Ahmednagar College, Ahmednagar
Department of Physics
Courses offered at Undergraduate Level (B.Sc. Physics)

Sr. No.	Program	Program Objectives	Program Specific Outcomes
1	B. Sc. Physics	To provide in depth knowledge of scientific and technological aspects of Physics · To familiarize with current and recent scientific and technological developments · To enrich knowledge through problem solving, hand on activities, study visits, projects etc. · To train students in skills related to research, education, industry, and market. · To create foundation for research and development in Electronics · To develop analytical abilities towards real world problems · To help students build-up a progressive and successful career in Physics	1. After completion of program, students will be able to have in-depth knowledge of basic concepts in Physics. 2. Students will be able to apply the laws of Physics in real life situations to solve the problems. 3. Students develop aptitude of doing research through undertaking small projects. 4. Student will have set his foundation to pursue higher education in Physics. 5. After completing the program student will have developed interdisciplinary approach and can pursue higher studies in subjects other than Physics

Sr. No.	Course	Course Outcome
		F. Y. B. Sc.
1	1. Mechanics	1. Demonstrate an understanding of Newton's laws and applying them in calculations of the motion of simple systems. 2. Use the free body diagrams to analyse the forces on the object. 3. Understand the concepts of energy, work, power, the concepts of conservation of energy and be able to perform calculations using them. 4. Understand the concepts of elasticity and be able to perform calculations using them. 5. Understand the concepts of surface tension and viscosity and be able to perform calculations using them. 6. Use of Bernoulli's theorem in real life problems. 7. Demonstrate quantitative problem solving skills in all the topics covered.
	2. Heat and Thermodynamics	1. Describe the properties of and relationships between the thermodynamic properties of a pure substance. 2. Describe the ideal gas equation and its limitations. 3. Describe the real gas equation. 4. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process. 5. Analyze the heat engines and calculate thermal efficiency. 6. Analyze the refrigerators, heat pumps and calculate coefficient of performance. 7. Understand property 'entropy' and derive some thermo dynamical relations using entropy concept. 8. Understand the types of thermometers and their usage.
	3. Physics Principles and Applications	1. To demonstrate an understanding of electromagnetic waves and its spectrum. 2. Understand the types and sources of electromagnetic waves and applications. 3. To understand the general structure of atom, spectrum of hydrogen atom. 4. To understand the atomic excitation and LASER principles. 5. To understand the bonding mechanism in molecules and rotational and vibrational energy levels of diatomic molecules. 6. To demonstrate quantitative problem solving skills in all the topics covered.

	4. Electromagnetic	1. Demonstrate an understanding of the electric force, field and potential, and related concepts, for stationary charges. 2. Calculate electrostatic field and potential of simple charge distributions using Coulomb's law and Gauss's law. 3. Demonstrate an understanding of the dielectric and effect on dielectric due to electric field. 4. Demonstrate an understanding of the magnetic field for steady currents using Biot-Savart and Ampere's laws. 5. Demonstrate an understanding of magnetization of materials. 6. Demonstrate quantitative problem solving skills in all the topics covered.
	5. Practical	1. Acquire technical and manipulative skills in using laboratory equipment, tools, and materials. 2. Demonstrate an ability to collect data through observation and/or experimentation and interpreting data. 3. Demonstrate an understanding of laboratory procedures including safety, and scientific methods. 4. Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena. 5. Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.
S. Y. B. Sc.		
	Mathematical Methods in Physics I	After the completion of this course students will be able to 1. Understand the complex algebra useful in physics courses 2. Understand the concept of partial differentiation. 3. Understand the role of partial differential equations in physics 4. Understand vector algebra useful in mathematics and physics 5. Understand the singular points of differential equation.
	Electronics I	Students gain theoretical concepts of the electronic circuit design, instrumentations, and practical work along with hands-on experiences of the practical work.

	Oscillations, Waves and Sound	1. Solve the equations of motion for simple harmonic, damped, and forced oscillators. 2. Understand the physics and mathematics of oscillations. 3. Formulate these equations and understand their physical content in a variety of applications, 4. Describe oscillatory motion with graphs and equations, and use these descriptions to solve problems of oscillatory motion. 5. Explain oscillation in terms of energy exchange, giving various examples. 6. Solve problems relating to undamped, damped and force oscillators and superposition of oscillations. 7. Understand the mathematical description of travelling and standing waves. 8. Recognise the one-dimensional classical wave equation and solutions to it. 9. Calculate the phase velocity of a travelling wave. 10. Explain the Doppler effect, and predict in qualitative terms the frequency change that will occur for a stationary and a moving observer. 11. Define the decibel scale qualitatively, and give examples of sounds at various levels. 12. Explain in qualitative terms how frequency, amplitude, and wave shape affect. 13. The pitch, intensity, and quality of tones produced by musical instruments.
	Optics	Students understands different theoretical concepts of optics such as interference, polarization, diffraction etc. and are able to analyze the examples based on these concepts.
	Practical	Whatever the students learned in their theory courses such as, electronics, waves, oscillations and sound and optics. They need to verify these concept. This course will help to student to verify the concept from theory.
T. Y. B.Sc.		
	Mathematical Methods in Physics II	There are following four modules in this course: 1. Curvilinear Co-ordinates 2. The Special Theory of Relativity 3. Differential equations 4. Special functions This course acts as a foundation for other courses taught in Physics. Under this course the basic and advanced mathematical background required for other courses such as; classical mechanics, quantum mechanics, statistical physics, electrodynamics etc. are taught to the students. After successfully completing this course students get thorough knowledge of basics of curvilinear co-ordinate system, differential equations, special functions and special theory of relativity.

