RAYAT SHIKSHAN SANSTHA'S

SHREE SADGURU GANGAGEER MAHARAJ SCINCE, GAUTAM ARTS & SANJIVANI COMMERCE COLLEGE, KOPARGAON DIST AHMEDNAGAR

Program Outcomes, Program Specific Outcomes and Course Outcome

Department of Physics

Program outcome: M.Sc. (Physics)	
PO1.	• Get substantial knowledge in physics, basic knowledge in mathematics, and understanding of the interconnectedness of different disciplines;
PO2.	• Get some research experience within a specific field of physics, through a project work;
PO3.	• Get ability to apply knowledge of physics to the real world problems;
PO4.	• Be familiar with contemporary research within various fields of physics;
PO5.	• Use creativity, critical thinking, analysis and research skills to solve theoretical and real-world problems
PO6.	• Have the background and experience required to model, analyze, and solve advanced problems in physics;
PO7.	• Use creativity, critical thinking, analysis and research skills to solve theoretical and real-world problems
PO8.	• Be able to employ up-to-date and relevant knowledge and skills in several disciplines.
PO9.	• Able to enter new problem areas that require an analytic and innovative approach
PO10.	• Be able to understand the role of physics in society and has the background to consider ethical problems.
PO11.	• Know the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.
PO12.	• Get an ability to participate in constructive discussions and debates.

RAYAT SHIKSHAN SANSTHA'S

SHREE SADGURU GANGAGEER MAHARAJ SCINCE, GAUTAM ARTS & SANJIVANI COMMERCE COLLEGE, KOPARGAON DIST AHMEDNAGAR

Program Outcomes, Program Specific Outcomes and Course Outcome

Department of Physics

Program Specific outcome: M.Sc. (Physics)	
PSO1.	• Demonstrate and understanding of principles and theories of physics. These include: Classical Mechanics, Statistical Mechanics, electrodynamics electronics, optics, nuclear physics, quantum mechanics, Material Science;
PSO2.	• Apply vector algebra, complex algebra, differential and integral calculus as well as graphical methods to solve physics problems;
PSO3.	• Demonstrate ability to apply knowledge learned in classroom to plan, undertake, and report on a programme of original work; including the planning and execution of experiments, the analysis and interpretation of experimental results;
PSO4.	• Take research work at the higher degree level in the field of nanotechnology, computational physics and material science

RAYAT SHIKSHAN SANSTHA'S

SHREE SADGURU GANGAGEER MAHARAJ SCINCE, GAUTAM ARTS & SANJIVANI COMMERCE COLLEGE, KOPARGAON DIST AHMEDNAGAR

Program Outcomes, Program Specific Outcomes and Course Outcome

Department of Physics

Course Outcomes of M.Sc. (Physics)

Class	Course	Outcomes
M.Sc. I	PHCT-111 Mathematical Methods in Physics	• Generate Legendre, Hermite, Laguerre polynomials and Bessel functions of first kind. • Determine Laplace transform of standard functions. • Classify methods to obtain Laplace transform and inverse Laplace transform. • Illustrate the examples of vector spaces. • Solve problems on Fourier series, Fourier transform and Fourier integral • Solve problems on linear dependence and linear independence by using different methods. • Explain orthogonally of Legendre, Hermite, Laguerre polynomials and Bessel functions of first kind. • Define Hermitian, Orthogonal and Unitary matrices.
	PHCT-112 Classical Mechanics	• Formulate the Lagrange's and Hamilton's equation of motion for different systems. • Choose an appropriate set of generalised coordinates to describe the system. • Classify and handle the problem related to motion in non-inertial and inertial frames. • Solve problems on poisons brackets and canonical transformations. • Apply Variational Principle to real physical problem. • Explain the concept of symmetry and Galilean Invariance. • Define generalized momenta and cyclic coordinates. • Recall Poisson's and Lagrange identities.

