Study plan

Name of study plan: Jaderná chemie

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: NMSPJCH1 Name of the group: MDP P_JCHN 1st year

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 16 courses Credits in the group: 0

Note on the group:

Student absolvuje aspoň 1 blok povinně volitelných předmětů. Vstup do praktika 15SEPM je podmíněn absolvováním, nebo současným zápisem předmětu 15SMJ1. Vstup do praktika 15PRACH je podmíněn absolvováním, nebo současným zápisem předmětu 15RACH.

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
15RAEK	Helena Filipská Helena Filipská Helena Filipská (Gar.)	ZK	2	2+0	Z	Р
15EXK2	Excursion 2 Alena Zavadilová, Barbora Drtinová Alena Zavadilová Alena Zavadilová (Gar.)	Z	1	5 dn	L	Ρ
15FCHN3	Physical Chemistry 3 Václav uba Václav uba (Gar.)	Z,ZK	2	1+1	Z	Ρ
15FCHA4	Physical Chemistry 4 Viliam Mú ka, Lenka Prouzová Procházková Lenka Prouzová Procházková Viliam Mú ka (Gar.)	Z,ZK	4	2P+2C	L	Ρ
15PJCH	Practical Exercises in Nuclear Chemistry Kate ina ubová, Miroslava Semelová, Pavel Bartl Miroslava Semelová Kate ina ubová (Gar.)	КZ	4	0+4	Z	Ρ
15PRACH	Practical Exercises in Radiation Chemistry Lenka Prouzová Procházková, Jan Bárta Lenka Prouzová Procházková Jan Bárta (Gar.)	КZ	3	0+3	L	Ρ
15SEPM	Practical Exercises in Separation Methods Miroslava Semelová, Pavel Bartl, Mojmír N mec Miroslava Semelová Mojmír N mec (Gar.)	КZ	3	0+3	Z	Ρ
15PRAKN	Internship Václav uba Václav uba Václav uba (Gar.)	Z	4	2 týd	L	Ρ
15RACH	Radiation Chemistry Václav uba Václav uba Václav uba (Gar.)	ZK	4	3+0	L	Ρ
15RMBM	Radiation Methods in Biology and Medicine Václav uba Václav uba Václav uba (Gar.)	ZK	2	2+0	L	Ρ
15RAM	Radioanalytical Methods Jan John Jan John Jan John (Gar.)	ZK	3	3+0	L	Ρ
15STP	Trace Radiochemistry Helena Filipská Helena Filipská Helena Filipská (Gar.)	ZK	3	3+0	L	Ρ
15SMJ1	Separation Methods in Nuclear Chemistry 1 Mojmír N mec Mojmír N mec Mojmír N mec (Gar.)	ZK	3	3+0	Z	Ρ
15TLA	Solids Viliam Mú ka, Jan Bárta Jan Bárta Viliam Mú ka (Gar.)	ZK	1	1P	L	Ρ

15VUCH1	Research Project 1 Lenka Prouzová Procházková, Kate ina ubová, Miroslava Semelová, Pavel Bartl, Mojmír N mec, Jan John, Petr Distler Lenka Prouzová Procházková Lenka Prouzová Procházková (Gar.)	Z	6	0+6	Z	Р
15VUCH2	Research Project 2 Lenka Prouzová Procházková, Kate ina ubová, Pavel Bartl, Mojmír N mec, Jan John, Petr Distler Lenka Prouzová Procházková Lenka Prouzová Procházková (Gar.)	κz	8	0+8	L	Р
Characteristics of the	courses of this group of Study Plan: Code=NMSPJCH1 Name		IN 1st vez	ar		
15RAEK			int for you		ZK	2
-	als with general problems of the environment. Then composition of and natural process	es in basic parts o	of biogeosper	1		
	dioactivity are discussed in detail. The last part describes sources of environmental po	ollution, migration,	chemical rea	actions and	d effects of p	ollutants in the
	alysis of basic problems of radioecology.					
	cursion 2				Z	1
	ting the students the acquaintance with various radiochemical and radiation methods	used in practice.			7 71/	0
	rsical Chemistry 3 e, a general description and explanation of laws affecting behaviour of the particle sys	stems is provided	Subsequent		Z,ZK	2 described at
	tudy on the matter in motion, based on its inner structure, properties of structural elen	-	-		-	
some practical applications a		,				
15FCHA4 Phy	vsical Chemistry 4			Z	Z,ZK	4
In the first part of the Physical	chemistry 4 devoted to reaction kinetics, the course is focused on the reaction rate, isola	ated reactions of v	arious orders	, simultane	ous reactior	s, flow-through
	pendence of the rate constants. Hard-sphere collision theory, activated-complex theory	-				ere. The chain
	adicals and reactions in liquid solutions are discussed, too. These subjects are trained	d by solving of sel	ected reactio			
	ctical Exercises in Nuclear Chemistry				KZ	4
	is practical introduction to fundamental priciples of nuclear processes such as radionu dioactive equilibrium e.g. in radionuclide generators. The nuclear chemistry / radiocher					
of coprecipitation are demons		many processes	30011 83 0218			ind principles
	ctical Exercises in Radiation Chemistry				KZ	3
	e students will familiarize themselves with the principles of experimental radiation cher	mistry and photod	hemistry and			-
applications of radiation and p	photochemical methods for characterization of irradiation sources (chemical dosimetry	for determination	of dose rate i	n ionizing i	radiation sou	irces, chemical
	photon flow in non-ionizing radiation sources), syntheses of various inorganic materials	(metals, simple o	xides, indirec	t synthesis	of multicom	ponent oxides)
and other applications of pho-						
	ctical Exercises in Separation Methods			1	KZ	3
	ists of set of practical tasks aiming to show fundamental radiochemical separation me ceived in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistr					
	n, chromatographic, coprecipitation procedures and principles, in which good work ma	-		-		-
-	arious types of radionuclides, single or in genetic relationship are used.			5		
	ernship ing the student with practical experience.				Z	4
	diation Chemistry				ZK	4
Part one of this course deals	with the formation of Primary Intermediate Products of radiolysis (PIP) caused by the	absorption of ioni	zing radiatior	n in matters	s. General o	verview of their
	ling to the formation of Stable Products of Radiolysis (SPR) is given in this part as well	II. The part two (s	ystematic rac	liation chei	mistry) is de	dicated to the
radiolysis of selected materia					71/	
1	diation Methods in Biology and Medicine	tion of interaction	of ID with mo	1	ZK	2
	ionizing radiation (IR) used in biology and medicine are thoroughly discussed. Descrip ctures and organisms follows. The last part of the course is dedicated to theory of radi					-
safeguard and dozimetry.		·····g····	.,			,
15RAM Rad	dioanalytical Methods				ZK	3
1 1	verview of all main radioanalytical methods, specifically: Indicator methods, analysis by	y means of natura	ally occurring	radioactive	e elements,	sotope dilution
	etric IDA, radio-reagent methods, radiometric titrations, radio-release methods, RIA, a	-				radiation with
	irradiation with charged particles and gamma-rays, non-activation interaction analysis	s, X-ray fluoresce	nce analysis,			
	ce Radiochemistry			1	ZK	3
	e (speciation) and physicochemical behaviour of very low concentrations (traces) of matte their study. It presents detailed discussion of formation and properties of colloidal form			•		0
1 -	ect of the lecture is also the distribution of traces in macroheterogeneous systems, par					-
traces.		, , , , , , , , , , , , , , , , , , , ,				
15SMJ1 Sep	paration Methods in Nuclear Chemistry 1				ZK	3
This lecture consists of sever	al chapters, at the beginning the chemistry of complex compounds, its generation and	d stability is discu	ssed followed	with spec	iation calcul	ations. Next
	iew of the separation methods and their comparison. Further, the fundamentals of liquid	-				
	her with ion-exchange chromatography, and other chromatographic methods are discu		-	-		-
15TLA Sol	es. The whole lecture is oriented to utilization of these methods in nuclear and radioch	iemistry, meir auv	aniayes anu	· ·	ZK	1
	properties of solid materials resulting from their crystalline structure and on characte	rization of solid m	naterials throu		1	-
	roduction to crystallography, chemical bonds in solids, crystal structure and its description					-
	lifferent X-ray types based on their production mechanism, and methods for their dete			-	-	
	, X-ray diffraction instrumentation, various measurements methods such as Laue's me			-		
	II-Davey nomograms. The last part covers applications of diffraction methods including		-	-		ation of various
	using diffraction methods, measurements under non-standard conditions and also the	e principies of elec	and neu	Iron diffrac		~
15VUCH1 Res Thesis for internal defence.	search Project 1				Z	6
	search Project 2				KZ	8
Thesis for internal defence.				I		0

