Radiometry – Course Syllabus

Course Information

Semester	UEF 5.2 – Applied Geophysics
Teaching Hours	52h30 (Lecture: 1h30, Tutorial: 1h30)
Credits	5
Coefficient	2

Course Objectives

- Understand the nature and origin of natural nuclear radiation.
- Describe radioactive decay laws and the units used in radiometry.
- Identify radioactive elements present in geological formations and their gamma-ray spectra.
- Explain gamma–matter interactions and attenuation mechanisms.
- Understand the functioning of radiometric instruments (gas detectors, scintillometers, gamma spectrometers).
- Perform basic processing, calibration, and interpretation of radiometric survey data.
- Prepare students for advanced radiometric field acquisition and spectrometry.

Prerequisites

Students should have successfully completed first- and second-year courses in:

- General physics
- Nuclear physics (basics)
- Geology
- Mathematics
  These provide the necessary background to follow the course in good conditions.

Course Content

I – General Concepts

1. Historical background of radiometry
2. Nuclear radiation types (α, β, γ)
3. Radioactive decay law
4. Radiometric units and measurement conventions
5. Applications of radiometry in geophysics

II – Radioactive Phenomena in Geological Formations

1. Abundance of radioactive elements in the Earth’s crust
2. Radioactive series of Uranium, Thorium, and Actinium
    - Composition
    - Gamma-ray emission spectra

Radiometry – Course Syllabus

3. Interaction of gamma rays with matter
    - Absorption mechanisms
    - Attenuation coefficients
    - Calculation methods
4. Induced radioactivity
    - Production of radioactive isotopes
    - Recording induced activity
    - Geophysical applications

III – Radiometric Instruments

1. Gas-filled detectors
2. Ionization chambers
3. Geiger–Müller counters
4. Scintillometers: structure and operation
5. Gamma-ray spectrometers
    - Detector structure
    - Energy discrimination
    - Selection of energy windows (K, Th, U channels)
6. Modes of gamma activity recording using spectrometers
7. Calibration procedures
    - Total count calibration
    - Three-channel spectrometric calibration (K, Th, U)

Practical Work (TP)

1. Radioactive decay law (measurements & calculations)
2. Applications of radiometry
3. Gas-filled detector operation
4. Gamma spectrometer structure and functioning
5. Selection and calibration of energy windows

Mode of Evaluation

- **Continuous assessment:** quizzes, reports, TP evaluation
- **Final exam:** written or written + problem-solving
  Combined evaluation according to department rules.

Recommended References

- *Review of Radiation Oncology Physics – A Handbook for Teachers and Students* (IAEA)
- Kazimierz Rozanski & Klaus Froehlich (1996). *Radioactivité et sciences de la Terre.*
- Jean Colin, Emmanuel Vient, François Mauger (2010). *Interactions Rayonnement–Matière.* Notes de cours