MANAV RACHNA UNIVERSITY

DEPARTMENT OF PHYSICS

M.Sc. Mapping of COs with POs and PSOs

M.Sc SEMESTER 1

Courses Code	Courses	Course Outcomes	CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PHHE01B	Mathematical Physics	CO1	**Find eigen values and eigen vectors using matrix algebra**	✓	✓	x	x	x	x	✓	x	x	x	✓
		CO2	**Solve differential equations of special functions**	✓	✓	x	x	x	x	✓	x	x	x	✓
		CO3	**Find Fourier transforms, Laplace Transforms and Inverse LT for various functions applied to physics theory**	✓	✓	x	x	x	x	✓	x	x	x	✓
PHHE02B	Classical Mechanics	CO1	Students would be able to understand, explain and demonstrate fundamental laws and concepts classical mechanics and further analyze and solve related problems.	✓	✓	✓	x	✓	x	✓	x	x	✓	✓
		CO2	Students would be able to demonstrate the concept of generalized coordinates, compare and apply various invariance and symmetry laws and solve various related problems. They would further formulate lagrangian of various physical systems and solve them. Students would be able to hypothesize new problems.	✓	✓	✓	x	✓	x	✓	x	x	✓	✓
		CO3	Students would be able to describe and demonstrate the concepts of central body problems and apply Kepler's laws on motion of planetary bodies. They would also be able to formulate and construct a solution pertaining to it. They would be able to hypothesize and formulate central body problems.	✓	✓	✓	x	✓	x	✓	x	x	✓	✓
		CO4	Students would be able to do Canonical transformations, solve Poisson's brackets and further explain and solve problems related to small oscillations. They	✓	✓	✓	x	x	x	✓	x	x	✓	✓
PHHE03B	Quantum Mechanics-I	CO1	Students would be able to understand, explain and demonstrate various laws and concepts of essentials of Quantum physics related to it's basic structure, stratification, movement and solve related problems	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x
		CO2	Students will be able to explain the concepts of wave-function, Schrodinger equation and problem solving of He and other heavy elements.	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x
		CO3	Students will be able to understand various Operators (Momentum, Hamiltonian, Hermitian) etc. Students also able to solve the Bra-Ket matrix	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x
		CO4	Students will be able to design and explain various mechanisms/working conditions of Time independent perturbation theory and its application to explain and solve the problems of Zeeman and Stark effects.	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x
PHHE04B	Physics of Electronic Devices	CO1	Students would be able to apply basics of Semiconductors,pn-junction,Zener and avalanche breakdowns,configurations and characteristics,JFET to solve numerical problems with demostration	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x
		CO2	Students would be able to understand and analysis of CE, CB, and CC amplifiers,input and output impedances of amplifiers,Analysis of amplifiers	✓	✓	x	x	x	x	✓	✓	x	x	x
		CO3	The frequency response of RC coupled CE amplifiers and gain-frequency plots of amplifier response	✓	✓	x	x	x	x	✓	✓	x	x	x
		CO4	Students would be able to understand and analysis of different types of Power amplifiers	✓	✓	x	x	x	x	✓	✓	x	x	x
PHSS05B	Computational Method and Programming	CO1	Use and apply main features of the MATLAB program development environment to enable their usage in the higher learning.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		CO2	Implement simple mathematical functions/equations in numerical computing environment such as MATLAB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		CO3	Interpret and visualize simple mathematical functions and operations thereon using plots/display.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		CO4	Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PHHE06B	Laboratory Work	CO	Apply diodes and transistors in Power supply and amplifiers, design circuits for clipping and clamping actions., realize the differentiating and integrating circuits,modulate and demodulate the signals by designing the circuits.	✓	✓	x	✓	✓	x	✓	✓	✓	✓	✓

