

Physics Refresher Course

The course is a fast-paced review of physics subject matter that students should be familiar with in preparation for the Nuclear Reactor Analysis (UN 0802) course. Topics include atomic and nuclear structure, nuclear reactions and radioactive decay, interaction of radiation with matter, neutron interactions, introduction to nuclear power production, linear algebra and vector calculus.

Textbook

Introduction to Nuclear Engineering (third edition)

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Outline

1. Atomic And Nuclear Physics
 - 1.1. Elements of Relativity
 - 1.1.1. Relativistic Mass Formula
 - 1.1.2. Relativistic Energy
 - 1.1.3. Relativistic Momentum
 - 1.2. Photoelectric Effect
 - 1.3. Compton Effect
 - 1.4. Atomic Spectra
 - 1.5. Bohr's Atomic Model
 - 1.6. De Broglie Waves
 - 1.7. Nuclear Constituents
 - 1.8. Notations of Isotopes
 - 1.9. Descriptions of Nuclear Particles (Mass, Charge, Spin)
 - 1.10. Binding Energy
 - 1.11. Nuclear Reactions
 - 1.11.1. Conservation laws
 - 1.11.2. Q value
2. Radioactivity
 - 2.1. The Decay Process
 - 2.2. Natural Radioactivity
 - 2.3. Induced Radioactivity (activation)
 - 2.4. Decay Chains (Bateman Equations)
3. Interaction of Radiation With Matter
 - 3.1. Interactions of Heavy Charged Particles
 - 3.2. Interactions of Light Charged Particles
 - 3.3. Interactions of Gamma Radiation
 - 3.4. Interactions of Neutrons
 - 3.4.1. Types of Neutron-Induced Nuclear Reactions
 - 3.5. Reaction Cross Sections
 - 3.6. Attenuation of a parallel beam
 - 3.7. Reaction Rate Density

4. Additional topics on neutron interactions
 - 4.1. Neutron Flux
 - 4.2. Energy spectrum
 - 4.3. Volumetric Source
5. Complementary Topics in Mathematics
 - 5.1. Vector algebra
 - 5.2. Vectors, Matrices, Operators
 - 5.3. Systems of linear algebraic equations
 - 5.4. Co-Ordinate Systems
 - 5.5. Gradient of a Function
 - 5.6. Divergence of a Vector Function
 - 5.7. Curl
 - 5.8. Laplacian
6. Nuclear Reactors and Nuclear Power
 - 6.1. The Fission Chain Reaction
 - 6.2. Nuclear Reactor Fuel
 - 6.3. Nuclear Plant Components