Code of the group: NMSPJCH2 Name of the group: MDP P_JCHN 2nd year Requirement credits in the group: Requirement courses in the group: In this group you have to complete at least 5 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
15NUK1	Aplication of Radionuclides 1 Ji í Mizera Ji í Mizera Ji í Mizera (Gar.)	ZK	3	2+0	Z	Ρ
15DPCH1	Master Thesis 1 Kate ina ubová, Pavel Bartl, Mojmír N mec, Jan John, Petr Distler, Ján Kozempel, Barbora Neužilová, Jaroslav ervenák, Libor Juha Jan John Jan John (Gar.)	Z	10	10	Z	Ρ
15DPCH2	Master Thesis 2 Kate ina ubová, Pavel Bartl, Jan John, Petr Distler, Ján Kozempel, Barbora Neužilová, Libor Juha, Michal Sakmár, Ivo Sv tlík Petr Distler Jan John (Gar.)	Z	20	20	L	Ρ
15SEMA1	Seminar 1 Kate ina ubová Kate ina ubová Kate ina ubová (Gar.)	Z	3	3S	Z	Ρ
15SEMA2	Seminar 2 Kate ina ubová Kate ina ubová Kate ina ubová (Gar.)	Z	3	3S	L	Ρ

Characteristics of the courses of this group of Study Plan: Code=NMSPJCH2 Name=MDP P_JCHN 2nd year

15NUK1	Aplication of Radionuclides 1	ZK	3				
In the introduction,	nuclear methods and their basic principles are generally classified. It is followed by explanation of the specific features of workin	g methods in radio	ochemistry. The				
following lectures introduce separately physical principles and practical applications of radiochronometry, methods based on chemical, biological and physical effects of ionizing radiation,							
indicator methods, i	indicator methods, isotope exchange reactions and isotopic effects. The most important technical and industrial applications of radionuclides are presented.						
15DPCH1	Master Thesis 1	Z	10				
Diploma work.		•	'				
15DPCH2	Master Thesis 2	Z	20				
Diploma work.		1	1				
15SEMA1	Seminar 1	Z	3				
Getting acquainted	Getting acquainted with advanced radiochemical and radiation-chemical topics.						
15SEMA2	Seminar 2	Z	3				
Get acquainted with	radiochemical and radiation problems.	1					

Name of the block: Compulsory elective courses Minimal number of credits of the block: 2 The role of the block: PV

Code of the group: NMSPJCHB1

Name of the group: MDP P_JCHN Required optional corses block 1

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 3 courses Credits in the group: 0

Note on the group:

Student absolvuje aspoň 1 blok povinně volitelných předmětů.

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
15CHRP	Chemistry of Radioactive Elements Jan John Jan John (Gar.)	ZK	2	2+0	Z	PV
15TPC	Technology of Fuel Cycles of Nuclear Power Stations Kate ina ubová, Karel Štamberg Kate ina ubová Kate ina ubová (Gar.)	ZK	2	2+0	Z	PV
15VJZ	Decomissioning of Nuclear Facilities Kate ina ubová Kate ina ubová Kate ina ubová (Gar.)	ZK	2	2+0	L	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCHB1 Name=MDP P_JCHN Required optional corses block

15CHRP	Chemistry of Radioactive Elements	ZK	2			
The course gives a detailed overview of chemical properties of all known radioactive elements from the group of cis-uranium elements, actinoids and trans-actinoids.						
15TPC	Technology of Fuel Cycles of Nuclear Power Stations	ZK	2			
At first, the basic types of	of uranium ores and their classification, and physical and radiometric ore dressing methods are specified. The main attention is	paid to the chemi	cal-technological			
operations by means of	operations by means of which the products of technical grade and then of nuclear grade, as metallic U, UO2, UN, UC and UF6, are obtained. In this domain, the sol-gel processes and					
uranium isotopes separations are implicated. The manufacturing of fuel elements, based on metallic uranium, on tablets of UO2 or MOX fuel (UO2+PuO2), and of assemblies for basic						
types of nuclear reactor	s (LWR, FBR and HTGR) is described. The principles of spent fuel reprocessing and of radioactive wastes treatment are me	ntioned, too.				

15VJZ	Decomissioning of Nuclear Facilities	ZK	2
1. History, situation, long	-term operation. 2. Strategy of decomissioning. 3. Stages of decomissioning. 4. Legislation 5. Costs 6. Treatment of the waste	e: characterization	i, inventory of
radionuclides, storage a	nd storage		

Code of the group: NMSPJCHB2

Name of the group: MDP P_JCHN Required optional courses block 2

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 3 courses Credits in the group: 0

Note on the group:

Student absolvuje aspoň 1 blok povinně volitelných předmětů.

