Study plan

Name of study plan: Radiolgická fyzika

Faculty/Institute/Others:
Department:
Branch of study guaranteed by the department: Welcome page
Garantor of the study branch:
Program of study: Radiological Physics
Type of study: Follow-up master full-time
Required credits: 0
Elective courses credits: 120
Sum of credits in the plan: 120
Note on the plan:

Name of the block: Compulsory courses in the program
Minimal number of credits of the block: 0
The role of the block: P

Code of the group: NMSPRF1
Name of the group: NMS P_RF 1st year
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 14 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
01DIZO	**Digital Image Processing** *Barbara Zitová* ***Barbara Zitová*** *Barbara Zitová (Gar.)*	ZK	4	2P+2C		P
01DOMA1	**Additional Topics of Calculus 1** *Jan Kovář, Milan Krbálek, Jiří Mikyška* ***Jiří Mikyška*** *Jan Kovář (Gar.)*	Z,ZK	4	2P+2C		P
01DOMA2	**Additional topics of Calculus 2** *Milan Krbálek, Jiří Mikyška, Juraj Kováč* ***Milan Krbálek*** *Milan Krbálek (Gar.)*	Z,ZK	4	2P+2C		P
16EX	**Excursion** ***Lenka Thinová*** *Lenka Thinová (Gar.)*	Z	3	1t		P
16JRFRF	**Nuclear and Radiation Physics for MP** *Ladislav Musílek, Tomáš Urban* ***Tomáš Urban*** *Ladislav Musílek (Gar.)*	Z,ZK	3	2P+1C	1	P
16KLD2	**Clinical Dosimetry 2** *Tomáš Trojek, Tereza Hanušová, Josef Novotný* ***Tereza Hanušová*** *Tereza Hanušová (Gar.)*	ZK	2	2P+0C	Z	P
02KFM	**Quantum Physics** *Filip Petrásek* ***Petr Jizba*** *Filip Petrásek (Gar.)*	Z,ZK	3	2P+1C	Z	P
16MCRF	**Monte Carlo Method in Radiation Physics** *Tomáš Urban* ***Tomáš Urban*** *Tomáš Urban (Gar.)*	Z,ZK	4	2+2	2	P
16PAFZ2	**Pathology, Anatomy and Physiology in Imaging Techniques 2** *Jana Votrubová Vlastimil Válek (Gar.)*	ZK	2	2+0		P
16RBIO	**Radiobiology** *Marie Davídková* ***Marie Davídková*** *Marie Davídková (Gar.)*	ZK	2	2+0	L	P
02SFKT	**Statistical physics and kinetic theory** *Igor Jex, Jaroslav Novotný Igor Jex (Gar.)*	Z,ZK	4	2P+2C	L	P
02VOAM	**Waves, Optics and Atomic Physics** *Josef Schmidt* ***Jan Vysoký*** *Jiří Tolar (Gar.)*	Z,ZK	6	4P+2C	Z	P
16VURF1	**Research Project 1** ***Kateřina Pilařová*** *Kateřina Pilařová (Gar.)*	Z	6	0+6	1	P
16VURF2	**Research Project 2** *Kateřina Pilařová* ***Kateřina Pilařová*** *Kateřina Pilařová (Gar.)*	KZ	8	0+8	2	P

Characteristics of the courses of this group of Study Plan: Code=NMSPRF1 Name=NMS P_RF 1st year

01DIZO	Digital Image Processing	ZK	4

image sampling and quantization, Shannon theorem, aliasing basic image operations, histogram, contrast stretching, noise removal, image sharpening linear filtering in the spatial and frequency domains, convolution, Fourier transform edge detection, corner detection feature detection image degradations and their modelling, inverse and Wiener filtering, restoration of motion-blurred and out-of-focus blurred images image segmentation mathematical morphology image registration and matching

