	Appendix 3 No. 1	Study program fo	or int ycle o	egrated first a f studies	and second		
1.	Name of the course	GENERAL AND IN	ORC	GANIC CHEN	AISTRY		
2.	Code	3FMN191925					
3.	Study program	Pharmacy					
	Study program organizer	Faculty of Medical S	cience	es,			
4.	(department, institute, branch)	Goce Delcev Univers	sity, S	tip			
5.	Degree (first, second, third cycle)	Integrated first and se	econd	cycle of studie	es		
6.	Academic year / semester	First year / First semester	7.	Number of ECTS	6		
8.	Professor	Assoc. Prof. Dr.sc. A	leksa	ndar Cvetkovs	ki		
9.	Pre-conditions for course registration	Enrolled in first seme	ester c	of studies			
	Aims of the study program (compet	ences):					
10.	 Acquiring knowledge in the principles of laws of mass action of matter, reactivity, and aggregate states; Comparative study on atom models and elementary particle theories; Comparative study on the periodicity of the elements in the Periodic Table of the Elements and the inorganic substance of the groups of compounds of the chemical elements that are of interest for the application of medicinal substances, auxiliary 						
	medicinal substances in pharmacy	and medicine, as well	l as fr	om the ingredi	ents in		
	Content of the study program (appl	ies both for theoretic	al and	l practical pa	rt):		
11.	 Theoretical part: Modern approaches in getting and chemical reactivity; Electronic configuration of at Elements; Chemical bonds and hybridiza Geometry of molecules; Types of chemical reactions in Systematics of non-metals; Systematics of metals from th Systematics of f-elements (lar Coordination chemistry, chem metal-organic compounds of it Practical part: Calculations based on chemica Solutions, calculation of conc of solutions; Concept of pH, concentration Buffers, properties of buffers Buffer capacity; Hydrolysis; Thermochemistry; 	to know the structure oms and Periodicity of ation; n inorganic chemistry; e main groups of the P ement (d-elements); nthanoids and actinoids nistry of complex, coor interest for application al formulas; s and calculus; l equations (stoichiom entration of solutions, of hydrogen and hydro and preparation of buf	of ma Felema Periodi s); rdinati as dru etric o prepa oxide fers;	atter, substance ents in the Peri ic Table (elem- ion compounds ugs in diagnost calculations); ration of soluti ions;	es, mixtures, iodic Table of ents); s, including tic purposes.		
	10. Energetics of chemical reaction	ons.					
12.	Lectures, seminars, exercises, individu group discussion.	ual assignments, collab		ve lectures, me	thods of		
13.	I otal amount of time available	$6 ECTS \times 30 hours =$	= 180 1	hours (3+2)			

14.	Distrib	ution of	tasks		45+30+15+45+45			
	Truess	- f 1		15.1.	Lectures – theory		45 hours	
15.	activiti	es	ng/teaching	15.2.	Tutorials (laboratory, auditory), seminars, tear	nwork	30 hours	
				16.1.	Projects		15 hours	
16.	Other t	ypes of	activities	16.2.	Individual tasks		45 hours	
				16.3.	Home study – tasks		45 hours	
	Evalua	tion / as	sessment metho	ods				
	17.1.	Tests					40 points	
17.	17.2.	Individ	lual tasks / proje	ect (pres	sentation: written and oral)	10 points	
	17.3.	Activit	y and participat	ion			20 points	
	17.4. Final exam						30 points	
					Up to 50 points		5 (five) (F))
					51 – 60 points		6 (six) (E)	
10			····		61 – 70 points		7 (seven) (D)
18.	Assess	ment cri	teria (points / g	rade)	71-80 points		8 (eight) (C)	
					81 – 90 points		9 (nine) (B)	
					91 – 100 points		10 (ten) (A	<u>,</u>)
	Eligibi	lity for s	ignature and tal	king	60% realization of pre-e	xam act	ivities, i.e., 4	42 points
19.	the fina	al exam	0	U	from two tests, seminary	or prac	tical work, a	and
					regular participation to t	he organ	nized activiti	ies.
