FACULTY OF SCIENCES

SYLLABUS

of

Master of Science (Physics)

(Semester: I -IV)

(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Session: 2022-24

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Program Specific Outcomes: M.Sc. (Physics)

After the successful completion of the program, the student will be able to do the following

PSO 1. The Master of Science in Physics program provides the detailed functional knowledge of the fundamental theoretical concepts and experimental methods of physics. It will help the candidate to enhance her general competence, and analytical skills on an advanced level, and will prepare her according to the jobs needed in education, research or public administration.

PSO 2. The student will have the knowledge of the topics of the research conducted by researchers at the Department of Physics, and knowledge of a well-defined area of research within physics.

PSO 3. The student will have the understanding of the basic concepts of classical mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.

 PSO 4. The student will learn to carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, spectroscopy, lasers and electronics.

PSO 5. The work course of project and assignment will give the students special expertise within one of the research areas represented at the Department of Physics which will result in some research experience within a specific field of physics, through a supervised project.

PSO 6. The student will be able to critically apply the knowledge gained during the course to scientific models and solve problems in the areas of electrodynamics, quantum mechanics, classical mechanics, statistical mechanics, and advanced mathematical methods.

PSO 7. General competence The candidate will be able to

• Understand the role of physics in society and know the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.

• Gather, assess, and make use of new information.

Master of Science (Physics)
SEMESTER-I

(SESSION 2022-23)

COURSE CODE: MPHL-1391
ANALOG AND DIGITAL ELECTRONICS

COURSE OUTCOMES

After passing this course the student will be able to:

CO 1. Understand the concept of Electronic devices (MOSFET, UJT, SCR) and their applications.
CO 2. Demonstrate the concept of Electronic circuits: Operational Amplifier and its applications
CO 3. Use concept of Digital Principles for electronic conversions.
CO 4. Demonstrate application of sequential circuits.

Master of Science (Physics) SEMESTER-I
(SESSION 2022-23)

COURSE CODE: MPHL-1392
MATHEMATICAL PHYSICS

COURSE OUTCOMES OF MATHEMATICAL PHYSICS

On completion of this course a student will be able to:

CO 1. Understand and use, advanced mathematical methods and theories on various mathematical and physical problems.

CO 2. Identify different special mathematical functions.

CO 3. Understand Cartesian (X, Y, Z), Spherical polar (r, θ, φ) and Cylindrical (ρ, φ, z) co-ordinate systems and their transformation equations.

CO 4. Solve partial differential equations with appropriate initial or boundary conditions with Green function techniques

CO 5. Have confidence in solving mathematical problems arising in physics by a variety of mathematical techniques

Master of Science (Physics)
Semester-1
(SESSION 2022-23)

COURSE CODE: MPHL-1393

CLASSICAL MECHANICS

COURSE OUTCOMES

CO 1. After the students complete this course they will be familiar with aspects of Classical Mechanics such as Lagrangian and Hamiltonian formulation, particle in central potentials, rigid body motion. These will form the essential background for other courses such as Quantum Mechanics, Electrodynamics and High Energy Physics that students would learn in the subsequent semesters.

CO 2. Students will learn the importance of Lagrangian and Hamiltonian mechanics over the Newtonian mechanics and be able to solve the complex problems on the equations of motion by applying these two techniques.

CO 3. Having successfully completed this course, students will be able to demonstrate knowledge and understanding of orbit problems using the conservation of angular momentum and total energy.

CO 4. Students will also be able to demonstrate understanding of rigid body motion using Euler theorem and Euler angles, which will help them to solve advanced problems pertaining to celestial mechanics.

Master of Science (Physics)
SEMESTER-I
(SESSION 2022-23)

COURSE CODE: MPHL-1394
COMPUTATIONAL TECHNIQUES

COURSE OUTCOMES

On completion of this course a student will be able to:

CO 1. The very first outcome of the course is having knowledge about various programming languages, their need in research and development.

CO 2. The introduction to MATLAB gives a basic knowledge about syntaxes and procedures used in MATLAB to solve various mathematical problems.

CO 3. Understanding of interpolation of data from an experimental data with equal and unequal intervals.

CO 4. The students will be able to solve integration and differentiation numerically by using various methods.

CO 5. Understanding of various numerical methods to solve polynomial and transcendental equations gives an insight of working of these methods.

Master of Science (Physics)
SEMESTER-I
(SESSION 2022-23)

COURSE CODE: MPHP-1395
ELECTRONICS LAB

COURSE OUTCOMES

After successfully completion of this lab student will be able to

CO1: Characterise and understand the applications of DIAC, TRIAC, UJT and SCR.

CO2: Investigate characteristics of MOSFET and Multivibrators.

CO3: understand experimentally working of Operational Amplifier and its applications

CO4: basics about Digital Logic circuits from logic gates to ALU.