M.Sc SEMESTER 2

Courses Code	Courses	Course Outcomes	CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PHH607B	Quantum Mechanics-II	CO1	discuss and interpret experiments/Theories that reveal the Schrodinger wave equation and Perturbation theory was not enough to solve the energy of He like atoms. Therefore, variotional method and other approximation (like; WKB) methods were used.	✓	✓	x	x	x	x	x	x	x	x	x
		CO2	Interpret and Apply the Collision in 3-D scattering; Laboratory and CM reference frames; Scattering amplitude; differential scattering cross section and total scattering cross section; Apply the scattering theory on solving the energetic particle-solid interaction and calculation of recoil/scatterer atoms.	✓	✓	x	x	x	x	x	✓	x	x	x
		CO3	Design and construct spectral problems using angular momentum, Tounderstand and apply the Complex potential and absorption in scattering. Identical particles; Symmetric and antisymmetric wave functions; Collision of identical particles; Spin angular momentum; Spin functions for a many-electron system.	✓	✓	x	x	x	x	x	x	x	✓	✓
		CO4	Develop and explain the Semiclassical theory of radiation; Transition probability for absorption and induced emission; Electric dipole and forbidden transitions; Selection rules	✓	✓	x	x	x	x	x	x	x	✓	✓
PHE608B	Statistical Mechanics	CO1	To develop familiarity with the physical concepts and facility with the mathematical methods of Statistical mechanics	✓	✓	✓	✓	✓	✓	✓	x	x	x	✓
		CO2	To cultivate skills at formulating and solving physics problems	✓	✓	✓	✓	✓	✓	✓	x	x	x	✓
		CO3	**To provide a firm foundation to students in a very fundamental subject of Statistical Mechanics**	✓	✓	✓	✓	✓	✓	✓	x	x	x	✓
PHE609B	Solid State Physics	CO1	Explain and analyze the XRD pattern and determine the crystal structure of a material.	✓	✓	x	✓	✓	✓	✓	✓		✓	✓
		CO2	Explain and apply different models for thermal properties of solids.	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓
		CO3	Explain and analyze the electrical properties of metals and semiconductors.	✓	✓	x	✓	x	✓	✓	✓	✓	✓	✓
		CO4	Explain the theory related to superconductors.	✓	✓	x	✓	x	x	x	✓	x	✓	x
PHE610B	Atomic and Molecular Physics	CO1	Explain spectrum of hydrogen and hydrogen like atoms using quantum theory and study the effect of weak and strong magnetic field on the spectrum.	✓	✓	✓	x	x	x	x	x	✓	✓	x
		CO2	Explain hyperfine structure of atoms using different coupling schemes.	✓	✓	✓	x	x	x	x	x	✓	✓	x
		CO3	explain molecular spectra using different models of molecules.	✓	✓	✓	x	x	x	x	x	✓	✓	x
		CO4	explain different spectrometers to study optical properties of molecules.	✓	x	✓	x	x	x	x	x	✓	✓	✓
PHH612B	Laboratory Work	CO1	Apply FET and MOSFET in amplifiers, Application of 741, ESR spectrometer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RDO503	Scientific Research I	CO	Describe research and its impact. Identify broad area of research, analyze, the processes and procedures to Carryout research. Use different tools for literature survey. Choose specific area of research and supervisor/mentor is finalized.Understand and adopt the ethical practice that are to be followed in the research activities.Work in groups with guidance	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

M.Sc SEMESTER 3

Courses Code	Courses	Course Outcomes	CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PHH601B	Nuclear and Particle Physics	CO1	Students would be able to understand, explain and demonstrate various laws and concepts of nuclear and particle physics related to its basic nucleus structure. The students would be able to analyze and evaluate the related problems.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO2	Students would be able to understand, compare and analyze various nuclear models proposed till date.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO3	Students would be able to describe, analyze and evaluate the basic interaction mechanisms for charged particles and electromagnetic radiation relevant for radiation detectors and explain their importance for detecting various types of ionizing radiation at different energies.	✓	✓	x	x	x	x	✓	x	✓	x	✓
		CO4	Students would be able to compare and simulate the basic features involved in alpha and beta decays, nuclear forces and formulate various kinds of nuclear reactions besides the fundamentals of elementary particle physics.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
PHH602B	Electrodynamics and Plasma Physics	CO1	Demonstrate an understanding of the use of Laplace equation, boundary conditions and method of images	✓	✓	✓	✓	✓	x	✓	x	✓	✓	✓
		CO2	Know and use Biot savart law, time dependent field, Maxwell's equations, Know and use of scalar potential, vector potential, gauge transformation	✓	✓	✓	✓	✓	x	✓	x	✓	✓	✓
		CO3	Demonstrate power radiated by a point charge, radiation due to an oscillating electric dipole	✓	✓	✓	✓	✓	x	✓	x	✓	✓	✓
		CO4	Understanding of relativistic electrodynamics and basic understanding of Plasma state essential for research purpose	✓	✓	✓	✓	✓	x	✓	x	✓	✓	✓
PHH603B	Advanced solid state physics	CO1	**To understand and analyze the behavior of electrons in metals and semiconductors and to realize their importance in gaining vital information about**	x	✓	x	✓	✓	✓	✓	✓		✓	✓
		CO2	**To understand the physics governing the optical properties of materials and to evaluate and analyze the optical properties of materials.**	x	✓	x	✓	✓	✓	✓	✓	✓	✓	✓
		CO3	**To understand the physics governing the dielectric properties of materials in order to explain their technological applications and to evaluate and analyze the dielectric properties of materials.**	x	✓	x	✓	x	✓	✓	✓	✓	✓	✓
		CO4	**To understand the classical and quantum physics governing the magnetic properties of materials in order to evaluate and analyze the magnetic properties of materials and to explain their technological applications.**	x	✓	x	✓	x	x	x	✓	x	✓	✓
PHH604B	Fundamental Atmospheric Physics	CO1	Explain the physical laws governing the structure and evolution of atmospheric phenomena spanning a broad range of spatial and temporal	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO2	Apply mathematical tools to study atmospheric processes.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO3	Explain the principles behind and use of, meteorological instrumentation.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO4	Describe analyze and create graphical depictions of meteorological information.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
PHH605B	Synthesis and Characterization Techniques	CO1	Students will be able to understand, basic concept of thin films, nano-structures, and quantum confinement effects. Thin film deposition techniques and consequences of deposition parameters on the film quality and applications.	✓	✓	x	x	x	✓	✓	x	x	x	x
		CO2	Students will be able to learn and explain the concepts growth processes by chemical and physical methods. Moreover, differences in the properties/applications of chemical method grown and physical method grown nano-structures should be answered by the students.	✓	✓	x	x	x	✓	✓	x	x	x	x
		CO3	Students will be able to calculate and examine the particle size change effect on the XRD patterns and determination of particle size using XRD. Similarly, quantum size confinement effects can be evaluated by students using, Raman, UV-vis, FTIR and PL	✓	✓	x	x	x	✓	✓	x	x	x	x
		CO4	Students will be able to understand and explain various surface characterization techniques like TEM, SEM, AFM and will be able to estimate the	✓	✓	x	x	x	✓	✓	x	x	x	x
PHH607B	Laboratory Work	CO1	Pulse Amplitude Modulation/Demodulation, FSK Modulation Demodulation using Timer/PLL, Fibre Optics communication	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RDO603	Scientific Research II	CO	Critically evaluate the work done by various researchers relevant to the research topic. Integrate the relevant theory and practices followed in a logical way and draw appropriate. Understand the research methodologies/approaches/techniques used in the literature. Structure and organize the collected information or findings through an appropriate abstract,	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

