

Course Title	MODERN PHYSICS
Course Code	MPHY-231
Credit Hours	CH3
Pre- requisites	MPHY-111, MPHY-112, MPHY-221
Learning outcomes	Modern Physics is a one-semester course covering major concepts of twentieth-century physics.
Contents	Relativity: Invariance of physical laws, relativity of simultaneity, relativity of time intervals lengths, Lorentz transformations, Dopplers effects of Electromagnetic waves, Relativistic momentum, work and energy, Newtonian mechanics and relativity. Wave particle and duality: Photoelectric effect, X-ray productions, Compton scattering and pair production, Wave particle duality, probability and Uncertainty, Electron waves, The nuclear atom and atomic spectra, energy levels and Bohr model of atom, Laser continuous spectra, Uncertainty principle. Wave functions and atomic structure: Wave function and one dimension Schrodinger Wave equation, Particle in a box, potential wells, Potential barrier and tunneling, Harmonic Oscillator, Measurements in quantum mechanics, Schrodinger equation in three dimensions, Particles in three-dimensional box, Hydrogen atom, Zeeman effect, Electron spin, Many electron atoms and Exclusion principle, X-ray spectra, Quantum entanglement, statistical distributions, Maxwell-Boltzman statistics, molecular energies in an ideal gas, quantum statistics. Molecules and condense matter: Types of molecular bonds, Molecular spectra, Structures of solids, Energy Bands, Free electron model of metals, Semiconductors, semiconductor devices, Superconductivity. Nuclear, particle physics, and cosmology: Nuclear properties, stable nuclei, binding energy, radioactive decays, half-life, alpha decay, beta decay, gamma decay, cross-section, nuclear reaction, nuclear fission, nuclear reactor, nuclear fusion. Carbon dating. Applications of nuclear physics fundamental particles, particle accelerators and detectors, particle interactions, Standard Model and beyond, expanding universe and beginning of time.
Teaching-learning Strategies	Classroom teaching / Lecturing
Assignments- Types and Number	Problem sheets: 3-4
Assessment and Examinations	Mid-Term Assessment: 35% Formative Assessment: (25%): It includes classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc. Final Term Assessment: 40%
Text Books	1. Concepts of Modern Physics, A. Beiser, McGraw Hill, (6th edition), (2002). 2. Physics (Vol. 1 & 2) by R. Resnick, D. Halliday and K. S. Krane (5th Edition), Wiley (2002). 3. University Physics with Modern Physics by H. D. Young, R. A. Freedman (14th Edition), Addison-Wesley (2015). 4. Quantum Physics by E. H. Wichmann, Berkeley Physics Course Volume 4, Berkeley (1965) 5. Physics for Scientists and Engineers with Modern Physics by D. C. Giancoli (4th Edition), Addison-Wesley (2008).