20.	Langua	ige of th	e study progran	n	English			
21	Quality	v assurar	nce methods of	the	Salf evaluation			
21.	teachin	g proces	SS		Self-evaluation			
	Literature							
		Manda	atory literature					
		No.	Author		Title	Pu	ıblisher	Year
	22.1.	1.	House, J. E.		Inorganic Chemistry	Acade as an i Elsevi	mic Press mprint of er	2008
			Weller, M.,					
			Overton, T.,		Inorganic Chemistry	Oxfore	đ	2010
22		2.	Rourke, J.,		(7 th Edition)	Unive	rsity Press	2018
22.			Armstrong, F.				5	
		Additi	onal literature		•			
		No.	Author		Title	Pu	blisher	Year
					Essentials of Inorganic			
	22.2				Chemistry: For			
	22.2.	1	G. 1011 IV		Students of Pharmacy,	337'1		2015
		1.	Stronieldt, K.	А.	Pharmaceutical	wiley		2015
					Sciences, and			
				Medicinal Chemistry				

		Appendix 3 No. 2		Study program fo cy	r inte	egrated first a f studies	and second
1.	Name	of the course		MATHEMATICS			
2.	Code			FI100125			
3.	Study	program		Pharmacy			
	Study	program organizer		Faculty of Medical Sc	cience	es.	
4.	(depar	tment, institute, branch)		Goce Delcev Universit	ity, S	tip	
5.	Degree	e (first, second, third cyc	cle)	Integrated first and se	cond	cycle of studie	es
6.	Acade	mic year / semester		First year / First semester	7.	Number of ECTS	5
8.	Profes	sor		Assoc. Prof. Dr.sc. M	arija	Miteva	
0	Pre-co	nditions for course		Ennelled in first some	ator o	fatudiaa	
9.	registr	ation		Enrolled in first seme	ster o	1 studies	
10.	Aims Studer practic	of the study program (ats will gain knowledge cal problems related to th	compet from the	ences): e field of mathematics, fession.	whic	h is necessary	for solving
	Conte	nt of the study program	n (appl	ies both for theoretica	l and	l practical pa	rt):
11.	First p Operat and lin Propor mixtur	<i>part:</i> tions on the set of real mean inequality. System of tionality of quantities (res. Basic elements of co	umbers. of linear ate, pro ombinate	Degrees. Logarithms. equations. Quadratic e portion, triple rule, percortics.	Polyr quati centag	omials. Linea on and quadra ge). Calculatio	r equation tic inequality. n of
	Second Real se Real fi	<i>d part:</i> equences. Arithmetic an unctions of one real vari	d geom able. So	etric progression. Limit ome elementary function	t valu ns (lii	e (limes) of a shear function,	sequence. quadratic
	functio Differe deriva	on, exponential function entiation of function. Ap tives (practical problems	, logarit oplicatio s). Indef	hmic function). Limit v on of real functions of o finite integral. Definite	value ne rea integr	(limes) of a fu al variable and ral.	nction. I their
12	Study	methods:					
12.	Lectur	es, exercises, project wo	ork.				
13.	I otal a	amount of time available	2	5 ECTS x 30 hours =	150 h	nours $(2+2)$	
14.	Distrit	oution of tasks	1.7.1	30+30+20+20+50		20.1	
15.	Types activit	of learning/teaching ies	15.1.	Tutorials (laboratory,		30 hour	°S
			16.1	Droioota	zamw	01K 20 hour	1 0
16	Other	types of estivities	16.1.	Individual taska		20 hour	.8
10.	Other	types of activities	16.2.	Home study tasks		20 hour	.S
	Evalue	ation / assessment metho	1 10. <u>3.</u> 0ds	Tionie study – tasks		50 11001	
	17.1	Tests	<i>A</i> ³			40 poin	ts
17	17.1	Individual tasks / proje	ect (pres	sentation: written and o	ral)	10 poin	ts
17.	17.2.	Activity and participat	tion	Sentation: written and of	iuij	20 poin	ts
	17.5.	Final exam	.1011			30 poin	ts
	17.1.	T mui exum		Up to 50 points		5 (five)	(F)
				51 - 60 points		6 (six)	(F)
				61 - 70 points		7 (seve	(\mathbf{L})
18.	Assess	sment criteria (points / g	71 - 80 points		8 (eight	(D)	
				$\frac{71}{81} = 90$ points		9 (nine)	(B)
				81 - 90 points 9 (nine) (B) 10 (tor) (A)			(Δ)
	Fligib	ility for signature and ta	king	51 - 100 points	-ev91	n activities i	42 noints
19	the fin	al exam	KIIIg	from two tests semin	arv o	n actival wor	k and
19.				regular narticipation t	ary OI A the	organized acti	vities
20	Langu	age of the study program	n	Fnolish	o ine	organizeu acti	villes.
∠0.	Langu	age of the study program	11	LUIGUOU			

21.	Quality assurance methods of the teaching process			Self-evaluation			
	Literati	ure					
		Manda	atory literature				
	22.1.	No.	Author	Title	Publisher	Year	
22		1. Miteva, M.	Mitava M	Internal textbook with	Goce Delcev	2024	
22.			lectures and exercises	University, Stip	2024		
		Additi	onal literature				
	22.2.	No.	Author	Title	Publisher	Year	

	Appendix 3	Study program fo	or int	egrated first a	and second				
1	Name of the course	BIOLOGY FOR PE	JARN						
2	Code	3FMN192125							
3.	Study program	Pharmacy							
	Study program organizer	Faculty of Medical S	cienco	es.					