Master of Science (Physics)
SEMESTER-I
(SESSION 2022-23)

COURSE CODE: MPHP-1396
COMPUTER LAB

After completion of this lab Student will be

CO1: familiar with various MATLAB syntaxes and techniques to carryout simple calculations.

CO2: able to develop MATLAB programs to find roots of equations.

CO3: able to apply MATLAB commands to plot simple graphs in 2D.

CO4: able to write MATLAB programs to solve numerical integration, numerical differentiation and interpolation.

Master of Science (Physics) SEMESTER-II
(SESSION 2022-23)

COURSE CODE: MPHL-2391
QUANTUM MECHANICS-I

COURSE OUTCOMES OF QUANTUM MECHANICS

This course develops concepts in quantum mechanics such that the behavior of the physical universe could be understood from a fundamental point of view. It provides a basis for further study of quantum mechanics

CO 1. The very first outcome of the course is that the student will learn the mathematical tools needed to solve quantum mechanics problems. This will include complex functions and Hilbert spaces, and the theory of operator algebra and the concept that quantum states could be described in a vector space. Solutions of ordinary and partial differential equations that arise in quantum mechanics will also be studied.

CO 2. The student will be able to build connections between mathematical development and conceptual understanding.

CO 3. The student will be able to apply the concepts of quantum mechanics to solve the one and three dimensional problems of quantum mechanics to understand the basics of atomic structures and the wave mechanics of these atoms.

CO 4. The student will learn the basic concepts of spin and angular momentum and the role of spherical harmonics in determining the shape of electronic clouds around the nucleus. They will also learn about the utilization of simple harmonic oscillator and the role of Hilbert space in developing simple harmonic oscillator.

Master of Science (Physics)
SEMESTER-II
(SESSION 2022-23)

COURSE CODE: MPHL-2392
ELECTRODYNAMICS-I

COURSE OUTCOMES
After passing this course the students will be able to:

CO1:   understand the basic concepts of electrostatics and magnetism and related quantities and their calculations for different charge distribution as well as the behaviour of electric and magnetic field inside matter. The students will have the ability to solve the electrostatic problems by method of images helps.

CO2: demonstrate knowledge about the time-varying magnetic and electric fields and their effects by

CO3: understand the propagation of electromagnetic waves in conducting and insulating media.

COURSE CODE: MPHL-2393
CONDENSED MATTER PHYSICS-I

Course Outcome of Condensed Matter Physics-I

After studying this course, the students will be able to understand:

CO1: various theories related to heat capacities and significance of lattice heat capacity and phonons

CO2: about various types of lattice defects, dislocations and grain boundaries and their role in cryatal growth.

CO3: concepts related with electrical and thermal conductivities and relation between them as well as concepts of activation and hydration energies.

CO4: properties and concepts related to Dielectrics and Ferro Electrics and thermodynamics of ferroelectric transitions

Master of Science (Physics)
SEMESTER II
(SESSION 2022-23)

COURSE CODE: MPHL-2394

ATOMIC AND MOLECULAR SPECTROSCOPY

COURSE OUTCOMES
Students will have achieved the ability to

CO 1. Describe the atomic spectra of one and two valance electron atoms. the student will understand the relativistic corrections for the energy levels of the hydrogen atom and their effect on optical spectra and the key properties of many electron atoms

CO 2. Explain the change in behaviour of atoms in external applied electric and magnetic field.

CO 3. Explain rotational, vibrational, electronic and Raman spectra of molecules.

CO 4. Explain the role of Frank Condon principle in determining electronic spectra of the molecule. The student will also learn about the dissociation and pre-dissociation energies.

CO 5. state and justify the selection rules for various optical spectroscopies in terms of the symmetries of molecular vibrations

Master of Science (Physics) SEMESTER-II
(SESSION 2022-23)
COURSE CODE: MPHP-2395
CONDENSED MATTER PHYSICS LAB-I

COURSE OUTCOMES

Student upon completion of this course will be able to

CO 1. successfully apply the theoretical techniques presented in the course to practical problems

CO 2. Understand Hall Effect and demonstrate concept of Pn junction g-factor using ESR, formation and analysis of Hysteresis loop.

CO 3. Demonstrate experimental determination of Energy gap using Four Probe Method and characteristics of photovoltaic cell.

Master of Science (Physics) SEMESTER-II
(SESSION 2022-23)
COURSE CODE: MPHP-2396
SPECTROSCOPY LAB

Course Outcomes

On successful completion of the course students will be able to:

CO 1. develop analytical, laboratory skills through laboratory which involve the application of physics to various spectroscopy systems.

CO 2. successfully apply the theoretical techniques presented in the course to practical problems

CO 3. set up the Fabry Parot interferometer, Michelson Morley interferometer, Zeeman experimental instrument and constant deviation spectrometer.