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
15MSZP	Modelling and Simulation of Radionuclide Migration in the Environment Aleš Vetešník, Dušan Vopálka Aleš Vetešník Dušan Vopálka (Gar.)	Z,ZK	3	2+1	Z	PV
15ZOCH	Protection of Environment Helena Filipská Helena Filipská (Gar.)	ZK	2	2+0	Z	PV
15SRZP	Determination of Radionuclides in Environment Mojmír N mec Mojmír N mec Mojmír N mec (Gar.)	ZK	2	2+0	L	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCHB2 Name=MDP P_JCHN Required optional courses block

15MSZP	Modelling and Simulation of Radionuclide Migration in the Environment	Z,ZK	3
Introduction in ecolo	jical modelling focused on the problems of radionuclide migration in the environment. Formulation of mathematical and compute	er models, charact	erization of their
qualities. Models of	issolved contaminants interaction with the solids phase, including sophisticated multi-component models. Practical modelling in	n the PHREEQC e	nvironment.
Simulation exercises	with transport codes prepared in the GoldSim environment.		
15ZOCH	Protection of Environment	ZK	2
The source provides	n'ere a norther en norther and the term of the second second	' '	
The course provides	basic information about detrimental pollutants, about their impact on flora and fauna including man. It presents overview on the	e environmental sa	impling, sample
	basic information about detrimental pollutants, about their impact on flora and fauna including man. It presents overview on the ontrol the concentrations and pollutant migration, determining the limits and environmental legislation. The migration of pollutan		1 0 1
analysis in order to o			1 0 1
analysis in order to o	ontrol the concentrations and pollutant migration, determining the limits and environmental legislation. The migration of pollutan		1 0 1
analysis in order to o ways of the environr 15SRZP	ontrol the concentrations and pollutant migration, determining the limits and environmental legislation. The migration of pollutan ient protection and pollution prevention will be discussed.	ts in the environm	ent and possible
analysis in order to o ways of the environr 15SRZP The introduction of t	ontrol the concentrations and pollutant migration, determining the limits and environmental legislation. The migration of pollutan ent protection and pollution prevention will be discussed. Determination of Radionuclides in Environment	ts in the environm ZK , sampling and pre	ent and possible 2 e-treatment of
analysis in order to o ways of the environm 15SRZP The introduction of t samples are discuss	ontrol the concentrations and pollutant migration, determining the limits and environmental legislation. The migration of pollutant ent protection and pollution prevention will be discussed. Determination of Radionuclides in Environment e lecture consit of the list of the important and monitored radionuclides in the environment and their abundance. Sample types	ts in the environm ZK , sampling and pre- nethods for environ	ent and possible 2 e-treatment of amental samples

Code of the group: NMSPJCHB3

Name of the group: MDP P_JCHN Required optional courses block 3

Requirement credits in the group:

Requirement courses in the group: In this group you have to complete at least 3 courses Credits in the group: 0

Note on the group:

Student absolvuje aspoň 1 blok povinně volitelných předmětů.

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
15CHRP	Chemistry of Radioactive Elements Jan John Jan John Jan John (Gar.)	ZK	2	2+0	Z	PV
15PRN	Radionuclide Production Ond ej Lebeda Ond ej Lebeda (Gar.)	ZK	2	2+0	Z	PV
15RDFM	Radiopharmaceuticals 1 Ond ej Lebeda Ond ej Lebeda (Gar.)	ZK	2	2+0	Z	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCHB3 Name=MDP P_JCHN Required optional courses block

5							
15CHRP	Chemistry of Radioactive Elements	ZK	2				
The course gives a detailed overview of chemical properties of all known radioactive elements from the group of cis-uranium elements, actinoids and trans-actinoids.							
15PRN	Radionuclide Production	ZK	2				
An overview of the different ways in which radionuclides may be produced (natural sources, nuclear reactions, generators). Classification of nuclear reactions (neutron, charged particles							
and photon induced reactions, their course, cross-sections). Calculations of radionuclide yields and their modelling for different production set-ups. Design and operation of target							
systems (solid, liquid ar	ad gaseous). Target processing with respect to the subsequent use of the produced radionuclide. Radionuclides generators, p	production, and the	eir use.				
15RDFM	Radiopharmaceuticals 1	ZK	2				
The course introduces fundamentals of nuclear chemistry applications in research, development and production of radiopharmaceuticals. The first part of the course is focused on							
issues of appropriate radionuclide selection, general requirements for PET and SPECT diagnostics and therapeutic radiopharmaceuticals, ways of their application and labelling							
chemistry. The second	part of the course provides fundamentals of routine production and quality control of radiopharmaceuticals (GMP rules) and d	discusses in detai	I production of a				
few particular radiophar	maceuticals. In the end of the course, students will learn about the last trends in the research of radiopharmaceuticals						

Code of the group: NMSPJCHPV1 Name of the group: MDP P_JCHN Required optional courses Requirement credits in the group: In this group you have to gain at least 2 credits Requirement courses in the group: Credits in the group: 2

Note on the group:

Student získá během studia aspoň 2 kredity z této skupiny předmětů.

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
15NUK2	Aplication of Radionuclides 2 Ji í Mizera Ji í Mizera Ji í Mizera (Gar.)	ZK	3	2+0	L	PV
15CHJE	The Chemistry of Operation of Nuclear Power Plants Barbora Drtinová Barbora Drtinová (Gar.)	ZK	2	2+0	Z	PV
16RBIO	Radiobiology Marie Davídková Marie Davídková (Gar.)	ZK	2	2+0	L	PV
15RFM2	Radiopharmaceuticals 2 Ján Kozempel, Marek Moša, Martin Vlk Martin Vlk Ján Kozempel (Gar.)	ZK	2	2+0	Z	PV
15SMJ2	Separation Methods in Nuclear Chemistry 2 Mojmír N mec Mojmír N mec Mojmír N mec (Gar.)	ZK	2	2+0	L	PV
15TRF	Radiopharmaceuticals Technology Ján Kozempel, Martin VIk Martin VIk Ján Kozempel (Gar.)	ZK	2	2+0	L	PV
15UFCB	Introduction to Photochemistry and Photobiology Lenka Prouzová Procházková, Libor Juha Lenka Prouzová Procházková Libor Juha (Gar.)	ZK	2	2+0	Z	PV

Characteristics of the courses of this group of Study Plan: Code=NMSPJCHPV1 Name=MDP P_JCHN Required optional courses

