COURSE UNIT DESCRITPION

Course title: **Radiation Protection in Nuclear Power Plant and Technical Application of Ionizing Radiation**	
Field: **Energy**	Hours/semester: **120 h**
Speciality: **Nuclear Energy**	Lecture: **75 h**
Profile:	Classes:
Code:	Laboratory: **30 h**
ECTS points :	Project/seminars: **15 h**

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Aims:
Basic knowledge in:

- Basic elements of nuclear physics - nucleus parameters and models, nuclear reactions, nuclear fission, alfa, beta, gamma and neutron radiations;
- Radiation phenomena; natural and artificial radioactive elements;
- Natural radioactivity of water, soil, structural materials;
- Basic knowledge in nuclear physics and techniques;
- Interaction of radiation with matter;
- Measurement of nuclear radiation - gamma, beta, alfa and neutron measurement techniques;
- Some elements of the Polish Atomic Law;
- Basic elements of radiation protection - radioactive sources, doses and dose rates, radiation attenuation, ionizing radiation shields, radioactive waste and its utilization, health and safety precautions, personal protection, radiation hormesis phenomena;
- Influence of ionizing radiation on biological objects and environment;
- Radiological monitoring (working place and environment);
- Contamination and decontamination procedures;
- Nuclear energy production; legal aspects of nuclear energy;
- Radiological safety of nuclear power plant;
- Nuclear accidents;
- Waste management;
- Application of radiometric methods in controlling typical factories processes (chemical, mechanical and hydraulic);
- Application of radioactive elements - technical, medical and environmental protection;

Laboratory course description:

- Introductory Exercise 1 - Basic elements of radiation protection - radioactive sources, doses and dose rates, radiation attenuation, ionizing radiation shields, health and safety precautions, personal protection;
- Exercise 2 - ionizing radiation measurements, dosimeter equipments, ionizing radiation shields, doses and dose rates measurements, measurement of contamination and decontamination procedures;
- Exercise 3 – dosimeter calibration, isodose calculation and staking out; discovering of "losed" ionizing source;
- Exercise 4 – statistical basis for ionizing radiation measurements; gamma and beta measurement techniques (Geiger-Muller detectors);
- Exercise 5 – measurement of decay constant λ and half-life $T_{1/2}$ for "long-living" radioisotopes (^{40}K);
- Exercise 6 – alfa, beta, gamma, and neutron measurement techniques (photomultipliers and scintillation probes, crystal and plastic detectors);
- Exercise 7 - radiation attenuation (alfa, beta, gamma and neutron, ionizing radiation) shields; measurements of the linear absorption coefficient of Fe, Cu, Pb and "unknown" material;
- Exercise 8 – measurements of the natural radioactivity of : geological, water, soil and structural materials from some environmental areas; collecting and preparation of environmental samples;
- Exercise 9 – flow and leakage measured (flow measurement by peak timing, two points method, velocity profiles;
- Exercise 10 – gamma level gaging;
- Exercise 11 – alfa, beta and gamma spectrometry; identification of "unknown" radioisotope;

Examination methods:

Constant spoken control.

Bibliography:

1. H.A.C.Mc Kay, "*Principles of Radiochemistry*"; London Butterworths, 1985
2. Niesmiejanow, "*Radiochemistry*"; PWN Warszawa, 1995
3. J.Kroh, "*Radiation Techniques*", PWN Warszawa, 1980
4. B.Dziunikowski, "Application of Ionizing Radiation Sources in Techniques, Agriculture, Medicine"; AGH, Kraków 1995
5. Radiation Protection - materials from IAEA (International Atomic Energy Agency), Polish National Atomic Energy Agency and Polish Nuclear Society
6. W.Goraczko, "Radiochemistry and Radiation Protection", PP Poznan 2003.