Study: Physics

Type and level of studies: Bachelor studies

Course name: Radiation Physics

Lecturer**: Vučković Biljana**

Status: Elective

ECTS: 7

Attendance prerequisites: Physical Mechanics; Molecular Physics and Thermodynamics; Introduction to Theoretical Mechanics

Course aims

The students gain basic knowledge about radiation physics.

Course outcome

The students have acquired knowledge of radiation physics, particle-matter interactions and the effects of radiation and radiation protection.

Course content

Theoretical Part

HEAVY CHARGED PARTICLE INTERACTION WITH MATTER: Energy loss mechanisms. Maximum energy transmitted in a collision. Bethe formula for stopping power. Mean excitation energy. Stopping power for protons. Range and deceleration speed.

INTERACTION OF BETA PARTICLES WITH MATTER: Mechanisms of energy loss. Collision stopping power. Radiation stopping power. Radiation yield. Range and deceleration speed. Spectrum of single collisions in water. Examples of electronic traces in water.

PHENOMENA THAT FOLLOW TRACE OF ELECTRIC PARTICLES: Delta rays. Restricted stopping power. Linear energy transfer LET. Specific ionization. Scattering. Multiple Coulomb scattering.

PHOTON INTERACTION WITH MATTER: Mechanisms. Photoelectric effect. Requirements for maintaining energy and momentum during photon absorption by electrons. Compton effect. Pair production. Photonuclear reactions. Attenuation, absorption and scattering coefficients. Efficient cross-section.

NEUTRONS: Neutron sources. Neutron classification. Interaction with matter. Elastic scattering. Reactions. Neutron activation.

CHEMICAL AND BIOLOGICAL EFFECTS OF RADIATION: Time frame of radiation effects.

Physical and pre-chemical properties in irradiated water. Chemical stage. Examples of calculated traces of charged particles in water. Chemical yields in water. Biological effects. Sources of data on human exposure: occupational exposure, medical exposure, nuclear weapons. Acute radiation syndrome. Delayed somatic effects: cancer, degenerative changes, shortened life span, cataracts, teratogenic effects, sterility. Genetic effects. Dose-effect relationship. Factors affecting dose-effect relationship.

PROTECTION FROM EXTERNAL RADIATION: Distance, time and shielding. Gamma radiation shielding. Shielding from x-ray installations: primary protective barrier planning, secondary protective barrier and half-value layer planning, radiation leakage, scattered radiation. Beta emitter protection. Neutron protection.

Practical Part

COMPUTATIONAL EXERCISES: Computational exercises in the field of statistical physics equilibrium and nonequilibrium.

Literature

1. Turner, translation

Number of active classes				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:		

Teaching methods

Lectures (2 classes per week during the semester), computational exercises (2 classes per week during the semester).

Assessment (maximum 100 points)

Course assignments	**points**	Final exam	**points**
Lectures	15	oral exam	35
Two term papers	15	written exam	35
Practical exercises		.....	
Total	30		70