15NUK2	Aplication of Radionuclides 2	ZK	3		
The course is oriented t	o applications of nuclear methods and radionuclides, particularly in the field scientific research. The first part of the course price	esents production	and application		
of artificial radionuclides, labeled organic compounds, and generators of short-lived radionuclides. Another part of the course focuses on isotope exchange reactions and methods of					
their investigation. It is followed by explanation of thermodynamic and kinetic isotopic effects. The remaining lectures are devoted to applications of nuclear methods in general and					
physical chemistry to st	udy kinetics and mechanism of chemical reactions, structure of chemical compounds, solid phase surfaces, catalysis, and to	determine physic	o-chemical		
parameters.					
15CHJE	The Chemistry of Operation of Nuclear Power Plants	ZK	2		
At first, the principles of	water treatment processes, the sources of radioactive contamination and the principles of the treatment of all types of wastes	are discussed. The	e main attention		
	technological operations used to the purification of feeding waters and cooling circuits waters and of all liquid and gaseous ra		encountered in		
NPP. The technological	operations used to the treatment of wastes and the corrosion problems of the construction materials are discussed in detail,	too.			
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 cher	nical processes of	radiation action		
in biological material; m	echanisms of radiation damage to DNA and other cell components; types of damages and their repair; subcellular and cellula	ar sensitivity and r	esponse to		
irradiation; physical, bio	ogical and chemical modificators of the cell response to irradiation; theories and models for cell survival and radiation biology	y of normal and no	eoplastic tissue		
systems.					
15RFM2	Radiopharmaceuticals 2	ZK	2		
The basic principles of r	nuclear chemistry. A survey of radionuclides used in nuclear medicine. The common methods of radiopharmaceuticals prepar	ations. Quality an	d control of		
radiopharmaceuticals.T	he basic radiopharmaceuticals and their use in human diagnostic and therapy.				
15SMJ2	Separation Methods in Nuclear Chemistry 2	ZK	2		
The lecture is based an	d envolves Separation Methods in Radiochemistry I. Additional aspects of extraction separation methods such as classification	on and description	of the ion-pair		
formation extraction sys	téme, extraction with mixtures of agents, and accesories and devices used in solvent extraction. Separations with ion-exchar	ige resins includin	g accesories		
and high performance li	quid chromatography are discussed in more details. Finally, the lecture includes membrane separation processes, thermochr	omatography, dist	illation and		
electrochemical method	S.				
15TRF	Radiopharmaceuticals Technology	ZK	2		
1.Research and develop	oment of radiopharmaceuticals, preclinical and clinial studies. 2.Raw materials and precursors of radiopharmaceuticals. 3.Spe	ecificity of radioph	armaceuticals		
preparation and production. 4. Sources of radionuclides, target systems and apparatuses (gaseous, liquid, solid), natural and enriched materials, their recycling. 5. Manipulation with					
high activities, biological shielding. Automated synthesisers (dedicated/universal, separation modules, microfluidic systems, proces parameters sensors, etc.). 6. Sterile and non-sterile					
preparations. Dispensing, formulation, sterilization and marking. 7. Pharmacopoeia and proces quality control methods of radiopharmaceuticals. 8. Processes validation, quality assurance					
and management syste	ms, documentation. 9. Logistics of radiopharmaceuticals production. 10. Legislation requirements for radiopharmaceuticals pro	eparation and proc			
15UFCB	Introduction to Photochemistry and Photobiology	ZK	2		
At the beginning, an abs	orption of UV/vis radiation in molecular system and the energy transfer is explained and discussed. Then, photochemical laws and	d quantum yields c	of photochemical		
reactions are defined. E	xperimental techniques in photochemistry are reviewed. The light is also shed on the relationship between photochemistry ar	nd radiation chem	istry / plasma		
chemistry. Classes and	nature of different photochemical reactions are described in general. Within a part of the course devoted to the systematic ph	otochemistry, the	key reactions		
of illuminated inorganic, coordination, organometallic, organic and bio-organic compounds are reviewed. Practical utilization of photochemical reactions is summarized (photography,					
photolithography, photochemical syntheses, environmental photochemistry, etc.). Fundamentals of biological action of UV/vis radiation are exposed in the course. Special attention is					
paid to photosynthesis,	vision, and photodynamic therapy.				

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

Name of the group: MDP P_JCHN Optional courses Requirement credits in the group: Requirement courses in the group: Credits in the group: 0 Noto on the group

Note on the grou	Name of the course / Name of the group of courses					
Code	(in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
15AODPA	Waste Analysis Ji í Hendrych Ji í Hendrych Ji í Hendrych (Gar.)	Z,ZK	3	2P+1C	Z	V
15APRM	Application of Radiation Methods Viliam Mú ka Viliam Mú ka Viliam Mú ka (Gar.)	ZK	2	2+0	L	V
15ASCH	Astrochemistry Martin Ferus Martin Ferus (Gar.)	ZK	2	2+0	L	V
16BAF	Biochemistry and Pharmacology Jan Ková Jan Ková (Gar.)	ZK	2	2+0	1	V
15FCH5	Physical Chemistry 5 Lenka Prouzová Procházková Lenka Prouzová Procházková Lenka Prouzová Procházková (Gar.)	ZK	2	2+0	z	V
15GIMCH	Glycoconjugates and Immunochemistry Petr Pompach Petr Pompach (Gar.)	ZK	3	2+0	L	V
15HCHEA	Hydrochemistry	Z,ZK	5	3P+2C	L	V
15HYPEA	Hydrology and Pedology Dana Pokorná Dana Pokorná Dana Pokorná (Gar.)	Z,ZK	3	2P+1C	Z	V
15ISY	Isotopic Syntheses Ján Kozempel, Martin VIk Martin VIk Ján Kozempel (Gar.)	ZK	2	2+0	L	V
16MCRF	Monte Carlo Method in Radiation Physics Tomáš Urban Tomáš Urban Tomáš Urban (Gar.)	Z,ZK	4	2+2	2	V
15PRMB	Practical Exercises in Radiation Methods in Biology and Medicine Ján Kozempel, Martin VIk Martin VIk Ján Kozempel (Gar.)	КZ	4	0+4	L	V
15PRAM	Practical Exercises in Radioanalytical Methods Miroslava Semelová, Pavel Bartl, Mojmír N mec Miroslava Semelová Mojmír N mec (Gar.)	KZ	4	0+4	L	V
16RAO	Radiation Protection Ji í Martin ík, Darina Trojková, Dana Drábová, Ji í H Ika, Ladislav Tomášek, Tomáš Trojek Ji í Martin ík Tomáš Trojek (Gar.)	ZK	4	4+0	1	V
01SUP	Start-up Project Pemysl Rubeš Pemysl Rubeš (Gar.)	КZ	2	2P+0C		V
01SME	Statistical methods with applications Tomáš Hobza Tomáš Hobza Tomáš Hobza (Gar.)	KZ	2	2+0		V
15STA	Structure Analysis 1 Ján Kozempel, Martin VIk Martin VIk Ján Kozempel (Gar.)	Z,ZK	3	2+1	L	V
15NMR	Structure Analysis 2 Martin VIk	Z,ZK	3	2P+1C	Z	V
15TZOA	Waste Management and Treatment	ZK	3	3P	L	V
15TZRCH	Theoretical Foundations of Radiation Chemistry Libor Juha Libor Juha Libor Juha (Gar.)	ZK	2	2+0	Z	V
15ZFRM	General Pharmacology Stanislav Smr ek Stanislav Smr ek (Gar.)	ZK	2	2P		V
Characteristics of the	courses of this group of Study Plan: Code=NMSPJCHV Name	=MDP P_JCI	-IN Optio	nal cour	ses	
	aste Analysis			1	Z,ZK	3
	iste characterization, sampling, pre-treatment and treatment of samples, their processi	0 ,			0 0	
and their interpretation are e	naracterization. Theoretical principles, instrumentation and practical design of tests acc xplained.	ording to standar	uizeu anu n		nous, expressio	JI UI IESU
	plication of Radiation Methods d to the quantities and units of interaction of ionizing radiation with matter, the descrip	tion of radiation a	ouroop and	facilitian Nr	ZK	2
	is sterilization, cross-linking and degradation of polymers, polymerization, grafting and co				-	
e e	s devoted also to radiation processing in environment, , radiation in medical application					•
1	trochemistry				ZK	2
	summarize present knowledge of chemistry in the universe. The lecture should be focu pounds detection techniques and history of astrochemistry.	sed mainly on ch	emistry of o	ur solar sys	tem, interstella	clouds,
					71/	2
	ochemistry and Pharmacology chemistry, biochemistry and pathology of body fluids, biochemistry of breathing, bioch	emistry of digest	ion and reco	 arntion kide	ZK	2 biochemi
-	sm of water and minerals, metabolism of trace elements, nutrition. Basic principles of ph			-	-	
-	pharmacodynamics, classification of pharmaceuticals, chemotherapeutics, radiopharm			-		
and for their fabrication.			U			
15FCH5 Ph	ysical Chemistry 5				ZK	2
	chemistry and theory of solutions. Electrode phenomena, electric double layer, electro	chemical method	s in chemica	al analysis c		orrosion

Selected chapters of electrochemistry and theory of solutions. Electrode phenomena, electric double layer, electrochemical methods in chemical analysis, galvanic cells, corrosion. Methods of the reduction of equilibrium thermodynamic data to the zero ionic strength.