01DOMA1	Additional Topics of Calculus 1	Z,ZK	4
01DOMA2	Additional topics of Calculus 2	Z,ZK	4
16EX	Excursion	Z	3
Excursion in research institutes, laboratories and cooperative universities (CERN, JINR, TU Dresden,...) and modern research trends usig ionizing radiation.			
16JRFRF	Nuclear and Radiation Physics for MP	Z,ZK	3
The course extends and complements the knowledge acquired in the bachelor's program Nuclear Engineering at FNSPE CTU in Prague in subjects 16URF1 and 16URF2 or in similar courses at other university. Therefore, it deals with the level of difficulty corresponding to the master's level of the issue of atomic nuclei, their characteristics and models, the interaction of ionizing radiation with matter, radioactivity and nuclear reactions, and provides basic information on the physics of high energy particles. Particular attention is also paid to quantities characterizing the field and interaction of ionizing radiation in accordance with current international recommendations.			
16KLD2	Clinical Dosimetry 2	ZK	2
Learning outcomes of the course unit The aim of the course is to acquaint students with advanced dosimetric methods in accordance with the rapid development of technologies in the field: small field dosimetry, dosimetry in magnetic field, proton beams, special technologies. Furthermore, it should deepen theoretical knowledge (cavity theory).			
02KFM	Quantum Physics	Z,ZK	3
State description, wave function, postulates of quantum mechanics, Born´s statistical interpretation, expectation values, Schrödinger equation, Heisenberg uncertainty principle, quantization of angular momentum, solution of simple systems, hydrogen atom.			
16MCRF	Monte Carlo Method in Radiation Physics	Z,ZK	4
Basic principles of the MC method, probability theory and selected concepts in mathematical statistics. Ionising radiation transport simulation, photons, neutrons and charged particles interactions and their simulation, modelling of the geometric conditions. Statistical tests of the model calculations, variance reduction techniques. Codes for simulation of radiation transport, MCNP(X) code, properties and scope of usage, input file (description of the geometry, materials, sources, tallies), graphical tools, code user control. Tools for input fines creation/editing a visualization (VISED, Sabrina, Body Builder). Examples of application (practical training) concentrated on radiation physics (shielding, radiation fields/beams/sources, spectral/spatial distributions of the dosimetric quantities, responses of detection systems, radiation protection tasks. The basics of working with the program Fluka and Geant, SRIM code for simulation of the transport of charged particles.			
16PAFZ2	Pathology, Anatomy and Physiology in Imaging Techniques 2	ZK	2
To make the students familiar with pathology in imagine method, virtual reality, modulations and spatial reconstruction.			
16RBIO	Radiobiology	ZK	2
The presented lectures are aimed at basis of radiation biology. Students are introduced into biological effects of ionizing radiation; physical and chemical processes of radiation action in biological material; mechanisms of radiation damage to DNA and other cell components; types of damages and their repair; subcellular and cellular sensitivity and response to irradiation; physical, biological and chemical modificators of the cell response to irradiation; theories and models for cell survival and radiation biology of normal and neoplastic tissue systems.			
02SFKT	Statistical physics and kinetic theory	Z,ZK	4
02VOAM	Waves, Optics and Atomic Physics	Z,ZK	6
Wave phenomena in mechanics and electromagnetism: modes, standing and travelling waves, wave packets in dispersive media. Wave optics: polarization, interference, diffraction, coherence. Geometrical optics. Introduction to quantum physics: black body radiation, quantum of energy, photoeffect, the Compton effect, the de Broglie waves, the Schrodinger equation, stationary states and spectra of finite systems.			
16VURF1	Research Project 1	Z	6
Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.			
16VURF2	Research Project 2	KZ	8
Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.			

Code of the group: NMSPRF2
Name of the group: MDP P_RF 2nd year
Requirement credits in the group:
Requirement courses in the group: In this group you have to complete at least 11 courses
Credits in the group: 0
Note on the group:

Code	Name of the course / Name of the group of courses *(in case of groups of courses the list of codes of their members)* *Tutors,* ***authors*** *and guarantors (gar.)*	Completion	Credits	Scope	Semester	Role
16DPRF1	**Master Thesis 1** ***Tomáš Trojek*** *Tomáš Trojek (Gar.)*	Z	10	0+10		P
16DPRF2	**Master Thesis 2** ***Tomáš Trojek*** *Tomáš Trojek (Gar.)*	Z	20	0+20	4	P
16HTA	**Health technology assesment** *Gleb Donin, Vojtěch Kamenský, Ondřej Gajdoš, Irena Koniarová Vladimír Rogalewicz (Gar.)*	KZ	2	2P+0C	L	P
16MRSO	**Magnetic resonance and sonography** *Jaroslav Tintěra, Marek Mechl Jaroslav Tintěra (Gar.)*	ZK	2	2P+0C	Z	P
16NAM	**Standards and metrology** *Pavel Novotný* ***Pavel Novotný*** *Pavel Novotný (Gar.)*	ZK	2	2P+0C	L	P
16RFNMN	**Radiological Physics - Nuclear Medicine** *Tereza Kráčmerová, Jiří Trnka* ***Kateřina Pilařová*** *Tomáš Trojek (Gar.)*	Z,ZK	3	2P+1C	Z	P
16RFRTN	**Radiological Physics - Radiotherapy** *Josef Novotný, Irena Koniarová, Matěj Navrátil* ***Irena Koniarová*** *Irena Koniarová (Gar.)*	Z,ZK	3	2P+1C	Z	P
16RFRDN	**Radiological Physics - Diagnostic Radiology** *Kateřina Dudášová, Lucie Súkupová, Iva Krulová* ***Kateřina Pilařová*** *Lucie Súkupová (Gar.)*	Z,ZK	3	2P+1C	Z	P
01RMFM	**Equations of Mathematical Physics** *Juraj Kováč, Václav Klika, Matěj Tušek* ***Václav Klika*** *Václav Klika (Gar.)*	Z,ZK	6	4P+2C		P

16SEM2	**Seminar 2** ***Kateřina Pilařová*** *Kateřina Pilařová (Gar.)*	Z	2	0+2	L	P
01ROZP2	**Image Processing and Pattern Recognition 2** *Jan Flusser* ***Jan Flusser*** *Jan Flusser (Gar.)*	ZK	4	2+1		P

Characteristics of the courses of this group of Study Plan: Code=NMSPRF2 Name=MDP P_RF 2nd year

16DPRF1	Master Thesis 1	Z	10
Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.			
16DPRF2	Master Thesis 2	Z	20
Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.			
16HTA	Health technology assesment	KZ	2
In this course, students will be introduced to the issue of health technology assessment - HTA. Health technologies will be defined and the purpose of HTA described. Principles of evidence based medicine (EBM) as the basis of HTA. Students will learn the structure of studies, especially EUnetHTA Core Model. Calculate cost effectiveness and get input data (costs and outcomes). Specifics of using HTA at the level of national regulator and at the level of hospital management. Particular attention will be paid to the specifics of HTAs for medical devices. The conclusion of the lectures will be devoted to ethical questions of practical use of HTA.			
16MRSO	Magnetic resonance and sonography	ZK	2
Magnetic resonance and ultrasound: clinical imaging methods that do not use ionizing radiation.			
16NAM	Standards and metrology	ZK	2
Objectives and requirements of metrology, interpretation of radiation quantities and units in metrology, theoretical and experimental basis of metrology (uncertainties, relative and absolute measurements, data processing and evaluation of results of measurements, radiation etalons), evaluation of basic radiation quantities (activity, emission rate, exposure, absorbed dose), intercomparison measurements, metrology law and relevant regulations.			
16RFNMN	Radiological Physics - Nuclear Medicine	Z,ZK	3
The aim of the course is to extend the knowledge gained in previous studies in the field of nuclear medicine. The greatest attention is paid to current trends in imaging methods, dosimetry for individual treatment planning and newly developed procedures and pharmaceuticals for targeted radionuclide therapy. Part of the course is also devoted to the specifics of radiation protection in nuclear medicine workplaces.			
16RFRTN	Radiological Physics - Radiotherapy	Z,ZK	3
Curriculum offers introduction to medical physics in radiotherapy. It covers basics of radiation oncology, biological effects of ionising radiation, treatment planning, units used for treatment, basic techniques of external radiotherapy and brachytherapy, quality assurance.			
16RFRDN	Radiological Physics - Diagnostic Radiology	Z,ZK	3
Learning outcomes of the course unit The course is a follow-up to the course Radiological Technics - Diagnostic Radiology and the student gains a deeper overview of X-ray diagnostics including CT in practice. Furthermore, they will be acquainted in more detail with parameters for image quality and image processing and also with communication protocols in radiology. Last but not least, they will learn how to proceed in case of exposure to a pregnant patient and also how machine learning is used in radiology.			
01RMFM	Equations of Mathematical Physics	Z,ZK	6
The subject of this course is solving integral equations, theory of generalized functions, classification of partial differential equations, theory of integral transformations, and solution of partial differential equations (boundary value problem for eliptic PDE, mixed boundary problem for eliptic PDE).			
16SEM2	Seminar 2	Z	2
An oral presentation of Master's Thesis results. The presentation is evaluated by the other attendees of the seminary. The students are encouraged to write an article summarizing their Master thesis.			
01ROZP2	Image Processing and Pattern Recognition 2	ZK	4
The course is a continuation of ROZ1. Major attention is paid to features for shape description and recognition, and to general pattern recognition techniques. Numerous applications and experimental results are presented in addition to the theory.			