4.	(department, institute, branch)	Goce Delcev Univers	sity, S	tip					
5.	Degree (first, second, third cycle)	Integrated first and se	econd	cycle of studie	es				
6.	Academic year / semester	First year / First semester	7.	Number of ECTS	6				
8.	Professor	Full Prof. Dr.sc. Nev	enka `	Velichkova					
9.	Pre-conditions for course registration	Enrolled in first seme	ester c	of studies					
	Aims of the study program (compet	ences):							
	This course covers the structure and fu	unction of cells as the b	basic 1	unit of life, dif	ferences				
	between plant and animal cells and big	omolecules in cells. Th	ne stud	ly of modern b	oiological				
	principles and processes, the structure, replication, recombination and expression of								
	prokaryotic and eukaryotic genetic material. Specific topics include DNA to RNA to protein,								
	nuclear and cytoplasmic regulation of macromolecular synthesis, exchange of materials								
	across cell membranes, control of cell	growth, cell communi	catior	n, stem cells an	id cancer.				
	The competences of students include:								
	 ability to prepare microscope 	slides, view the slides	using	a light micros	cope and				
	interpret what you see by com drawings;	posing both overview	(tissu	es) and detaile	d (cells)				
10.	 recognize organs, tissues and 	cells from which orgar	nism a	re built up;					
10.	 recognize and explain the qua 	lities of classical and n	noder	n microscope t	techniques				
	applied to study tissues and organs;								
	- use the scientific method and understand its strengths and weaknesses, ability to								
	research a biological topic using traditional and computer technology and more								
	opportunities to obtain fundamental understanding of the cellular processes many								
	drugs ultimately impact;								
	- critically discuss issues regard	ling plant life cycles, li	ife for	ms, reproducti	on and				
	evolution;	ad in nharmaay which	0.000	nacially impo	topt and				
	- to use cytological methods use	orch	arees	specially impor					
	All the theoretical knowledge that the	students gather in this	subie	ct are controlle	ed and				
	determined with practical laboratory v	vork and practice.	sacje		u unu				
	Content of the study program (appl	ies both for theoretic	al anc	l practical pa	rt):				
	The skills above will be developed wh	ile students engage in	cours	e work focuse	d on the				
	following content:								
	 Basic and modern microscope 	e techniques;							
	 Composition of the cell; 								
	 Cell membrane structure and the str	transport through the c	ell me	embrane;					
	 Intracellular junctions; 								
11.	 Endoplasmic reticulum structu 	are and function;							
	 Golgi apparatus structure and 	tunction;							
	- Mitochondrial structure and fu	inction;							
	- Structure of lysosomes and pe	roxisomes and their fu	inction	ns;					
	- Cytoskeleton, cell division, ge	ene replication and exp	ressic	on;					
	- Apoptosis and necrosis;	l colla store - 11 - 1	ta	n aalla:					
	- Cell cycle regulation in norma	il cells, stem cells and	tumo	r cells;	1				
	 Properties of the cells and the 	ir interactions as comp	onent	s of tissues and	a organs;				

	- Four basic tissues in complex preparations (in, for instance, a light microscopy								
		section), explaining th	eir func	ctions.				
12.	Study	method	S:		1				
12	Lecture	es, exerc	ises, seminars,	practica	at activities. 10	0.1	(2 + 2)		
13.	Total a	mount o	time available		6 EC1S x 30 hours = 180 hours (3+2)				
14.	Distrib	ution of	tasks	1 7 1	45+30+15+45+45	451			
1.5	Types of	of learni	ng/teaching	15.1.	Lectures – theory	Lectures – theory			
15.	activiti	es	6 6	15.2.	auditory), seminars, team	nwork	30 hours		
		16.1			Projects		15 hours		
16.	Other t	ypes of a	activities	16.2.	Individual tasks		45 hours		
				16.3.	Home study – tasks		45 hours		
	Evalua	tion / ass	sessment metho	ds	· · ·				
	17.1.	Tests					40 points		
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participat	ion		/	20 points		
	17.4.	Final e	xam				30 points		
					Up to 50 points		5 (five) (F)		
					51 – 60 points		6 (six) (E)		
10				1 \	61-70 points		7 (seven) (D)	
18.	Assessi	ment cri	teria (points / gi	rade)	71 – 80 points		8 (eight) (0	$\overline{C)}$	
					81-90 points		9 (nine) (B	5)	
					91 – 100 points		10 (ten) (A	<u>)</u>	
	Eligibi	lity for s	ignature and tal	king	60% realization of pre-e	xam act	ivities, i.e., 4	2 points	
19.	the fina	al exam	0	U	from two tests, seminary or practical work, and				
					regular participation to the organized activities.				