15GIMCH			
13011011	Glycoconjugates and Immunochemistry	ZK	3
The course is focused of	the history and present of immunochemistry and molecular immunology. The most important molecules of immunity system an	re thoroughly disc	ussed (antibody,
T-cell receptor, HLA ant	gens, complement, adhesive molecules) as well as technical aspects of experimental immunology techniques, details of imm	nunology measure	ements and
appropriate instrumenta			
15HCHEA	Hydrochemistry	Z,ZK	5
15HYPEA	Hydrology and Pedology	Z,ZK	3
Hydrology is the discipline	e used to understand and design water management systems that are directly and indirectly related to the occurrence of wate	er on, above and b	elow the earth's
	ides basic hydrology, emphasizing an understanding of concepts, principles and ideas of hydrologic processes. Practical app		
	runoff volume and rate management, infiltration and soil water processes. Hydrology of reservoirs, wetlands and ground and soil water processes.	water is also pre	
15ISY	Isotopic Syntheses	ZK	2
	electure students become familiar with the preparation of enriched stable nuclides and radionuclides, nomenclature of labelle	-	
	ements for laboratory equipment and experimental setup for work with isotopes. Next, laboratory operations with labelled com	-	
	analyses are discussed, together with specificity of carrier-added and carrier-free preparations, fast and online syntheses, aut		-
	the lecture, the isotope-specific methods of the most common elements are particularly discussed, together with the applica		-
16MCRF	Monte Carlo Method in Radiation Physics	Z,ZK	4
	C method, probability theory and selected concepts in mathematical statistics. Ionising radiation transport simulation, photon		
	nulation, modelling of the geometric conditions. Statistical tests of the model calculations, variance reduction techniques. Con		
	e, properties and scope of usage, input file (description of the geometry, materials, sources, tallies), graphical tools, code us		
-	zation (VISED, Sabrina, Body Builder). Examples of application (practical training) concentrated on radiation physics (shieldin	-	
	ons of the dosimetric quantities, responses of detection systems, radiation protection tasks. The basics of working with the p	orogram Fluka and	d Geant, SRIM
	e transport of charged particles.		
15PRMB	Practical Exercises in Radiation Methods in Biology and Medicine	KZ	4
	of practical work with mikroorganisms and ezymes, including preparation of samples for irradiation. They get knowledge of basic	c aspects of work	with radionuclide
	f labelled compounds and determination of radiochemical purity.		
15PRAM	Practical Exercises in Radioanalytical Methods	KZ	4
	actical carrying out of various radioanalytical methods from determination of solubility constant over radiometric titrations to dete	ermination of vario	us radionuclides
	o includes substoichiometric diulution analysis, radioimmunological, rentgenfluorescence, and neutron activation analyses.		
16RAO	Radiation Protection	ZK	4
-	to provide a self-contained overview of the radiation protection with a special focus on general principles. The subject is based or		
	nents, which specifies radiation protection in the Czech Republic and EU. The course is accepted as training, which allows of	btaining special c	ompetence in
	icipants will receive an appropriate certificate of attendance when fulfil all requirements defined in the permit of SONS.		
01SUP	Start-up Project		0
01SME		KZ	2
	Statistical methods with applications	KZ	2
	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m	KZ nethods, continge	2 ncy tables,
simulation of random va	Statistical methods with applications	KZ nethods, continge	2 ncy tables,
simulation of random va are also included.	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m iables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam	KZ nethods, continge nples by use of sta	2 ncy tables, atistical software
simulation of random va are also included. 15STA	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m iables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1	KZ nethods, continge nples by use of sta Z,ZK	2 ncy tables, atistical software 3
simulation of random va are also included. 15STA Methods of molecular s	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examination Structure Analysis 1 vectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis	KZ nethods, continge nples by use of sta Z,ZK is. Special technic	2 ncy tables, atistical software 3 jues 2D NMR,
simulation of random va are also included. 15STA Methods of molecular s COSY, HECTOR. Infrare	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric miables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examinations Structure Analysis 1 vectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental	KZ nethods, continge nples by use of sta Z,ZK is. Special technic	2 ncy tables, atistical software 3 jues 2D NMR,
simulation of random va are also included. 15STA Methods of molecular s COSY, HECTOR. Infrare methods, ionization tech	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m rables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1 Pectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis.	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass	2 ncy tables, atistical software 3 gues 2D NMR, s spectrometry,
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrare methods, ionization tech 15NMR	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m riables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1 ectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK	2 ncy tables, atistical software 3 jues 2D NMR, s spectrometry, 3
simulation of random va are also included. 15STA Methods of molecular s COSY, HECTOR. Infrare methods, ionization tech	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m rables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1 Pectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis.	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass	2 ncy tables, atistical software 3 gues 2D NMR, s spectrometry,
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrare methods, ionization tech 15NMR	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m riables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1 ectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK	2 ncy tables, atistical software gues 2D NMR, s spectrometry, 3
simulation of random va are also included. 15STA Methods of molecular s COSY, HECTOR. Infrar methods, ionization tech 15NMR 15TZOA 15TZRCH	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric miables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examinables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examinables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examinables and their applications. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examinables and their applications. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis dispectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamenta niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment	KZ nethods, continge pples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK ZK	2 ncy tables, atistical software 3 jues 2D NMR, s spectrometry, 3 3 2
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrar methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples concerted examples and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples concerted examples for the statistical principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis dispectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry	KZ nethods, continge pples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK ZK n. Recombination	2 ncy tables, atistical software 3 jues 2D NMR, s spectrometry, 3 3 2 kinetics; charge
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrar methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description and energy transfer in n models. Radiation chem	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples concept, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionizatior olecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solvical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK ZK n. Recombination rated electrons. Tr	2 ncy tables, atistical software 3 jues 2D NMR, s spectrometry, 3 3 2 kinetics; charge ack theory and
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrare methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description and energy transfer in n models. Radiation chem radiation chemical react	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m iables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1 ectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionizatior olecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solv ical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and vity.	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK ZK n. Recombination rated electrons. Tr gases. State-of-n	2 ncy tables, atistical software 3 ues 2D NMR, s spectrometry, 3 3 2 kinetics; charge ack theory and natter effects in
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrar methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description and energy transfer in n models. Radiation chem	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples concept, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionizatior olecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solvical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and	KZ nethods, continge nples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK ZK n. Recombination rated electrons. Tr	2 ncy tables, atistical software 3 jues 2D NMR, s spectrometry, 3 3 2 kinetics; charge ack theory and
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrare methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description and energy transfer in n models. Radiation chem radiation chemical react 15ZFRM	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric m iables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete exam Structure Analysis 1 ectroscopy, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionizatior olecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solv ical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and vity.	KZ nethods, contingen pples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK ZK L. Recombination rated electrons. Tr gases. State-of-n ZK	2 ncy tables, atistical software 3 ues 2D NMR, s spectrometry, 3 3 2 kinetics; charge ack theory and natter effects in 2
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrare methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description and energy transfer in n models. Radiation chem radiation chemical react 15ZFRM The lecture deals with u subjects of general pha	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their applications. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their applications. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples dynamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis dispectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental niques, fragmentations, applications in structural analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionization olecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solvical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and vity. General Pharmacology general Pharmacology se of organic compounds in human pharmacotherapy. The relation between chemical constitution and biological activity is diamacology (distribution in organisms, kinetic parameters, biotransformation, dose response etc.) are explained. The second of the m	KZ nethods, contingen pples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK D. Recombination rated electrons. Tr gases. State-of-m ZK scussed. In the fir one deals with pha	2 ncy tables, atistical software 3 ues 2D NMR, s spectrometry, 3 3 2 kinetics; charge ack theory and natter effects in 2 st part the basic armacological
simulation of random va are also included. 15STA Methods of molecular si COSY, HECTOR. Infrare methods, ionization tech 15NMR 15TZOA 15TZRCH Theoretical description and energy transfer in n models. Radiation chem radiation chemical react 15ZFRM The lecture deals with u subjects of general pha groups of therapeutical	Statistical methods with applications elected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete examples concept, fundamental principles. Nuclear magnetic resonance, 1H and 13C NMR techniques in organic structural analysis d spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental principles. Finger print and practical applications in analysis. UV-VIS spectroscopy, fundamental principles. Theory of prince print and practical applications in analysis. Structure Analysis 2 Waste Management and Treatment Theoretical Foundations of Radiation Chemistry of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionization olecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solvical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and vity. General Pharmacology General Pharmacology	KZ nethods, contingen pples by use of sta Z,ZK is. Special technic al principles. Mass Z,ZK ZK D. Recombination rated electrons. Tr gases. State-of-m ZK scussed. In the fir one deals with pha	2 ncy tables, atistical software 3 ues 2D NMR, s spectrometry, 3 3 2 kinetics; charge ack theory and natter effects in 2 st part the basic armacological
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List of courses of this pass:

Code	Name of the course	Completion	Credits		
01SME	Statistical methods with applications	KZ	2		
The course cons	The course consists of selected methods of statistical data analysis such as: linear regression and correlation, analysis of variance, nonparametric methods, contingency tables,				
simulation of rando	m variables and their application. The aim is to illustrate the use of statistical procedures on examples. Solutions of concrete example	es by use of statisti	cal software		
	are also included.				
01SUP	Start-up Project	KZ	2		
15AODPA	Waste Analysis	Z,ZK	3		
The course is focus	ed on waste characterization, sampling, pre-treatment and treatment of samples, their processing and analysis of components limite	d in legislative reg	ulations and		
other methods of m	atrices characterization. Theoretical principles, instrumentation and practical design of tests according to standardized and modified and their interpretation are explained.	methods, expressi	on of results		

The beginning part	Application of Radiation Methods	ZK	2		
	is devoted to the quantities and units of interaction of ionizing radiation with matter, the description of radiation sources and facilities	. Next chapters are	e devoted to		
radiation technologi	diation technologies such as sterilization, cross-linking and degradation of polymers, polymerization, grafting and curing, radiation treatment of agricultural products, radiation synthes				
Last but not least	attention is devoted also to radiation processing in environment, , radiation in medical applications, economic considerations and d	osimetry in context	of safety.		
15ASCH	Astrochemistry	ZK	2		
The aim of this le	cture is to summarize present knowledge of chemistry in the universe. The lecture should be focused mainly on chemistry of our sola	ar system, interstel	lar clouds,		
	origin of life, interstellar compounds detection techniques and history of astrochemistry.				
15CHJE	The Chemistry of Operation of Nuclear Power Plants	ZK	2		
	es of water treatment processes, the sources of radioactive contamination and the principles of the treatment of all types of wastes are				
-	idual technological operations used to the purification of feeding waters and cooling circuits waters and of all liquid and gaseous rad		ountered in		
NPF	? The technological operations used to the treatment of wastes and the corrosion problems of the construction materials are discuss	ed in detail, too.			
15CHRP	Chemistry of Radioactive Elements	ZK	2		
The course	e gives a detailed overview of chemical properties of all known radioactive elements from the group of cis-uranium elements, actinoid	ds and trans-actino	ids.		
15DPCH1	Master Thesis 1	Z	10		
	Diploma work.				
15DPCH2	Master Thesis 2	Z	20		
	Diploma work.				
15EXK2	Excursion 2	Z	1		
	The excursion aims at mediating the students the acquaintance with various radiochemical and radiation methods used in pra	ctice.			
15FCH5	Physical Chemistry 5	ZK	2		
Selected chapters	of electrochemistry and theory of solutions. Electrode phenomena, electric double layer, electrochemical methods in chemical anal	ysis,galvanic cells,	corrosion.		
	Methods of the reduction of equilibrium thermodynamic data to the zero ionic strength.				
15FCHA4	Physical Chemistry 4	Z,ZK	4		
In the first part of the	Physical chemistry 4 devoted to reaction kinetics, the course is focused on the reaction rate, isolated reactions of various orders, simul		low-through		
reactors and tempe	prature dependence of the rate constants. Hard-sphere collision theory, activated-complex theory and chemical dynamics are thoroug	ghly discussed here	e. The chain		
reactio	ons of atoms and free radicals and reactions in liquid solutions are discussed, too. These subjects are trained by solving of selected	reaction systems.			
15FCHN3	Physical Chemistry 3	Z,ZK	2		
At the beginning of	the course, a general description and explanation of laws affecting behaviour of the particle systems is provided. Subsequently, par	ticle systems are d	escribed at		
molecular level. Fol	lows the study on the matter in motion, based on its inner structure, properties of structural elements, mutual interactions and force f	ields. The course a	lso contains		
	some practical applications and fundamental calculations.				
15GIMCH	Glycoconjugates and Immunochemistry	ZK	3		
The course is focus	ed on the history and present of immunochemistry and molecular immunology. The most important molecules of immunity system are t	horoughly discusse	ed (antibody,		
T-cell receptor, H	LA antigens, complement, adhesive molecules) as well as technical aspects of experimental immunology techniques, details of imm	unology measuren	nents and		
	appropriate instrumentation.				
15HCHEA	Hydrochemistry	Z,ZK	5		
15HYPEA	Hydrology and Pedology	Z,ZK	3		
Hydrology is the dis	cipline used to understand and design water management systems that are directly and indirectly related to the occurrence of water o	n, above and below	, the earth's		
surface. The course includes basic hydrology, emphasizing an understanding of concepts, principles and ideas of hydrologic processes. Practical applications are presented for water					
		-	ed for water		
quantity consid	derations and runoff volume and rate management, infiltration and soil water processes. Hydrology of reservoirs, wetlands and groun	-	ed for water		
		-	ed for water		
quantity consid 15ISY In the general part	derations and runoff volume and rate management, infiltration and soil water processes. Hydrology of reservoirs, wetlands and groun Isotopic Syntheses of the lecture students become familiar with the preparation of enriched stable nuclides and radionuclides, nomenclature of labelled	d water is also pre ZK compounds, basic	ed for water sented. 2 principles of		
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	Practical Exercises in Radioanalytical Methods	KZ	4
Exercise is focused	d to practical carrying out of various radioanalytical methods from determination of solubility constant over radiometric titrations to determ	ination of various r	adionuclides
	n the environment. It also includes substoichiometric diulution analysis, radioimmunological, rentgenfluorescence, and neutron activat	ion analyses.	1
15PRMB	Practical Exercises in Radiation Methods in Biology and Medicine	KZ	4
Students get knowl	ledge of practical work with mikroorganisms and ezymes, including preparation of samples for irradiation. They get knowledge of basic as	spects of work with	radionuclide
45001	generator, preparation of labelled compounds and determination of radiochemical purity.	71/	-
15PRN	Radionuclide Production different ways in which radionuclides may be produced (natural sources, nuclear reactions, generators). Classification of nuclear reaction	ZK	2
	iced reactions, their course, cross-sections). Calculations of radionuclide yields and their modelling for different production set-ups. De		
