ISOTOPIC METHODS

3, 4 semestral M.Sc. studies held at the Faculty of Mathematics and Physics
Silesian University of Technology
since academic year 2010/11

Additional courses are not included

Gliwice, May 25, 2010
Program of 3 semestral study

SEMESTER 1

Modern physics (30h lectures + 30h exercises)

Physics of condensate state (30h lectures)
Types and properties of fundamental interactions. The impact of the strong, weak, electromagnetic and gravitational. Impact in the nucleus of an atom.
Structure and properties of atomic nuclei in the ground state. Isotopes, isobars, izotony, kernel mirror. Size and shape of atomic nuclei. Kernel weight distribution. The density of nuclear matter. The structure of the nucleon carrier. Nucleus binding energy.
Spin and electromagnetic moments of nuclei. Parity and spins of the nuclei. Statistics nuclei. Conservation laws in nuclear physics. Types and ownership transformation of radioactive nuclei.

Numerical methods (30h lectures +45h laboratory)

Elements of matter structure (30h lectures + 30h seminar)

Detection and spectrometry of particle radiation (30h lectures +45h laboratory)

**Laboratory of physics** (45h laboratory)

**SEMESTER 2**

**Physics of condensate state** (30h lectures)

**Numerical methods** (30h lectures +45h laboratory)

**Laboratory of physics** (45h laboratory)

**Dosimetry of particle radiation** (30h lectures + 30h exercises)

**Isotopic mass spectrometry** (30h lectures + 15h laboratory + 15h seminar)

**Isotopic measurement in nuclear energetic** (15h lectures + 30h exercises + 15h seminar)

**Particle radiation protection** (30h lectures)
Radioactive waste.
Radiation Protection in Nuclear Energy.
Radiation accidents. Accidents at nuclear installations. Contingency planning.

**Geochemistry of isotopes** (30h lectures + 30h seminar)
Basic concepts of geochemistry - elements and their occurrence in the universe. Basic concepts of isotope geochemistry.
Isotope geochemistry as a tool for environmental studies and restoration of contemporary environmental change in the past.
The main elements used in environmental studies. Patterns used in isotopic studies.
Measurement methods and sample preparation methodology. Problems of standardization of methods and results.
Tritium in atmospheric waters. Isotope Fractionation during evaporation and condensation.
Hydrogen and oxygen isotopes in ice and snow. Elements of isotope hydrology.
Carbon isotopes. The isotopic composition of carbon in the biosphere.
The isotopic composition of organic carbon in sediments, and fossil fuels.
The isotopic composition of carbon in the atmosphere. 14C: the formation and circulation in nature, the main reservoirs of the isotope 14C, 14C isotope of anthropogenic origin.
Carbon isotopic composition of carbonate rocks of primary and secondary carbonates and shells.
Isotopes of sulfur. The isotopic composition and fractionation of sulfur isotopes in the environment.
Examples of use.
Isotopic geochemistry of uranium. The isotopic composition of natural uranium. Isotopic composition of uranium in marine waters, ocean and inland.
Isotopic methods in geochronometry. The use of isotopes for dating rocks and minerals using radiocarbon, Uranium-track, leaded and luminescence methods.

**Isotopic control of food, fuel and construction materials** (15h lectures + 15h laboratory)
Biochemical composition of food products.
Light stable isotopes, C-14, H-3 in the modern biosphere, fossil fuels.
A number of uranium, track, K-40, Cs-137 in the lithosphere.
C-14 and H-3 in the study of origin and composition of fuels.
The use of light stable isotopes in the study of origin and composition of food products.
Measurements of indoor radon concentration.

**SEMESTER 3**

**Fundaments and applications of luminescence method** (30h lectures + 15h seminars)
Thermoluminescence (TL) and optically stimulated luminescence (OSL) in solids
Model-band luminescence. Formation mechanisms of luminescence
Quenching thermal emission thermal power emission, anomalous luminescence decay and other phenomena affecting the properties of the emitted luminescence
Natural and artificial luminescent materials
Methods for determining the physical quantities describing the TL and OSL
Numerical modeling of luminescence in quartz
The measurement methods used in the applications of luminescence dosimeter
Analysis of OSL decay curves and growth curves. Application of genetic algorithms
Environmental dosimetry using TL and OSL
Retrospective dosimetry using building materials and other
Luminescence dosimetry in medical applications
Luminescent dating method
Luminescent signal problem zeroing in different sedimentary environments
Selected problems of geological and archaeological sites, employing luminescence dating.
Fundamentals and applications of radiocarbon method (30h lectures + 15h seminars)
The main reservoirs of carbon on Earth. Radiocarbon and the carbon cycle on Earth. Differentiation between the carbon isotopic composition of reservoirs. The carbon cycle and radiocarbon in the atmosphere.
Inorganic and organic Carbon in the ocean.

Isotopic archive of climate changes (30h lectures + 30h seminars)

Radioisotopic method of dating (30h lectures + 15h exercises + 30h laboratory)

Program of 4 semestral study

SEMESTER 1

Modeling of physical processes (30h lectures + 15h laboratory)

Electric and electronic survey (30h lectures + 30h laboratory)

Introduction to optoelectronics (15h lectures + 30h laboratory)

Experimental methods of technical physics (30h lectures + 45h laboratory)
Solid state physics (30h lectures + 30h exercises)
Method of data assimilation (15h lectures + 30h exercises)
Introduction to numerical methods (15h lectures +30h laboratory)
Nuclear reactors (30 h lectures)
Elements of geophysics (30 h lectures)

SEMESTER 2

Modern physics (30h lectures + 30h exercises)
Physics of condensate state (30h lectures)
Numerical methods (30h lectures +45h laboratory)
Elements of matter structure (30h lectures + 30h seminar)
Detection and spectrometry of particle radiation (30h lectures +45h laboratory)
Laboratory of physics (45h laboratory)

SEMESTER 3

Physics of condensate state (30h lectures)
Numerical methods (30h lectures +45h laboratory)
Laboratory of physics (45h laboratory)
Dosimetry of particle radiation (30h lectures + 30h exercises)
Isotopic measurement in nuclear energetic (15h lectures + 30h exercises + 15h seminar)
Particle radiation protection (30h lectures)
Geochemistry of isotopes (30h lectures + 30h seminar)
Isotopic control of food, fuel and construction materials (15h lectures + 15h laboratory)

SEMESTER 4
Fundaments and applications of luminescence method (30h lectures + 15h seminars)

Fundaments and applications of radiocarbon method (30h lectures + 15h seminars)

Isotopic archive of climate changes (30h lectures + 30h seminars)

Radioisotopic method of dating (30h lectures + 15 exercises + 30h laboratory)

All information available on webpage:


Contact person:

Andrzej.Bluszcz@polsl.pl, Andzej.Rakowski@polsl.pl