

Table. Modern Science Topics in the course

Num.	Course Name	Rationale & Essence for Modern Science Categorization	Key Modern Science Aspects Addressed
1	Fundamentals of Nanotechnology Structure	This course is categorized as Modern Science because nanotechnology is a definitive frontier of 21st-century science, manipulating matter at the atomic and molecular scale to create materials with novel properties; its essence is the study of the structure, properties, and applications of nanomaterials, which underpin revolutionary advances in fields like medicine, electronics, and materials science.	1. Quantum & Surface Effects: Understanding how quantum mechanics dominates at the nanoscale. 2. Novel Material Properties: Exploring how size changes optical, electrical, and mechanical properties. 3. Interdisciplinary Applications: Connecting physics to chemistry, biology, and engineering.
2	Quantum Physics	This course belongs to Modern Science as it forms the fundamental framework that replaced classical physics for describing the behavior of matter and energy at the smallest scales; its essence is the study of non-intuitive principles like wave-particle duality, quantization, and superposition, which are essential for understanding and developing modern technologies like semiconductors, lasers, and quantum computing.	1. Post-Newtonian Framework: Mastering concepts that defy classical intuition (e.g., uncertainty principle). 2. Quantization: Understanding discrete energy levels in atoms and molecules. 3. Foundation for Technology: Providing the theoretical basis for modern electronics and photonics.
3	Atomic Nucleus and Radioactivity	This course is categorized under Modern Science because it deals with the physics of the atomic nucleus, a field that emerged in the 20th century and is central to energy production, medical imaging, and astrophysics; its essence is the study of nuclear structure, stability, forces, and reactions (like fission and fusion), addressing both fundamental science and critical societal applications.	1. Nuclear Forces & Stability: Exploring the strong force that binds nucleons. 2. Nuclear Reactions: Analyzing fission, fusion, and radioactive decay processes. 3. Applications & Implications: Studying uses in energy and medicine, and managing radioactive waste.

4	Functional Programming in Physics Tasks	This course represents Modern Science in its methodological approach, as computational modeling and data analysis are now pillars of scientific discovery alongside theory and experiment; its essence is the application of a modern programming paradigm (functional programming) that offers powerful, efficient, and less error-prone ways to solve complex physics problems, simulate systems, and process large datasets.	1. Computational Physics: Using programming as a primary tool for investigation. 2. Modern Paradigm: Leveraging immutability and pure functions for robust scientific code. 3. Data-Intensive Science: Handling simulation output and experimental data effectively.
5	Internet of Things in Physics Learning	This course is included in Modern Science as the Internet of Things (IoT) itself is a transformative modern technology that enables new forms of data acquisition and interaction with the physical world; its essence is the study and use of networks of smart sensors and devices to collect real-time, real-world data for physics experiments, bridging the digital and physical realms and enabling previously impossible measurements.	1. Smart Sensor Technology: Utilizing interconnected devices for data collection. 2. Real-Time Data Acquisition: Capturing and analyzing continuous data streams from the environment. 3. Cyber-Physical Systems: Merging computation with physical processes for experimental science.