and radiation physics.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester IV Paper I Code USPHT07 Contents: Wave, Acoustics and Laser

After completion of this course students will gain -

CO1: an understanding of superposition of two harmonic oscillators, phenomenon of Beats, Lissajous figures and their applications.

CO2: an understanding of wave motion, Fourier theorem and its applications.

CO3: an understanding of ultrasonic waves- its properties and applications, basics of acoustics, music and acoustics of building.

CO4: an understanding of LASER- its properties, types, construction and working of different types of lasers and their applications in real life.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester IV Paper II Code USPHT08 Contents: Optical Physics

After completion of this course students will gain -

CO1: an understanding of basic concepts of light waves, phenomenon of interference, interference in thin films and applications.

CO2: an understanding of Newton's rings experiment and its applications and Michelson Interferometer and its applications.

CO3: an understanding of phenomenon of diffraction, its types, and applications.

CO4: an understanding of phenomenon of polarization, related laws, Nicol prism- its applications and polarization theory.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester IV Practicals Code USPHP04 Contents: 10 experiments

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on Sound, LASER, Acoustical physics and Optics.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Old Semester system

Semester V: Paper I (5S-PHY 501): Statistical Physics and Relativity
Paper II (5S-PHY 502): X-rays and Solid State Physics,
Practical (5S- PHY 503)
Semester VI: Paper I (6S-PHY 601): Nuclear Physics, Nanotechnology and Biophysics
Paper II (6S-PHY 602): Fibre Optics, Communication and Digital Electronics
Practical (6S- PHY 603)

Semester V: Paper I (5S-PHY 501): Statistical Physics and Relativity
After completion of this course students will gain -

CO1: an understanding of use of probability theory in physics and statistical basis of thermodynamics.

CO2: an understanding of fundamental concepts in statistical mechanics and theory of Maxwell-Boltzmann statistics and its application.

CO3: an understanding of theory of BE and FD statistics and their applications.

CO4: an understanding in special theory of relativity, negative results of Michelson Morley experiments and its impact.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Paper II (5S-PHY 502): X-rays and Solid State Physics,
After completion of this course students will gain -

CO1: an understanding of X-rays- its production and applications

CO2: an understanding of basics of solid state physics, crystal structure- its types, Braggs law and its application.

CO3: an understanding of Bonding between pair of atoms- types of bonding, magnetic properties of materials.

CO4: an understanding of free electron theory and Band theory of solids.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Practical (5S- PHY 503)
After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on Statistical physics, X-rays and solid state physics.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester VI: Paper I (6S-PHY 601): Nuclear Physics, Nanotechnology and Biophysics
After completion of this course students will gain -

CO1: an understanding of basics of nuclear physics, interaction of charged particles with matter, types of charged particle counters.

CO2: an understanding of structure of nuclei and its theories, nuclear fusion, theory of alpha decay.

CO3: an understanding of basics of Nanoscience and nanotechnology, nanomaterials and methods of synthesis and characterization of nanomaterials.

CO4: an understanding of applications of nanotechnology, concepts in biophysics and principles of ECG and EEG.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Paper II (6S-PHY 602): Fibre Optics, Communication and Digital Electronics
After completion of this course students will gain -

CO1: an understanding of theory of optical fibers and their applications.

CO2: an understanding of AM, FM and PM communication and their applications

CO3: an understanding of number system and digital logic gates and their applications.

CO4: an understanding of Multivibrators, Flip flops, Counters and registers in digital electronics.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Practical (6S- PHY 603)

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on Statistical physics, X-rays and solid state physics.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester V (CBCS) Elective Paper I Code USDSEPHT09 Contents: Elements of Modern Physics

After completion of this course, students will gain -

CO1: an understanding of failure of classical mechanics and basic formulation of quantum mechanics.

CO2: an understanding of Schrodinger's wave equation and it's applications.

CO3: an understanding of nucleus and its stability and basics of radioactivity**.**

CO4: an understanding of process of beta decay, gamma decay and fission fusion reactions and their applications.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester V (CBCS) Elective Paper II Code USDSEPHT10 Contents: Solid State Physics

After completion of this course students will gain -

CO1: an understanding of basics of solid state physics, crystal structure- its types, Braggs law and its application.

CO2: an understanding of Dia-, Para-, Ferri- and Ferromagnetic Materials and their theories.

CO3: an understanding of dielectric properties of materials.

CO4: an understanding of elements of Band theory of solids and superconductivity.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester V (CBCS) Elective Paper III Code USDSEPHT11 Contents: Medical Physics

After completion of this course students will gain -

CO1: an understanding of mechanics of body movements and energy consumption in body.

CO2: an understanding of the acoustics of a body.