M.Sc. I	PHCT-113 Electronics	• Recall basic knowledge of electronics. • Define Astable, monostable multi vibrator, Op-amp, voltage regulators, Boolean identities and expression, counter and shift register, basics of digital and binary conversions. • Discuss IC 555, types of voltage regulators, types of counters and shift registers and types of ADC and DAC. • Perform working of ICs (IC 555 in astable and monostable mode, IC78xx/IC79xxand ICLM317 of 3 pin regulators, IC 7490,IC 7495,VCO IC 566, PLL IC 565) • Apply the working of according to their applications. • Designs and performs ICs. • Assemble the ICs • Communicate, demonstrate and write effectively the needs in industrial fields.
	PHOT-114C4 Lasers and Applications	• Explain the interaction of radiation with matter, Gaussian beam and their properties. • Illustrate the absorption, spontaneous and stimulated emission with appropriate diagrams. • Derive the Einstein's coefficients, g-parameters of laser cavity. • Distinguish between ordinary light and laser light. • Analyse the merits and demerits of three and four level laser system. • List the characteristics of laser light. • Categorize the different types of lasers. • Discuss the applications of lasers in various fields
	PHCP-115 Physics Lab-I	• Design skills of electronic circuits. • Handling of electronic instruments. • Understand of basic concepts of electronic devices.

M.Sc. I	PHCT-121 Electrodynamics	• Define electric charge, charge density (λ, σ, ρ). • Apply the laws of electromagnetism and Maxwell's equations in different forms and different media • Explain the fundamental concepts of special relativity and their physical consequences, such as the Lorentz transformation, invariant quantities, the metric, and four-vectors and more general tensors, as well as their use in covariant formulations of physical laws. • Discuss origin of Maxwell's equations in magnetic and dielectric media and understand transport of energy and Poynting vector. • Calculate the magnetic forces that act on moving charges and the magnetic fields, due to currents (Biot-Savart and Ampere laws) • Solve multipole expansions of electrostatic fields. • Analyze propagation, reflection and transmission of plane waves • Evaluate radiation energy losses by passage through the matter.
	PHCT-122 Atoms and Molecules	• Recite atomic structure, quantum number Calculate the ground state, apply Hund's rule. Diagram the fine and hyperfine structure • Explain Zeeman effect Solve problems on Zeeman effect for different materials in Zeeman effect • Identify different regions of spectra & Summarize types of spectra with regions • Classify different molecular spectra &analyse band structure • Determine dissociation energy and dissociation product for explanation of ESR &NMR • Predict the band head position in rotational fine structure to solve problems on ESR&NMR. • Define X-ray diffraction, Explain SC, FCC, BCC HCP structure and calculate atomic structure factor of SC, FCC, BCC, HCP and diamond structure. • Explain different modes of vibration. Simplify atomic scattering factor. Relate Acoustic & optical modes of vibration

M.Sc. I	PHCT-123 Quantum Mechanics	• Recall the main aspects of the historical development of quantum mechanics by replacing the classical mechanics and able to discuss wave properties of matter. • Understand Schrodinger's equation, uncertainty principle, representation of states, relation between quantum mechanics and linear algebra. • Solve Schrodinger's equation in one to three dimensions, Eigen function of operator, uncertainties as well as their physical interpretations. • Solve problems by applying Dirac notations. • Simplify angular momentum and spin, their rules for quantization and additions, Clebsch-Gorden coefficients in simple cases. • Explain Zeeman Effect, spin- orbit coupling. • Solve Schrodinger equation using various approximation methods. • Develop an understanding of both analytic and numerical methods and solutions are important in quantum mechanics.
	CBOP II, PHOT-124D4 Physics of Semiconductor Devices	• Recognize the physical characteristics such as electronic structures, optical and transport properties of semiconductors and IV characteristics of semiconductor devices. • Discuss the transport and optical properties of semiconductors. • Relate the electronic structures of semiconductors to their atomic and crystal characteristics. • Relate to fundamental physics process with device characteristics. • Apply fundamental principles and processes to operational semi-conductor devices and their uses. • Analyse and model some semiconductor properties, processes and device characteristics using equations. • Evaluate and analyse device characteristics in terms of the material properties and structural parameters. • Design junction device and calculate its various junction parameters.
	PHCP-125Physics Lab-II	• Perform Experiments. • Develop skills of independent working. • Designing of physics/electronics experiments