M.Sc SEMESTER 4

Courses Code	Courses	Course Outcomes	CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PHK609B	Advanced Aomospheric Physics	CO1	Demonstrate expert knowledge of the weather and climate of the tropics.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO2	Apply basic atmospheric thermodynamics principles such as potential temperature, equivalent potential temperature, vapour pressure, mixing ratio and first and second laws of thermodynamics to understand weather & climate issues.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
		CO3	Create sophisticated computer programs and/or utilize those available on the web.	✓	✓	x	x	x	x	✓	x	✓	x	✓
		CO4	Work independently with an observational dataset or numerical simulation.	✓	✓	x	x	x	✓	✓	x	✓	x	✓
PHK610B	Advanced Plasma Physics	CO1	Understand that using fundamental plasma parameters, under what conditions an ionised gas consisting of charged particles (electrons and ions) can be treated as a plasma.	✔	✔	x	✔	x	x	✔	x	✔	✔	✔
		CO2	Able to distinguish the single particle approach, fluid approach and kinetic statistical approach to describe different plasma phenomena.	✔	✔	x	✔	x	x	✔	x	✔	✔	✔
		CO3	Able to determine the velocities, both fast and slow (drift velocities), of charged particles moving in electric and magnetic fields that are either uniform or vary slowly in space and time.	✔	✔	x	✔	x	x	✔	x	✔	✔	✔
		CO4	Formulate the conditions for a plasma to be in a state of thermodynamic equilibrium, or non-equilibrium, and analyse the stability of this equilibrium and account for the most important plasma instabilities	✔	✔	x	✔	x	x	✔	x	✔	✔	✔
		CO5	Explain the physical mechanism behind Landau damping and make calculations in this area using kinetic theory	✔	✔	x	✔	x	x	✔	x	✔	✓	✔
PHK611B	Condensed Matter Physics	CO1		✓	✓	x	x	x	x	x	x	x	✓	✓
		CO2	To discuss and interpret the Hartree-Fock approximation, Koopmans's theorem; Description of quantum states and the Dirac notation, Density operators, Hartree Fock theory in Density-matrix form	✓	✓	x	x	x	x	x	x	x	✓	✓
		CO3	To Construction of Density functional theory (DFT), local density methods, gradient corrected methods, hybrid methods; Comparison with conventional wave function approach, Hohenberg-Kohn Theorem.	✓	✓	x	x	x	x	x	x	x	✓	✓
		CO4	develop and explain the theory and experiments of superconductors. explore the Magnetic properties of type-I and type-II superconductors-characteristic length, flux lattice, introduction to high-temperature superconductors	✓	✓	x	x	x	x	x	x	x	✓	✓
PHN 612B	Project Work	CO1	Understand and adopt the ethical practice that are to be followed in the research activities.Work in groups with guidance	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