CO3: an understanding of physics of diagnostics and therapeutic systems and radiation physics.

CO4: an understanding of radiation detectors and medical imaging.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester V (CBCS) Elective Paper IV Code USDSEPHT12 Contents: Mathematical Physics

After completion of this course students will gain -

CO1: an understanding of Fourier Series and its applications.

CO2: an understanding of Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations.

CO3: an understanding of Some Special Integrals like Beta and Gamma Functions and Relation between them and partial differential equations and their solution methods.

CO4: an understanding of complex analysis**.**

CO5: an understanding of problem solving methods.

Semester V (CBCS) Practicals Code USDSEPHP05 Contents: 10 Experiments

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on any two of the discipline specific elective papers.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester V (CBCS) Skill Enhancement Course Code USSECPH01 Contents: Physics Workshop Skill

After completion of this course students will gain -

CO1: an understanding of different types of measurement system.

CO2: an understanding of different electrical and electronic instruments like multimeter, oscilloscopes, timer circuits etc also learn about soldering of electrical circuits.

CO3: an understanding of mechanism of prime movers (machines).

CO4: an understanding of designing of various electrical circuits on bread boards.

CO5: will gain practical training on physics lab skills.

Semester V (CBCS) Skill Enhancement Course Code USSECPH02 Contents: Electrical Circuits and Network Skills

After completion of this course students will gain -

CO1: an understanding of electricity principles and electrical circuits.

CO2: an understanding of electrical drawings, symbols, generators and transformers.

CO3: an understanding of electrical motors, solid state devices like Diodes, Transistors, Thermisters and LED, Diode and rectifiers and their uses.

CO4: an understanding of electrical safety methods through fuses and circuit breakers.

CO5: will gain practical training on electrical circuits and network skills.

Semester VI (CBCS) Elective Paper I Code USDSEPHT13 Contents: Nuclear and Particle Physics

After completion of this course students will gain -

CO1: an understanding of general properties of nuclei.

CO2: an understanding of different types of nuclear models.

CO3: an understanding of nuclear reactions and interaction of radiation with matter.

CO4: an understanding of different types of radiation detectors and particle accelerator.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester VI (CBCS) Elective Paper II Code USDSEPHT14 Contents: Digital & Analog Circuits and Instrumentation

After completion of this course students will gain -

CO1: an understanding of digital circuits and their applications.

CO2: an understanding of solid state devices and their applications.

CO3: an understanding of bipolar junction transistors, their characteristics and voltage amplifiers.

CO4: an understanding of Operational amplifiers and their applications.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester VI (CBCS) Elective Paper III Code USDSEPHT15 Contents: Embedded system: Introduction to Microcontrollers

After completion of this course students will gain -

CO1: an understanding of embedded systems and general purpose computer systems and microprocessors.

CO2: an understanding of architecture and overview of 8051 microcontroller.

CO3: an understanding of assembly language programming of 8051 microprocessor.

CO4: an understanding of Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging, and design and development of embedded systems.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester VI (CBCS) Elective Paper IV Code USDSEPHT16 Contents: Quantum Mechanics

After completion of this course students will gain -

CO1: an understanding of Time dependent & Time independent Schrodinger equation and dynamical evolution of a quantum state; Eigen functions and eigen values.

CO2: an understanding of boundary conditions, application to one-dimensional problem-square well potential and Quantum mechanics of simple harmonic oscillator.

CO3: an understanding of quantum theory of hydrogen like atoms.

CO4: an understanding of quantum states of atoms in electric and magnetic fields.

CO5: logical and mathematical problem solving skills through the numerical on all the topics.

Semester VI (CBCS) Practical Code USDSEPHP06 Contents: 10 experiments

After completion of this course -

CO1: Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes based on any two of the discipline specific elective papers.

CO2: Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

Semester VI (CBCS) Skill Enhancement Course Code USSECPH03 Contents: Basic Instrumentation Skills

After completion of this course students will gain -

CO1: an understanding of basics of measuring instruments and multimeter.

CO2: an understanding of working of electronic voltmeter and its use.

CO3: an understanding of cathode ray oscilloscope and it's working.

CO4: an understanding of design and working of digital instruments.

CO5: will gain practical training on instrumentation skills.

Semester VI (CBCS) Skill Enhancement Course Code USSECPH04 Contents: Renewable Energy and Energy Harvesting

After completion of this course students will -

CO1: learn about fossil fuels and alternate sources of energy.

CO2: learn about solar energy and its importance.

CO3: learn about wind energy harvesting and geothermal energy.

CO4: learn about harvesting ocean energy and hydro power energy.

CO5: gain practical training on renewable energy and energy harvesting.