20.	Langua	ige of th	e study progran	n	English				
21	Quality	assurar	ice methods of t	the	Salf avaluation				
21.	teachin	g proces	SS		Self-evaluation				
	Literati	ure							
		Manda	tory literature						
		No.	Author		Title	Pu	ıblisher	Year	
			Böhmer, D.,		Introduction to	Aaltlaa			
		1.	Repiská, V.,		medical and molecular	Brotic		2010	
	22.1.		Danišovič, L.		biology	Diatis	lava		
22.		2	Ross, M. H.,		Cell and molecular	Tabar		2010	
		2.	Vojnic, P.		biology	Tabell	lakui	2010	
		3	Pollard, T.,		Cell Biology	Fleevi	er	2008	
		5.	Earnshaw, W.			LISCVI		2000	
		Additi	onal literature		1			r	
	22.2.	No.	Author		Title	Pu	ıblisher	Year	
	Γ								

	-	Appendix 3 No. 4		Study program for integrat cycle of stud	ted first and second dies			
1.	Name	of the course		BIOPHYSICS				
2.	Code			3FMN192225				
3.	Study	program		Pharmacy				
4	Study	program organizer		Faculty of Medical Sciences,				
	(depar	tment, institute, branch)		Goce Delcev University, Stip				
5.	Degree	e (first, second, third cyc	cle)	Integrated first and second cycle of studies				
6.	Acade	mic year / semester		First year / First semester7.Nur EC	mber of 5 TS 5			
8.	Profes	sor		Full Prof. Dr.sc. Zdenka Stojano	ovska			
9	Pre-co	nditions for course		Enrolled in first semester of stu	dies			
	registr	ation						
10.	Aims e Establi science	of the study program (ishment and extension o e.	f basic 1	ences): knowledge of physics and its app	lication in medical			
	Conte	nt of the study program	n (appl	ies both for theoretical and pra	ctical part):			
	 Mechanics and biomechanics, real systems, energy, work and power, elasticity and plasticity; Mechanical oscillations and mechanical waves, bioaccustics, ultrasound and its 							
	_	application;	is and n	nechanical waves, bioacoustics, u	ltrasound and its			
	—	Biomechanics of fluid	s, ideal	and real fluids;				
11.	-	Thermodynamics, tran	isport p	rocesses;				
	-	Electrical phenomena,	electric	cal signals in the body;				
	-	Physics of electro-diag	gnostics	and electrotherapy;	CC			
	-	Basic phenomena and	laws in	optics, optical instruments, light	effects, vision, lasers			
	and their application in medicine;							
	 Ionization radiation: generation, interactions, biological effects; Physics of nuclear medicine, Radiology and Padiotherapy. 							
	 Study	methods:	uicine, l	Radiology and Radiometapy.				
12.	Discus	sions, laboratory and nu	merica	exercises homework home lear	ming			
13.	Total a	mount of time available	<u>)</u>	5 ECTS x 30 hours = 150 hours	(2+2)			
14.	Distrib	ution of tasks		30+30+0+45+45				
1.0	_		15.1.	Lectures – theory	30 hours			
15.	Types	of learning/teaching	17.0	Tutorials (laboratory.	20.1			
	activiti	les	15.2.	auditory), seminars, teamwork	30 hours			
			16.1.	Projects	0 hours			
16.	Other	types of activities	16.2.	Individual tasks	45 hours			
			16.3.	Home study – tasks	45 hours			
	Evalua	tion / assessment metho	ods					
	17.1.	Tests			40 points			
17.	17.2.	Individual tasks / proje	ect (pres	sentation: written and oral)	10 points			
	17.3.	Activity and participat	10n		20 points			
	17.4.	Final exam			30 points			
				Up to 50 points	5 (five) (F)			
				51 - 60 points	0 (S1X) (E)			
18.	Assess	ment criteria (points / g	rade)	01 - 10 points	/ (seven) (D)			
			í.	/1 - 80 points	δ (eignt) (C)			
				$\delta 1 - 90$ points	9 (nine) (B)			
				91 – 100 points	10 (ten) (A)			

	Eligibi	lity for s	ignature and taking	60% realization of pre-exam activities, i.e., 42 points				
19.	the fina	al exam		from two tests, seminary or practical work, and				
				regular participation to t	he organized activit	ies.		