	Classical Electrodynamics	After completion of course students should 1. Be able to use method of images in electrostatics to solve the boundary value problems. 2. Should have understood the basic laws in magneto statics like Biot-Savart's law, Ampere's law etc. 3. have understood the concept of magnetic vector potential. 4. Have understood Maxwell's laws of electrodynamics. 5. Be able to solve Maxwell's equations in free space and write equation of plane e-m waves.
	Solid State Physics	After completion of course students should 1. Have deep understanding of various types of crystal structures and should have understood the concept of reciprocal lattice. 2. Have clear idea of various characterization techniques like x-ray diffraction, UV-visible spectroscopy, SEM, TGA etc. 3. Have understood the free electron model, band formation and origin of band gap. 4. Be able to understand the theory of magnetism and phenomena like superconductivity.
	Quantum Mechanics	Quantum Mechanics course is a foundation course. In this course, student will learn the historical aspects of development of quantum mechanics, understand and explain the differences between classical and quantum mechanics, understand the idea of wave function and the uncertainty relations, solve Schroedinger equation for simple potentials. Also, students will gain a basic understanding of the formalism and 'language' of quantum mechanics especially commutation brackets, various quantum mechanical operators.
	Classical Mechanics	The course aims to develop an understanding of Lagrangian and Hamiltonian formulation which allow for simplified treatments of many complex problems in classical mechanics and provides the foundation for the modern understanding of dynamics. At the end of the course, students will have thorough knowledge and problem solving skills related to the Classical mechanics T.Y. B.Sc. Syllabus topics. Internal class test I Home Assignment (Book Problem solving) Internal class test II
	Thermodynamics and Statistical Physics	1. Upon completion of this course, students clearly understand basic principles, be able to see relationships between ideas, and be able to use principles and ideas to calculate properties of simple statistical systems students will learn assumptions of kinetic theory of gases, transport phenomenon. 2. Thermodynamical Functions and Maxwell Relations, Elementary concepts of Statistics such as probability, distribution functions, Gaussian Probability distribution etc. Statistical distribution of system of particles, Different statistical ensembles: micro canonical, canonical and calculation of mean values in canonical ensembles, Maxwell-Boltzmann's, Bose Einstein , Fermi Dirac Statistics, comparison of the distribution. Problem solving on respective points.

	Atomic and Molecular Physics	The structure of matter, in the form of atoms and molecules, is a fundamental subject in physics. The study of atoms and molecules has played a major role in the development of physics and in the development of our understanding of the structures of matter as it is encountered in everyday life. On successful completion of this course students will be able to understand about- Development of Atomic structures starts from Rutherford's atomic model up to Vector atomic model.Concept of atomic absorption and emission spectra, spectra associated with hydrogen atom Pauli Exclusion Principle, Spectral notation for quantum states. The concepts of space quantization, Spectra of sodium atom LS and jj coupling schemes associated with two valence electron system. The splitting of atomic energy levels and associated spectral lines when atoms are placed in external magnetic and electric field: Zeeman Effect, Stark Effect. The idea about x-ray spectroscopy, molecular spectroscopy. Details about the Raman Effect and Applications.
	Nuclear Physics	The students will have an understanding of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of nuclear radiation with matter. The students will have an understanding of quantum behavior of atoms in external electric and magnetic fields. At the end of the course, students will have thorough knowledge basic nuclear forces ; composition of nucleus etc and problem solving skills related to the Nuclear Physics T.Y. B.Sc. Syllabus topics Internal class test I Home Assignment (Book Problem solving) Internal class test II
	Computational Physics	Computational Physics course is a foundation course. In this course, student will learn basic concepts of algorithms and flowcharts, programming in C language, errors in computations and various numerical analysis methods such as, obtaining roots of a function, finding integration. Also, students will get practice of programming through small programs like sorting array, graphics, finding factorial, using functions and pointers etc.
	Electronics/Advanced Electronics	1. Able to design various circuits which can be used professionally. 2. Able to understand AC, DC current/voltages concept for safety measurements. 3. Able to design various types of power supply, which can be used professionally. 4. Able to design communication systems.
	Elements of Materials Science	1. Student will know the various properties of materials which are using day to day life. 2. They easily identify the concept of Physics used and extend their knowledge towards.

	Physics of Nanomaterials	1. The main objectives of course are to introduce the basic physics behind size and effect of nano-materials and to understand the working principle of equipments used in nanostructures. In this course, students will gain knowledge of introduction to nanomaterials and their properties and growth techniques. It also discusses tools like UV, XRD, SEM and TEM to characterize the nanomaterials and applications of nanomaterials. 2. There are following modules in this course: 1. Introduction to nanomaterials 2. Methods of Synthesis of nanomaterials 3. Characterization Techniques 4. Properties of nanomaterials 5. Special Nanomaterials 6. Applications After successfully completing this course students get thorough knowledge of background of nanomaterials, their synthesis methods, characterization techniques, properties and applications.
	Practical course- I	To increase the understanding depth of theoretical concept like properties of matter, quantum mechanics, nuclear physics, statistical mechanics, electrodynamics etc.