	d, liquid and gaseous). Target processing with respect to the subsequent use of the produced radionuclide. Radionuclides generators,		-
15RACH	Radiation Chemistry	ZK	4
	urse deals with the formation of Primary Intermediate Products of radiolysis (PIP) caused by the absorption of ionizing radiation in ma	tters. General over	rview of thei
properties and rea	actions leading to the formation of Stable Products of Radiolysis (SPR) is given in this part as well. The part two (systematic radiation	chemistry) is dedi	cated to the
	radiolysis of selected material systems.		
15RAEK		ZK	2
	e course deals with general problems of the environment. Then composition of and natural processes in basic parts of biogeospere, biog		
and natural enviror	nmental radioactivity are discussed in detail. The last part describes sources of environmental pollution, migration, chemical reactions	and effects of poll	lutants in the
	environment and presents analysis of basic problems of radioecology.	ZK	3
15RAM	Radioanalytical Methods a detailed overview of all main radioanalytical methods, specifically: Indicator methods, analysis by means of naturally occurring radioa		-
s.	bstoichiometric IDA, radio-reagent methods, radiometric titrations, radio-release methods, RIA, activation analysis, irradiation with the		•
	nd resonance neutrons, irradiation with charged particles and gamma-rays, non-activation interaction analysis, X-ray fluorescence and		
15RDFM	Radiopharmaceuticals 1	ZK	2
	duces fundamentals of nuclear chemistry applications in research, development and production of radiopharmaceuticals. The first particular and production of radiopharmaceuticals.	1	
	priate radionuclide selection, general requirements for PET and SPECT diagnostics and therapeutic radiopharmaceuticals, ways of the		
chemistry. The sec	cond part of the course provides fundamentals of routine production and quality control of radiopharmaceuticals (GMP rules) and disc		oduction of a
	few particular radiopharmaceuticals. In the end of the course, students will learn about the last trends in the research of radiopharm	aceuticals.	1
15RFM2	Radiopharmaceuticals 2	ZK	2
The basic princip	ples of nuclear chemistry. A survey of radionuclides used in nuclear medicine. The common methods of radiopharmaceuticals prepara	ations. Quality and	control of
(50)(0)(radiopharmaceuticals. The basic radiopharmaceuticals and their use in human diagnostic and therapy.	714	
15RMBM	Radiation Methods in Biology and Medicine	ZK	2
	e sources of ionizing radiation (IR) used in biology and medicine are thoroughly discussed. Description of interaction of IR with matter an portant structures and organisms follows. The last part of the course is dedicated to theory of radiobiological action, radiodiagnostic ar		-
	safeguard and dozimetry.		ai metrious
15SEMA1	Seminar 1	Z	3
100EM/T	Getting acquainted with advanced radiochemical and radiation-chemical topics.		
15SEMA2	Seminar 2	Z	3
	Get acquainted with radiochemical and radiation problems.	-	-
15SEPM	Practical Exercises in Separation Methods	KZ	3
		1	-
This advanced exe Students apply kno	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in	tion at work with ra	dionuclides ry exercises
This advanced exe Students apply kno	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in ng extraction, chromatographic, coprecipitation procedures and principles, in which good work management and proper handling with	tion at work with ra	dionuclides ry exercises
This advanced exe Students apply kno Tasks are includin	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in ng extraction, chromatographic, coprecipitation procedures and principles, in which good work management and proper handling with nuclear waste is necessary. Various types of radionuclides, single or in genetic relationship are used.	tion at work with ra previous laborato open radioactive s	adionuclides ry exercises sources and
This advanced exe Students apply kno Tasks are includin 15SMJ1	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in ng extraction, chromatographic, coprecipitation procedures and principles, in which good work management and proper handling with nuclear waste is necessary. Various types of radionuclides, single or in genetic relationship are used. Separation Methods in Nuclear Chemistry 1	previous laborato open radioactive s	adionuclides ry exercises sources and
This advanced exe Students apply kno Tasks are includin 15SMJ1 This lecture cons	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in ng extraction, chromatographic, coprecipitation procedures and principles, in which good work management and proper handling with nuclear waste is necessary. Various types of radionuclides, single or in genetic relationship are used. Separation Methods in Nuclear Chemistry 1 sists of several chapters, at the beginning the chemistry of complex compounds, its generation and stability is discussed followed with	previous laborato open radioactive s ZK speciation calcula	adionuclides ry exercises sources and 3 ations. Next
This advanced exe Students apply kno Tasks are includin 15SMJ1 This lecture cons chapter gives a ger	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in ng extraction, chromatographic, coprecipitation procedures and principles, in which good work management and proper handling with nuclear waste is necessary. Various types of radionuclides, single or in genetic relationship are used. Separation Methods in Nuclear Chemistry 1 sists of several chapters, at the beginning the chemistry of complex compounds, its generation and stability is discussed followed with neral overview of the separation methods and their comparison. Further, the fundamentals of liquid-liquid extraction, extraction of chelat	ion at work with ra previous laborato open radioactive s ZK speciation calcula ies, extraction chro	adionuclides ry exercises sources and 3 ations. Next matography
This advanced exe Students apply kno Tasks are includin 15SMJ1 This lecture cons chapter gives a ger theory of ion excha	Practical Exercises in Separation Methods ercise consists of set of practical tasks aiming to show fundamental radiochemical separation methods, their modifications and utilizat owledge received in lectures "Separation methods in Nuclear Chemistry 1" and "Nuclear Chemistry" and are also using skill acquired in ng extraction, chromatographic, coprecipitation procedures and principles, in which good work management and proper handling with nuclear waste is necessary. Various types of radionuclides, single or in genetic relationship are used. Separation Methods in Nuclear Chemistry 1 sists of several chapters, at the beginning the chemistry of complex compounds, its generation and stability is discussed followed with	ion at work with ra previous laborato open radioactive s ZK speciation calcula ies, extraction chro ts of the methods,	dionuclides ry exercises sources and ations. Next matography widely usec