20.	Langua	ige of th	e study program	English				
21.	Quality assurance methods of the teaching process			Self-evaluation				
	Literat	ure						
		Manda	atory literature					
		No.	Author	Title	Publisher	Year		
	22.1.	1.	Stojanovska, Z.	Lecture notes	Goce Delcev University, Stip	/		
		2.	Irving, H. P.	Physics of the Human Body	Springer	2007		
22.		3.	Bushberg, J. T., Seibert, J. A., Leidholdt, E. M., Boone, J. M.	The Essential Physics of Medical Imaging (3 rd Edition)	Lippincott Williams & Wilkins	2012		
		Additi	onal literature					
		No.	Author	Title	Publisher	Year		
	22.2.	1.	Franklin, K., Muir, P., Scott, T., Willcocks, L., Yates, P.	Introduction to Biological Physics for the Health and Life Sciences	Wiley	2010		

		Appendix 3 No. 5		Study program for cyc	· inte :le of	grated first a studies	and second		
1.	Name	of the course		INTRODUCTION T	O PH	IARMACY			
2.	Code			3FMN192325					
3.	Study	program		Pharmacy					
	Study	program organizer		Faculty of Medical Sci	ience	5,			
4.	(depart	tment, institute, branch)		Goce Delcev Universit	ty, St	ip			
5.	Degree	e (first, second, third cyc	cle)	Integrated first and second cycle of studies					
6.	Acade	mic year / semester		First year / First semester	7.	Number of ECTS	4		
8.	Profess	sor		Assoc. Prof. Dr.sc. Ele	ena D	rakalska Sers	emova		
0	Pre-co	nditions for course		Enrolled in first somes	tor of	Estudios			
9.	registra	ation		Enrolled in first semes	ter of	studies			
	Aims	of the study program (compet	ences):					
	To ena	ble students to understa	nd the s	cope and essence of the	phar	macist's pract	tical work		
10	and the	eir role within the health	ncare sys	stem, industrial producti	ion, re	egulatory bod	ies, and		
10.	researc	ch activities.							
	Additionally, to develop a rational, evidence-based approach to problem-solving in practice,								
	ground	grounded in findings from scientific research.							
	Conte	nt of the study program	n (appl	ies both for theoretical	and	practical par	rt):		
	 Subject of Pharmacy: Definitions and Professional Opportunities; 								
	- Development of Pharmacy: Key Achievements in the 19 th and 20 th Centuries;								
	_	Legal Frameworks Re	gulating	g the Pharmaceutical Sec	ctor in	n the Republic	c of North		
		Macedonia;							
	—	European and Internat	ional Pl	armacy Regulations: Pr	ocess	s of Internatio	nal		
11.		Harmonization;			1 7		•		
	- Good Fractices: An Essential Component of International Drug Regulations in National Legislation:								
	National Legislation; — Evidence Based Medicine, Evidence Based Decreasiv								
	 Evidence-Based Medicine, Evidence-Based Pharmacy; The Discussion Profession: 								
	 The Pharmacy Profession; 								
	_	Learning and Training							
	_	Pharmaceutical Assoc	1ations;						
	_	Finished Pharmaceutic	cal Prod	uct, Drug Quality;					
	_	Pharmacy and Hospita	al Pharm	iacy;					
		methoda.	cal Prac	tice.					
12.	Loctur	memous:	racaara	work					
13	Total	es, interactive teaching,		$\frac{11 \text{ work.}}{1 \text{ ECTS x 30 hours} = 1}$	20 h	ours $(2+1)$			
14	Distrib	ution of tasks	<u> </u>	$\frac{4}{20+15+60+30+15}$	20 11	$\operatorname{ours}(2+1)$			
14.	Distric		15.1	Lectures _ theory		30 hour	°C		
15	Types	of learning/teaching	15.1.	Tutorials (laboratory		50 11001	.5		
15.	activiti	es	15.2.	auditory) seminars tea	amw	ork 15 hour	S		
			16.1	Projects		60 hour	°S		
16	Other t	vnes of activities	16.2	Individual tasks		30 hour	`S		
10.	other	spes of derivities	16.3	Home study – tasks		15 hour	`S		
<u> </u>	Evalua	tion / assessment metho	ods	monto study works		10 1100			
	17.1	Tests				40 poin	ts		
17	17.2	Individual tasks / proje	ect (pres	entation: written and or	al)	10 poin	ts		
· · ·	17.3	Activity and participat	tion	withen and Or)	20 poin	ts		
	17.4	Final exam				30 poin	ts		
<u> </u>	17.4. Filial exam			Up to 50 points		5 (five)	(\mathbf{F})		
10			1 1						

				61 – 70 points		7 (seven) (D)		
				71 – 80 points		8 (eight) (0	C)		
				81 – 90 points		9 (nine) (B)			
				91 – 100 points		10 (ten) (A	.)		