Name of the block: Elective courses
Minimal number of credits of the block: 0
The role of the block: V

Code of the group: NMSPRFV
Name of the group: MDP P_RF Optional courses
Requirement credits in the group:
Requirement courses in the group:
Credits in the group: 0
Note on the group:

Code	**Name of the course / Name of the group of courses** ***(in case of groups of courses the list of codes of their members)*** *Tutors,* ***authors*** *and guarantors (gar.)*	**Completion**	**Credits**	**Scope**	**Semester**	**Role**
16AMMN	**Methods of Analytical Measurement** *Hana Průšová* ***Kateřina Pilařová*** *Hana Průšová (Gar.)*	KZ	2	2P+0C	2	V
16APIZ1	**Applications of Ionizing Radiation 1** *Tomáš Trojek, Václav Procházka, Tomáš Čechák* ***Tomáš Trojek*** *Tomáš Čechák (Gar.)*	ZK	3	3P+0C	L	V
17APIZ2	**Application of Ionizing Radiation 2** *Martin Cesnek, Marcel Miglierini, Milan Štefánik*	Z,ZK	3	2P+1L	L	V
18AMTL	**Matlab Applications** ***Jaromír Kukal***	KZ	4	2P+2C	L	V
16DNEU	**Neutron Dosimetry** *Michal Košťál, Ondřej Ploc* ***Ondřej Ploc*** *Ondřej Ploc (Gar.)*	ZK	2	2+0	3	V
16DZAR	**Dosimetry of Internal Radiation Sources** *Ladislav Musílek* ***Ladislav Musílek*** *Ladislav Musílek (Gar.)*	ZK	2	2+0	4	V

18MEMC	**Monte Carlo Method** *Jaromír Kukal, Miroslav Virius* ***Miroslav Virius*** *Miroslav Virius (Gar.)*	Z,ZK	4	2P+2C	Z	v
16MER	**Instrumentation for Radiation Measurements** *Petr Průša* ***Petr Průša*** *Petr Průša (Gar.)*	ZK	2	2+0	1	v
16MERV	**Instrumentation for Radiation Measurements** *Petr Průša* ***Petr Průša*** *Petr Průša (Gar.)*	Z,ZK	4	2P+2C	1	v
16MDOZI	**Microdosimetry** *Kateřina Pachnerová Brabcová* ***Anna Jelínek Michaelidesová*** *Kateřina Pachnerová Brabcová (Gar.)*	KZ	2	2P+0C	Z	v
15RFM2	**Radiopharmaceuticals 2** *Ján Kozempel, Marek Moša, Martin Vlk* ***Martin Vlk*** *Ján Kozempel (Gar.)*	ZK	2	2+0	Z	v
16SPD	**Spectrometry in Dosimetry** *Pavel Novotný* ***Pavel Novotný*** *Tomáš Čechák (Gar.)*	ZK	2	2P+0C	Z	v
01SUP	**Start-up Project** *Přemysl Rubeš* ***Přemysl Rubeš*** *Přemysl Rubeš (Gar.)*	KZ	2	2P+0C		v
16UAZ	**Principles of Ionizing Radiation Application** *Ladislav Musílek* ***Ladislav Musílek*** *Ladislav Musílek (Gar.)*	ZK	2	2+0	1	v

Characteristics of the courses of this group of Study Plan: Code=NMSPRFV Name=MDP P_RF Optional courses

16AMMN	Methods of Analytical Measurement	KZ	2

Principles, technical performance and utilization of methods of chemical analysis. Methodology of analytical determination, gravimetry, titration methods, potentiometry, polarography, refractometry, polarimetry, UV-VIS spectroscopy, atomic emission and absorption spectroscopy, infrared and Raman spectroscopy, X-ray structural analysis, nuclear magnetic and electron spin resonance, mass spectrometry, thermometric methods, gas and liquid chromatography.