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	rs, and Hull-Davey nomograms. The last part covers applications of diffraction methods including phase identification, quantitative and -chemical properties using diffraction methods, measurements under non-standard conditions and also the principles of electron and	-	
15TPC	Technology of Fuel Cycles of Nuclear Power Stations	ZK	2
	pes of uranium ores and their classification, and physical and radiometric ore dressing methods are specified. The main attention is pair		-
	ns of which the products of technical grade and then of nuclear grade, as metallic U, UO2, UN, UC and UF6, are obtained. In this dom		
	eparations are implicated. The manufacturing of fuel elements, based on metallic uranium, on tablets of UO2 or MOX fuel (UO2+PuO nuclear reactors (LWR, FBR and HTGR) is described. The principles of spent fuel reprocessing and of radioactive wastes treatment		
15TRF	Radiopharmaceuticals Technology	ZK	. 2
	evelopment of radiopharmaceuticals, preclinical and clinial studies. 2.Raw materials and precursors of radiopharmaceuticals. 3.Speci	I	1
	production. 4. Sources of radionuclides, target systems and apparatuses (gaseous, liquid, solid), natural and enriched materials, their i		
	ogical shielding. Automated synthesisers (dedicated/universal, separation modules, microfluidic systems, proces parameters sensors,		
	ensing, formulation, sterilization and marking. 7. Pharmacopoeia and proces quality control methods of radiopharmaceuticals. 8. Process		-
	ent systems, documentation. 9. Logistics of radiopharmaceuticals production. 10. Legislation requirements for radiopharmaceuticals p		
15TZOA	Waste Management and Treatment	ZK	3
15TZRCH	Theoretical Foundations of Radiation Chemistry	ZK	2
	otion of an interaction of ionizing radiation with matter. Theory of primary processes in radiation chemistry: excitation and ionization. R er in molecular systems. Inelastic electron scattering. Primary radiation chemical yields. Formation, structure and properties of solvate		-
	chemical kinetics. Theory of an action of ionizing radiation in solids (electron-phonon interaction; radiation defects in crystals) and ga		-
	radiation chemical reactivity.		
15UFCB	Introduction to Photochemistry and Photobiology	ZK	2
5 S.	n absorption of UV/vis radiation in molecular system and the energy transfer is explained and discussed. Then, photochemical laws and qu		
	ned. Experimental techniques in photochemistry are reviewed. The light is also shed on the relationship between photochemistry and		
-	s and nature of different photochemical reactions are described in general. Within a part of the course devoted to the systematic photochemical reactions are described in general. Within a part of the course devoted to the systematic photochemical reactions are described in general. Within a part of the course devoted to the systematic photochemical reactions are described in general.		-
-	ganic, coordination, organometallic, organic and bio-organic compounds are reviewed. Practical utilization of photochemical reactions photochemical syntheses, environmental photochemistry, etc.). Fundamentals of biological action of UV/vis radiation are exposed in t		
	paid to photosynthesis, vision, and photodynamic therapy.	ne course. Opeciai	
15VJZ	Decomissioning of Nuclear Facilities	ZK	2
	n, long-term operation. 2. Strategy of decomissioning. 3. Stages of decomissioning. 4. Legislation 5. Costs 6. Treatment of the waste:	characterization, in	ventory of
	radionuclides, storage and storage		
15VUCH1	Research Project 1	Z	6
	Thesis for internal defence.		
15VUCH2	Research Project 2	KZ	8
	Thesis for internal defence.	714	
15ZFRM	General Pharmacology	ZK	2
	vith use of organic compounds in human pharmacotherapy. The relation between chemical constitution and biological activity is discu al pharmacology (distribution in organisms, kinetic parameters, biotransformation, dose response etc.) are explained. The second on	-	
	utically useful substances. The definition and explanation of common pharmacotherapeutical terms and a survey of pharmaceutics in	-	-
	also involved.		
15ZOCH	Protection of Environment	ZK	2
	es basic information about detrimental pollutants, about their impact on flora and fauna including man. It presents overview on the en		
analysis in order to	control the concentrations and pollutant migration, determining the limits and environmental legislation. The migration of pollutants in	the environment a	and possible
40045	ways of the environment protection and pollution prevention will be discussed.	71/	0
16BAF	Biochemistry and Pharmacology	ZK	2
	of organic chemistry, biochemistry and pathology of body fluids, biochemistry of breathing, biochemistry of digestion and resorption, k , metabolism of water and minerals, metabolism of trace elements, nutrition. Basic principles of pharmacology - biotransformation of pha	-	
-	nination, pharmacodynamics, classification of pharmaceuticals, chemotherapeutics, radiopharmaceuticals and diagnostic preparation		-
	and for their fabrication.		
16MCRF	Monte Carlo Method in Radiation Physics	Z,ZK	4
	the MC method, probability theory and selected concepts in mathematical statistics. Ionising radiation transport simulation, photons, r	-	-
	their simulation, modelling of the geometric conditions. Statistical tests of the model calculations, variance reduction techniques. Cod		
	(X) code, properties and scope of usage, input file (description of the geometry, materials, sources, tallies), graphical tools, code use isualization (VISED, Sabrina, Body Builder). Examples of application (practical training) concentrated on radiation physics (shielding, r		-
-	stributions of the dosimetric quantities, responses of detection systems, radiation protection tasks. The basics of working with the pro		
	code for simulation of the transport of charged particles.		
16RAO	Radiation Protection	ZK	4
The aim of the subje	ect is to provide a self-contained overview of the radiation protection with a special focus on general principles. The subject is based on the	e actual ICRP recor	mmendation
no. 103 and other	documents, which specifies radiation protection in the Czech Republic and EU. The course is accepted as training, which allows obt		petence in
405510	radiation protection. Participants will receive an appropriate certificate of attendance when fulfil all requirements defined in the permi		
16RBIO	Radiobiology	ZK	2
	ures are aimed at basis of radiation biology. Students are introduced into biological effects of ionizing radiation; physical and chemica erial; mechanisms of radiation damage to DNA and other cell components; types of damages and their repair; subcellular and cellula		
-	Il, biological and chemical modificators of the cell response to irradiation; theories and models for cell survival and radiation biology o	=	-
	,, since and models of our war and radiation bloogy of	2a. aa noopi	
	systems.		

For updated information see <u>http://bilakniha.cvut.cz/en/FF.html</u> Generated: day 2024-05-20, time 02:56.