	Eligibi	ity for s	ignature and taking	60% realization of pre-exam activities, i.e., 42 points					
19.	the fina	ıl exam		from two tests, seminary	or prac	tical work, a	ind		
				regular participation to t	he orgar	nized activiti	es.		
20.	Langua	ge of th	e study program	English					
21.	Quality teachin	assurar g proces	nce methods of the	Self-evaluation					
	Literatu	Literature							
		Manda	atory literature						
		No.	Author	Title	Pu	ıblisher	Year		
		1.	Azzonardi I M	Lecture Notes in	Pharm	aceutical	2010		
			Azzoparul, L. M.	Pharmacy Practice	Press		2010		
	22.1	2.1.	Whalley, B. J.,						
	22.1.		Fletcher, K. E.,	Foundation in	Pharm	aceutical	2008		
22		2.	Weston, S. E.,	Pharmacy Practice	Press		2000		
22.			Howard, R. L.						
		3	Angelovska, B.,	Introduction to	Goce l	Delcev	2013		
		5.	Ivanovska, V.	Pharmacy	Univer	rsity, Stip	2015		
		Additi	onal literature	•					
		No.	Author	Title	Pu	ıblisher	Year		
	22.2.		Krainovic D	Introduction to	Facult	y of			
		1.	Lakik D	Pharmacy	Pharm	acy,	2019		
			Lakik, D.	1 narmacy	Belgra	ıde			

	Appendix 3 No. 6	Study program for integrated first and second cycle of studies						
1.	Name of the course	ORGANIC CHEMISTRY						
2.	Code	3FMN192425						
3.	Study program	Pharmacy						
4	Study program organizer	Faculty of Medical Sciences,						
4.	(department, institute, branch)	Goce Delcev University, Stip						
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies						
6.	Academic year / semester	First year / Second semester7.Number of ECTS7						
8.	Professor	Adj. Ass. Prof. Dr.sc. Maja Chochevska						
9.	Pre-conditions for course registration	Enrolled in second semester of studies						
	Aims of the study program (competences): Providing basic knowledge of theoretical and experimental aspects of organic chemistry, with							
10.	 alkynes, dienes, alkyl halides, aromatic compounds, alcohols, ethers, phenols, aldehydes, ketones and ethers; Understanding the formulas of organic compounds (writing and naming the main organic molecules); Identifying the main functional groups; Predicting and recognizing the physicochemical Properties and stereochemical properties, reactivity and pharmaceutical importance of the organic molecules; Analyzing the relationship between the structure and the properties of the organic molecules. Student tasks (individual and homework) are planned on the topics covered during the course to achieve higher learning outcomes. Mainly to solve exercises on the reactivity and stereochemistry of the most common classes of organic compounds, and on their IUPAC nomenclature, as well as reaction mechanisms. 							
11.	<i>Theoretical part:</i> Introduction to organic chemistry an electronic configuration; Atom form multiple covalent bonds; Polar covale sp); Molecular geometries; Resonar compounds; Intramolecular interactic organic compounds, solubility in w Addition, Elimination, and Rearra conformational, geometric isomerism rules, and E/Z descriptors – optical iso properties and optical activity of enant of organic reactions: correlation betwee and acid/base properties (structure, compounds; functional groups and cl Organohalides – Alkyl Halides; Benz Epoxides; Thiols, Carbonyl Compound <i>Practical part:</i> Organic nomenclature (practical probl Building molecular models using the reactions practical work in organic reactions practical work in organic chemistry labo evaporation, distillation, and thin-lay (acetyl salicylic acid, benzamide, io organic molecules used in pharmacy.	nd organic compounds in pharmacy; Atomic structure, hal charge, atomic and molecular orbitals; Simple and ent bonds; Acids and bases; Hybridization (sp ³ , sp ² and nee structures; Stability of intermediates and organic ons, physicochemical properties of the main classes of rater and other solvents; Reaction types: Substitution, angement; Isomers and stereochemistry; Structural, a – <i>cis/trans</i> isomerism, Chain-Ingold and Prelog (CIP) omerism: chirality, R/S configurations, physicochemical tiomers, diastereoisomers; Kinetics and thermodynamics een the structural features of organic compounds and pK _a substituents, electronegativity, hybridization); Organic lassification; Alkanes, Cycloalkanes, Alkenes, Alkynes, tene and Aromaticity, Alcohols and Phenols, Ethers and ads: Aldehydes and Ketones.						