16APIZ1	Applications of Ionizing Radiation 1	ZK	3

Applications of ionizing radiation 1 inclusive of radioanalytical methods and application of radionuclides and ionizing radiation for analysis and diagnostics of industrial and research processes.

17APIZ2	Application of Ionizing Radiation 2	Z,ZK	3

The course provides overview of possibilities of the applications of ionizing radiation namely in the field of characteriza-tion and diagnostic of materials for the sake of science and technology. Emphasis will be given to advanced methods of materials characterization which utilize atomic and nuclear physical processes. Several diagnostic methods based upon ionizing radiation will be introduced.

18AMTL	Matlab Applications	KZ	4

Systematic application of Matlab optimization toolbox for the solution of linear, quadratic, binary, integer an nonlinear programming tasks. Simulation of chaotic systems an fractal set generation. Analysis of trajectories, attractors and fractal sets including estimation of their properties.

16DNEU	Neutron Dosimetry	ZK	2

Methods based on nuclear reactions with neutrons, methods based on recoiled nuclei, the time-of-flight method, neutron selectors and monochromators, activation methods, methods of integrating neutron dosimetry, possibilities of use of various methods, calibration of neutron dosimeters and other dose and dose rate measuring instruments.

16DZAR	Dosimetry of Internal Radiation Sources	ZK	2

Assessment of the radiation burden during internal contamination by radioactive materials, dosimetric quantities, compartment models of the kinetics of radioactive materials, ways of taking into account age dependence in dosimetric models, limitation of validity of used models and procedures, assessment of the radiation burden from radiopharmaceuticals in nuclear medicine - basic concepts, general procedure for calculating the absorbed dose from radiopharmaceuticals, finding data about the biological behaviour of radiopharmaceuticals, tables of absorbed doses and limitation of their validity, radiation burden for children, burden from contaminants in radiopharmaceuticals, development of methods for assessment of the radiation burden from internal sources, methods of measurement of internal contamination, detection in-vivo, excreta monitoring, monitoring of workplaces.

18MEMC	Monte Carlo Method	Z,ZK	4

This courseis devoted to the numerical method Monte Carlo and to its selected applications.

16MER	Instrumentation for Radiation Measurements	ZK	2

Methods of the processing of signal from detectors of ionizating radiation, spectroscopical systems, data processing and overview of the related electronics.

16MERV	Instrumentation for Radiation Measurements	Z,ZK	4

The lecture focuses on ionizing radiation detector signal processing, data acquisition and data processing. Among others, the most important topics are: energetic spectrometry, time spectrometry, coincidence measurements, pulse shape discrimination and spectrum deconvolution. Integral parts of the subject are several laboratory exercises. Thus, students are able to obtain practical experience and skills. The exercises are focused on detector signal processing by NIM standard electronic modules mostly. Students will learn how to operate an oscilloscope at advanced level as well. Absolvents should be able to design, build, operate and execute diagnostics of simple electronic circuit made of NIM standard modules.

16MDOZI	Microdosimetry	KZ	2

Basic characteristics of ionising radiation energy transfer to matter, importance of inelastic collisions of charged particles, excitation function, etc. Track and characteristics of ionising particles, time evolution of the energy transfer process. Microdosimetry, basic principles and approaches, stochastic and non-stochastic quantities, linear energy transfer, lineal energy, specific energy. Experimental and computational microdosimetry. Microdosimetry applied in radiobiology, radiation protection, radiotherapy.

15RFM2	Radiopharmaceuticals 2	ZK	2

The basic principles of nuclear chemistry. A survey of radionuclides used in nuclear medicine. The common methods of radiopharmaceuticals preparations. Quality and control of radiopharmaceuticals.The basic radiopharmaceuticals and their use in human diagnostic and therapy.

16SPD	Spectrometry in Dosimetry	ZK	2

The course deals with methods and applications of ionizing radiation (i.e. photons, charged particles and neutrons) spectrometry. The most important types of detectors, individual components of the electronic system used in spectrometry as well as spectra analysis procedures are discussed in detail.