M.Sc. II	PHUT-231 Statistical Mechanics	• Define basics of thermodynamics, states of the system, statistical ensemble, partition function, and equipartition theorem, postulates of Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac distributions and discuss black body radiation • Describe specification of state of system, types of ensembles, Gibb's paradox. • Calculate phase space trajectory, mean energy of the system, simple application of equipartition theorem and solve Einstein derivation of Plank's law, Bose condensation, and specific heat of fermions • Criticize state of system classically, categorized between types of ensembles, classify distribution of particles by Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistic, analyse Einstein and Debye model of solids. • Determine density of states, mean energy by using types of ensembles, Fermi energy and mean energy at absolute zero, compare mean values of velocities byusing Maxwell Boltzmann distribution. • Develop some problems dealing with statistical ensemble and Fermi energy, to solve some examples on particles by using particle distribution statistics. • Demonstrate understanding of various aspects of statistical mechanics. • Communicate, write, and make effective presentation on industrial needs of thermodynamics and statistical mechanic
	PHUT-232 Solid State Physics	• Calculate thermal and electrical properties in the free-electron model – know Bloch's theorem and what energy bands are • Apply the free electron theory to solids to describe electronic behaviour & explain the origin of energy bands, and how they influence electronic behaviour. • Discuss basic models of magnetism & Explain the classical, Langevin & quantum theory of Para magnetism. • Compare the magnetic properties of rare earth ions & iron group ion with graphical representation • Explain Wises theory, saturation magnetism with temperature dependence.

	PHUT-232 Solid State Physics	• Understand the anti-ferromagnetism, Neel temperature & susceptibility. • Distinguish between perfect conduction and perfect diamagnetism, and give qualitative description of the Meissner effect & explain how observation of a persistent current can be used to estimate an upper limit on the resistivity of superconductor, and perform calculations related to such estimates • Show how the London equations and Maxwell's equations lead to the prediction of the Meissner effect.
M.Sc. II	PHCT-233Experimental Techniques in Physics-I	• Define signals, vacuum, vacuum measurement units, gas transport phenomenon. • Classify signals and systems as discrete/continuous, linear/non-linear, causal/no causal, time variant/invariant, etc., errors in signals and pipe flows, vacuum pumps. • Interpret signals with correlation function of random processes. • Explain need of vacuum and gas transport properties. • Solve problems based on kinetic theory of gases and the application of the momentum and energy equations as well as various parameters of fluid mechanics • Convert vacuum measurement units from one unit to another unit. • Describe different vacuum gauges and vacuum pumps with their working principle, range of measurement, advantages and drawbacks. • Apply vacuum principles in preparation of thin and thick film.
	PHCT-234H4 Energy Studies-I	• Know Energy Sources. • Understand the Solar Radiation and Its Measurements. • Understand the Heat and Thermodynamics. • Know the types of energy storage systems
	PHCP-235 Physics Laboratory -III	• Know how to write program. • Develop skills of independent working. • Know how to execute program.

M.Sc. II	PHCT-241 Nuclear Physics	• Classify elementary particles and nuclear states in terms of their quantum numbers. • Describe the role of S-O coupling in the shell structure of atomic nuclei and predict the properties of nuclear ground and excited states based on the shell model. • Describe the properties of strong and weak interactions. • Explain the different processes by which ionising radiation interacts with matter and the construction and applications of detectors for radioactivity. • Determine the basic properties of nucleus. • Calculate the kinematics of various reactions and decay processes. • Analyse production and decay reactions for fundamental particles by applying conservation principles. • Evaluating: Evaluate radiation energy losses by passage through the matter.
	PHCT-242 Experimental Techniques in Physics-II	• List of required characterization techniques for fundamental research in material science and nanotechnology. • Identify the crystal structure, crystalline nature of any material by using X-ray diffraction technique. • Provide phase transition, absorption, chemical changes as temperature changes by using thermal analysis methods. • Make use of spectroscopic analysis for identification of materials i.e. which type of material is present by analysing their UV-Vis, IR, FTIR, DRS spectroscopies. • Study morphology, topography of any material by using SEM, TEM, and FESEM. • Find various applications like industrial, biomedical etc. by using magnetic characterization. • Apply the knowledge of characterization techniques for research. • Compile the information of characterization together to confirm the proposal in research work.

M.Sc. II	CBOP IV PHOT-243A4 Physics of Thin Films	• Recognize the various aspects of different thin film deposition, fundamental properties and various measurement techniques • Relate effect of various deposition parameters to growth of thin films and their typical uses for applications. • Discuss the differences and similarities between techniques and fundamental properties of thin film deposition. • Asses the relation between deposition technique, film structure and film properties. • Analyse effect of film growth on properties. • Evaluate and use models for nucleating and growth of thin films. • Motivate selection of deposition techniques for various applications. • Design novel thin film material synthesis by modified growth technique.
	PHOT-244H4 Energy Studies–II	• Know about Solar photovoltaic (SPV) Conversion. • Understand Photo-thermal Applications of Solar Energy. • Get knowledge of Hydrogen Energy.
	PHCP-245 Project	• Develop skills of independent working • Learn Literature survey • Designing of physics/electronics experiments • Develop writing and presentation skills