	Theore	tical lea	rning methods:	frontal	teaching through lectures	(PPT pr	esentations)	;
	Practic	al learn	ing methods: pr	oblem-	solving tasks (drawing mo	olecules,	nomenclatu	ire,
12	drawing	g reactio	on mechanisms)	, and la	boratory work (laboratory	v experin	$\frac{(2+2)}{(2+2)}$	
13.	Total a	mount o	of time available		7 ECTS x 30 hours = 21	0 hours	(3+3)	
14.	Distrib	ution of	tasks	15 1	45+45+15+25+80		45 1	
15	Types of	of learni	ng/teaching	15.1.	Tectures – theory		45 nours	
15.	activiti	es		15.2.	auditory), seminars, tear	nwork	45 hours	
				16.1.	Projects		15 hours	
16.	Other t	ypes of a	activities	16.2.	Individual tasks		25 hours	
		-		16.3.	Home study – tasks		80 hours	
	Evalua	tion / as	sessment metho	ds	· ·			
	17.1.	Tests					40 points	
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)	10 points	
	17.3.	Activit	y and participat	ion			20 points	
	17.4.	Final e	xam				30 points	
					Up to 50 points		5 (five) (F)	
					51 – 60 points		6 (six) (E)	
10			tania (nainta / a	(a b a a	61 – 70 points		7 (seven) (D)
18.	Assessi	ment cri	teria (points / gi	rade)	71 – 80 points		8 (eight) (0	C)
					81 – 90 points		9 (nine) (B	
					91 – 100 points		10 (ten) (A	
	Eligibi	lity for s	ignature and tal	king	60% realization of pre-e	xam act	ivities, i.e., 4	2 points
19.	the fina	the final exam			from two tests, seminary	or prac	tical work, a	ind
					regular participation to t	he organ	nized activiti	es.
20.	Langua	ige of th	e study progran	1	English	0		
21.	Quality	v assurar	nce methods of t	the	Self-evaluation			
	Literati	g proces	38					
	Mandatory literature							
		No	Author		Title	Pu	hlisher	Vear
		110.	Autior		Organic Chemistry	14		1 Cai
		1.	McMurry, J. I	Ξ.	(10 th Edition)	OpenS	tax	2023
	22.1.	2	Clayden, J.,		Out of the second secon	Oxfore	1	2012
		2.	Greeves, N., Warren S		Organic Chemistry	Unive	rsity Press	2012
			warren, 5.		Organic Chemistry: A			
		3.	Oulette, R. J.		Brief Introduction	Prentie	e Hall	1998
		Additi	onal literature					1
22.		No.	Author		Title	Pu	blisher	Year
			Oulette, R. J.,		Organic Chemistry:			2014
		1.	Rawn, J. D.		Structure, Mechanism,	Elsevi	er	2014
					and Synthesis			
					Essentials of Organic			
	22.2.				Chemisiry. For Students of Dhammaon			
		2.	Dewick, P. M		Students of Pharmacy, Medicinal Chemistry	Wiley		2006
					and Riological			
					Chamistry			
					Organic Chamistre			
		Bell,	Bell, C. E., Ta	ıber,	Laboratory: With	Harco	urt College	2001
		3.	D. F., Clark, A	4. K.	Qualitative Analysis	Publis	Publishers	

	Appendix 3 No. 7		Study program for cyc	r inte cle of	grated first a studies	and second
1.	Name of the course		PHYSICAL CHEMI	STR	Y	
2.	Code		3FMN192525			
3.	Study program		Pharmacy			
4	Study program organizer		Faculty of Medical Sc	iences	s,	
4.	(department, institute, branch)		Goce Delcev Universi	ity, Sti	ip	
5.	Degree (first, second, third cyc	ele)	Integrated first and see	cond o	cycle of studie	es
6.	Academic year / semester		First year / Second semester	7.	Number of ECTS	6
8.	Professor		Assoc. Prof. Dr.sc. Al	eksan	dar Cvetkovs	ki
9.	Pre-conditions for course registration		Enrolled in second ser	nestei	r of studies	
	Aims of the study program (compet	ences):			
10.	 Acquiring knowledge for the basic physicochemical laws according to which all chemical and biochemical reactions and changes in the state of matter in nature and the living world take place; Comparative study on the influence of thermodynamic and kinetic factors in change of mass and state of matter in homogeneous and heterogeneous isolated and open systems; 					
11.	 <i>Theoretical part:</i> Introduction to Physical Chemistry; Chemical thermodynamics; Aggregate states of matter; Solubility and formation of solutions and their colligative properties; Colloidal, dispersed systems; Phenomena of boundary surfaces; Molecular interactions that are not of covalent nature; Chemical kinetics; Radiochemistry. <i>Practical part:</i> Calculations in thermodynamics; Measurement of heat capacity; Phase equilibria; Electrical conductivity in electrolyte solutions; Electrode potential; Calculation of colligative properties of solutions; 					
-	Study methods.					