01SUP	Start-up Project	KZ	2
16UAZ	Principles of Ionizing Radiation Application	ZK	2

Historical outline of applications, review of interaction of radiation with a matter, ionizing radiation sources for applications, detectors and devices for applications, evaluation of radionuclide measurements, use of penetration and scattering of radiation beams, activation analysis, X-ray fluorescence methods, tracer methods, radionuclides in age determination, further possibilities for the use of ionizing radiation.

List of courses of this pass:

Code	Name of the course	Completion	Credits
01DIZO	Digital Image Processing	ZK	4
image sampling and quantization, Shannon theorem, aliasing basic image operations, histogram, contrast stretching, noise removal, image sharpening linear filtering in the spatial and frequency domains, convolution, Fourier transform edge detection, corner detection feature detection image degradations and their modelling, inverse and Wiener filtering, restoration of motion-blurred and out-of-focus blurred images image segmentation mathematical morphology image registration and matching			
01DOMA1	Additional Topics of Calculus 1	Z,ZK	4
01DOMA2	Additional topics of Calculus 2	Z,ZK	4
01RMFM	Equations of Mathematical Physics	Z,ZK	6
The subject of this course is solving integral equations, theory of generalized functions, classification of partial differential equations, theory of integral transformations, and solution of partial differential equations (boundary value problem for eliptic PDE, mixed boundary problem for eliptic PDE).			
01ROZP2	Image Processing and Pattern Recognition 2	ZK	4
The course is a continuation of ROZ1. Major attention is paid to features for shape description and recognition, and to general pattern recognition techniques. Numerous applications and experimental results are presented in addition to the theory.			
01SUP	Start-up Project	KZ	2
02KFM	Quantum Physics	Z,ZK	3
State description, wave function, postulates of quantum mechanics, Born´s statistical interpretation, expectation values, Schrödinger equation, Heisenberg uncertainty principle, quantization of angular momentum, solution of simple systems, hydrogen atom.			
02SFKT	Statistical physics and kinetic theory	Z,ZK	4
02VOAM	Waves, Optics and Atomic Physics	Z,ZK	6
Wave phenomena in mechanics and electromagnetism: modes, standing and travelling waves, wave packets in dispersive media. Wave optics: polarization, interference, diffraction, coherence. Geometrical optics. Introduction to quantum physics: black body radiation, quantum of energy, photoeffect, the Compton effect, the de Broglie waves, the Schrodinger equation, stationary states and spectra of finite systems.			
15RFM2	Radiopharmaceuticals 2	ZK	2
The basic principles of nuclear chemistry. A survey of radionuclides used in nuclear medicine. The common methods of radiopharmaceuticals preparations. Quality and control of radiopharmaceuticals.The basic radiopharmaceuticals and their use in human diagnostic and therapy.			
16AMMN	Methods of Analytical Measurement	KZ	2
Principles, technical performance and utilization of methods of chemical analysis. Methodology of analytical determination, gravimetry, titration methods, potentiometry, polarography, refractometry, polarimetry, UV-VIS spectroscopy, atomic emission and absorption spectroscopy, infrared and Raman spectroscopy, X-ray structural analysis, nuclear magnetic and electron spin resonance, mass spectrometry, thermometric methods, gas and liquid chromatography.			
16APIZ1	Applications of Ionizing Radiation 1	ZK	3
Applications of ionizing radiation 1 inclusive of radioanalytical methods and application of radionuclides and ionizing radiation for analysis and diagnostics of industrial and research processes.			
16DNEU	Neutron Dosimetry	ZK	2
