UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2016/17/1
Course:	Nuclear Measurements
Code:	VEMKRKM254N
Responsible department:	Institute of Radiochemistry and Radioecology
Department code:	MKRK
Responsible instructor:	dr. János Somlai

Course objectives:

Acquirement of the basic knowledge in the fields of nuclear metrology and knowledge about bases of different measuring methods.

Course content:

The radioactivity, radioactive decay modes, half life, decay scheme, energy of particles. Interactions of a-, b-, g-ray and neutron radiation with matter. Classification of radiation detectors. Viewpoints of classification: detection of intensity and dose as well as energy analysis. Gas-filled radiation detectors: basic processes, ionization and excitation of gas molecules, recombination. General properties (and requirements) of gas-filled detectors. Operation, design and applicability of ionization chambers and proportional counters. Operation design and applicability of Geiger-Müller counters. The mechanism of scintillation. Design and operation of scintillation detectors. Photomultiplier tube characteristics. General properties of scintillators, organic, inorganic and liquid scintillators. Spectroscopy of a-, b-, g-ray and neutron radiations with scintillators. Applications of scintillation detectors. General aspects of the operation of semiconductor detectors, semiconductor properties. Types and properties of semiconductor detectors: surface barrier detectors, diffused junction detectors, high purity or intrinsic detectors. Summary of the main features and applications of semiconductor detectors. Evaluation of experimental data. Deconvolution of energy spectra. Estimation of statistical accuracy. Electronic instrumentations: amplifiers, scalers, ratemeters. Single- and multichannel analyzers.

Plateau and working point measurement of a GM tube. Relaxation time, statistics of measured data. Efficiency of the GM tube, the quadratic rule of distance. Measurements with gas-filled detectors. Scintillation spectrometry. Energy calibration and precision of a scintillation spectrometer. High precision gamma spectrometry. Energy calibration and precision of a HpGe detector. Efficiency calibration of a semi-conductor detector. Measuring an unknown gamma-activity wint absolute and relative method. High precision X-ray fluorescent spectrometry. Action radius of alpha.particles. Alpha energy measurement with semi-conductor detector. Alpha-spectrometry with PERAL method. Measurements with liquid scintillation counter. Dose, dose rate and surface contamination measurements.

Requirements, evaluation and grading:

In the course of an oral examination two overall questions on the issues of the lectures are provided to each student. A short period of time (maximum 30 minutes) is supplied to the students to prepare some drafts of their answers.
The exam is qualified in the following ways:
- If draft and the answers provided by the student are clear, correct and explains every important relationship on the subject, the record is marked as excellent one (5).
- If he student is able to make an overall analysis on the issue solely by the directions of the teacher, he (she) is assessed with a good record (4).
- If the student is not able to give clear description on the main relationships of the subject but he (she) can define the fundamental conceptions, his grade is a fair (medium) (3).
- If the student can define the fundamental conceptions of the issue by the directions of the teacher, he gets a pass (2).
- Without having studied the fundamental conceptions the student is qualified with an unsatisfactory (fail) record (1).

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Requirements, evaluation and grading:

All the proper practices are to be executed by the students admitted the subject either on regular or on extra dates offered. To test the preparedness of the students they have to provide an entrance digger and the results of it contribute to the classification mark of the practice. The results of the determinations provided in the laboratories, including some intermediate data to control the endpoints, are to be presented in a protocol. The protocols are collected at the end of the practice and classified the conductor. The average of the marks of the protocols is reported as the endpoint of the practice.

Required and recommended readings:

G.F. Knoll: Radiation detection and Measurement. (J. W. & Sons, New York, 1989.)
W. H. Tait: Radiation detection (Butterworths, London,1980.)
Nagy L. Gy.: Radiokémia és izotóptechnika. Tankönyvkiadó, 1998.
Kanyár B., Németh Z.: Anyagszerkezeti vizsgálatok radioaktív sugárzással, VE Kiadó, 1999.
Bódizs Dénes: Atommag-sugárzások méréstechnikái, Typotex, Budapest, 2006
Radiokémiai laboratóriumi gyakorlatok, VE Kiadó, 1996.