Methods based on nuclear reactions with neutrons, methods based on recoiled nuclei, the time-of-flight method, neutron selectors and monochromators, activation methods, methods of integrating neutron dosimetry, possibilities of use of various methods, calibration of neutron dosimeters and other dose and dose rate measuring instruments.			
16DPRF1	Master Thesis 1	Z	10
Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.			
16DPRF2	Master Thesis 2	Z	20
Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.			
16DZAR	Dosimetry of Internal Radiation Sources	ZK	2
Assessment of the radiation burden during internal contamination by radioactive materials, dosimetric quantities, compartment models of the kinetics of radioactive materials, ways of taking into account age dependence in dosimetric models, limitation of validity of used models and procedures, assessment of the radiation burden from radiopharmaceuticals in nuclear medicine - basic concepts, general procedure for calculating the absorbed dose from radiopharmaceuticals, finding data about the biological behaviour of radiopharmaceuticals, tables of absorbed doses and limitation of their validity, radiation burden for children, burden from contaminants in radiopharmaceuticals, development of methods for assessment of the radiation burden from internal sources, methods of measurement of internal contamination, detection in-vivo, excreta monitoring, monitoring of workplaces.			
16EX	Excursion	Z	3
Excursion in research institutes, laboratories and cooperative universities (CERN, JINR, TU Dresden,...) and modern research trends usig ionizing radiation.			
16HTA	Health technology assesment	KZ	2
In this course, students will be introduced to the issue of health technology assessment - HTA. Health technologies will be defined and the purpose of HTA described. Principles of evidence based medicine (EBM) as the basis of HTA. Students will learn the structure of studies, especially EUnetHTA Core Model. Calculate cost effectiveness and get input data (costs and outcomes). Specifics of using HTA at the level of national regulator and at the level of hospital management. Particular attention will be paid to the specifics of HTAs for medical devices. The conclusion of the lectures will be devoted to ethical questions of practical use of HTA.			
16JRFRF	Nuclear and Radiation Physics for MP	Z,ZK	3
The course extends and complements the knowledge acquired in the bachelor's program Nuclear Engineering at FNSPE CTU in Prague in subjects 16URF1 and 16URF2 or in similar courses at other university. Therefore, it deals with the level of difficulty corresponding to the master's level of the issue of atomic nuclei, their characteristics and models, the interaction of ionizing radiation with matter, radioactivity and nuclear reactions, and provides basic information on the physics of high energy particles. Particular attention is also paid to quantities characterizing the field and interaction of ionizing radiation in accordance with current international recommendations.			
16KLD2	Clinical Dosimetry 2	ZK	2
Learning outcomes of the course unit The aim of the course is to acquaint students with advanced dosimetric methods in accordance with the rapid development of technologies in the field: small field dosimetry, dosimetry in magnetic field, proton beams, special technologies. Furthermore, it should deepen theoretical knowledge (cavity theory).			
16MCRF	Monte Carlo Method in Radiation Physics	Z,ZK	4
Basic principles of the MC method, probability theory and selected concepts in mathematical statistics. Ionising radiation transport simulation, photons, neutrons and charged particles interactions and their simulation, modelling of the geometric conditions. Statistical tests of the model calculations, variance reduction techniques. Codes for simulation of radiation transport, MCNP(X) code, properties and scope of usage, input file (description of the geometry, materials, sources, tallies), graphical tools, code user control. Tools for input fines			

	creation/editing a visualization (VISED, Sabrina, Body Builder). Examples of application (practical training) concentrated on radiation physics (shielding, radiation fields/beams/sources, spectral/spatial distributions of the dosimetric quantities, responses of detection systems, radiation protection tasks. The basics of working with the program Fluka and Geant, SRIM code for simulation of the transport of charged particles.		
16MDOZI	Microdosimetry	KZ	2
	Basic characteristics of ionising radiation energy transfer to matter, importance of inelastic collisions of charged particles, excitation function, etc. Track and characteristics of ionising particles, time evolution of the energy transfer process. Microdosimetry, basic principles and approaches, stochastic and non-stochastic quantities, linear energy transfer, lineal energy, specific energy. Experimental and computational microdosimetry. Microdosimetry applied in radiobiology, radiation protection, radiotherapy.		
16MER	Instrumentation for Radiation Measurements	ZK	2
	Methods of the processing of signal from detectors of ionizating radiation, spectroscopical systems, data processing and overview of the related electronics.		
16MERV	Instrumentation for Radiation Measurements	Z,ZK	4
	The lecture focuses on ionizing radiation detector signal processing, data acquisition and data processing. Among others, the most important topics are: energetic spectrometry, time spectrometry, coincidence measurements, pulse shape discrimination and spectrum deconvolution. Integral parts of the subject are several laboratory exercises. Thus, students are able to obtain practical experience and skills. The exercises are focused on detector signal processing by NIM standard electronic modules mostly. Students will learn how to operate an oscilloscope at advanced level as well. Absolvents should be able to design, build, operate and execute diagnostics of simple electronic circuit made of NIM standard modules.		
16MRSO	Magnetic resonance and sonography	ZK	2
	Magnetic resonance and ultrasound: clinical imaging methods that do not use ionizing radiation.		
16NAM	Standards and metrology	ZK	2
	Objectives and requirements of metrology, interpretation of radiation quantities and units in metrology, theoretical and experimental basis of metrology (uncertainties, relative and absolute measurements, data processing and evaluation of results of measurements, radiation etalons), evaluation of basic radiation quantities (activity, emission rate, exposure, absorbed dose), intercomparison measurements, metrology law and relevant regulations.		
16PAFZ2	Pathology, Anatomy and Physiology in Imaging Techniques 2	ZK	2
	To make the students familiar with pathology in imagine method, virtual reality, modulations and spatial reconstruction.		
16RBIO	Radiobiology	ZK	2
	The presented lectures are aimed at basis of radiation biology. Students are introduced into biological effects of ionizing radiation; physical and chemical processes of radiation action in biological material; mechanisms of radiation damage to DNA and other cell components; types of damages and their repair; subcellular and cellular sensitivity and response to irradiation; physical, biological and chemical modificators of the cell response to irradiation; theories and models for cell survival and radiation biology of normal and neoplastic tissue systems.		
16RFNMN	Radiological Physics - Nuclear Medicine	Z,ZK	3
	The aim of the course is to extend the knowledge gained in previous studies in the field of nuclear medicine. The greatest attention is paid to current trends in imaging methods, dosimetry for individual treatment planning and newly developed procedures and pharmaceuticals for targeted radionuclide therapy. Part of the course is also devoted to the specifics of radiation protection in nuclear medicine workplaces.		
16RFRDN	Radiological Physics - Diagnostic Radiology	Z,ZK	3
	Learning outcomes of the course unit The course is a follow-up to the course Radiological Technics - Diagnostic Radiology and the student gains a deeper overview of X-ray diagnostics including CT in practice. Furthermore, they will be acquainted in more detail with parameters for image quality and image processing and also with communication protocols in radiology. Last but not least, they will learn how to proceed in case of exposure to a pregnant patient and also how machine learning is used in radiology.		
16RFRTN	Radiological Physics - Radiotherapy	Z,ZK	3
	Curriculum offers introduction to medical physics in radiotherapy. It covers basics of radiation oncology, biological effects of ionising radiation, treatment planning, units used for treatment, basic techniques of external radiotherapy and brachytherapy, quality assurance.		
16SEM2	Seminar 2	Z	2
	An oral presentation of Master's Thesis results. The presentation is evaluated by the other attendees of the seminary. The students are encouraged to write an article summarizing their Master thesis.		
16SPD	Spectrometry in Dosimetry	ZK	2
	The course deals with methods and applications of ionizing radiation (i.e. photons, charged particles and neutrons) spectrometry. The most important types of detectors, individual components of the electronic system used in spectrometry as well as spectra analysis procedures are discussed in detail.		
16UAZ	Principles of Ionizing Radiation Application	ZK	2
	Historical outline of applications, review of interaction of radiation with a matter, ionizing radiation sources for applications, detectors and devices for applications, evaluation of radionuclide measurements, use of penetration and scattering of radiation beams, activation analysis, X-ray fluorescence methods, tracer methods, radionuclides in age determination, further possibilities for the use of ionizing radiation.		
16VURF1	Research Project 1	Z	6
	Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.		
16VURF2	Research Project 2	KZ	8
	Student on the assignment of work and under the guidance of a supervisor prepares an individual for a given topic for 2 semesters.		
17APIZ2	Application of Ionizing Radiation 2	Z,ZK	3
	The course provides overview of possibilities of the applications of ionizing radiation namely in the field of characteriza-tion and diagnostic of materials for the sake of science and technology. Emphasis will be given to advanced methods of materials characterization which utilize atomic and nuclear physical processes. Several diagnostic methods based upon ionizing radiation will be introduced.		
18AMTL	Matlab Applications	KZ	4
	Systematic application of Matlab optimization toolbox for the solution of linear, quadratic, binary, integer an nonlinear programming tasks. Simulation of chaotic systems an fractal set generation. Analysis of trajectories, attractors and fractal sets including estimation of their properties.		
18MEMC	Monte Carlo Method	Z,ZK	4
	This courseis devoted to the numerical method Monte Carlo and to its selected applications.		

For updated information see http://bilakniha.cvut.cz/en/FF.html
Generated: day 2025-07-13, time 08:19.