12.	Lectures, seminars, exercises, group discussions.	individu	ual assignments, collabo	orative	e lectures, me	thods of
13.	Total amount of time available	2	6 ECTS x 30 hours = 1000	1 <u>80</u> h	ours <u>(3+</u> 2)	
14.	Distribution of tasks		45+30+15+45+45			
	Types of learning/teaching	15.1.	Lectures – theory		45 hour	rs
15.	activities	15.2.	Tutorials (laboratory, auditory), seminars, te	eamwo	ork 30 hour	°S
		16.1.	Projects		15 hour	S
16.	Other types of activities	16.2.	Individual tasks		45 hour	S
		16.3.	Home study – tasks		45 hour	ŝ
17.	Evaluation / assessment method	ods	_			

	17.1.	Tests			40 points	40 points		
	17.2.	Individ	ual tasks / project (pres	sentation: written and oral) 10 points			
	17.3.	Activit	y and participation		20 points			
	17.4.	Final e	xam	30 points				
				Up to 50 points	5 (five) (F)		
				51 – 60 points	6 (six) (E)	1		
18	1	mont out	tonia (nainta / anada)	61 – 70 points	7 (seven)	(D)		
18.	Assess	ment cri	teria (points / grade)	71 – 80 points	8 (eight) (C)		
				81 – 90 points	9 (nine) (I	3)		
				91 – 100 points	10 (ten) (A	A)		
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam activities, i.e.,	42 points		
19.	the final exam			from two tests, seminary	v or practical work,	and		
				regular participation to the organized activities.				
20.	Langua	age of th	e study program	English				
21.	Quality teachin	assurar	nce methods of the	Self-evaluation				
	Literature							
		Manda	atory literature					
		No.	Author	Title	Publisher	Year		
			Atkins, P. W., De	Physical Chemistry for	Oxford	• • • •		
	22.1	1.	Paula, J.	the Life Sciences	University Press	2006		
	22.1.		,	Martin's Physical				
				Pharmacy and	Wolters Kluwer	2020		
22		2.	Sinko, P. J. (Editor)	Pharmaceutical	India Pvt Ltd	2020		
22.				Sciences (7 th Edition)				
		Additi	onal literature					
		No.	Author	Title	Publisher	Year		
				Thermodynamics of				
	22.2.			Pharmaceutical				
		1.	Connors, K. A.	Systems: An	Wiley	2008		
				Introduction for				
			Students of Pharmacy					

	Appendix 3 No. 8	Study program for integrated first and second cycle of studies		
1.	Name of the course	HUMAN PHYSIOLOGY AND ANATOMY		
2.	Code	3FMN192625		
3.	Study program	Pharmacy		
4	Study program organizer	Faculty of Medical Sciences,		
4.	(department, institute, branch)	Goce Delcev University, Stip		
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies		
6.	Academic year / semester	First year / Second semester7.Number of ECTS6		
8.	Professor	Assoc. Prof. Dr.sc. Jasminka Chabukovska Radulovska Adj. Assoc. Prof. Dr.sc. Eli Handjiska		
9.	Pre-conditions for course registration	Enrolled in second semester of studies		
10.	ences): knowledge in human anatomy and physiology, focusing pharmacy students to study and master the material a foundational understanding of human anatomy and structure and functions of organs and organ systems.			
11.	 Anatomy: This part of the course presents human system: Regions: Includes surface and Systems: Includes conceptual Key topics in this part of the course: Introduction to the human boo Tissue level of organization; Body regions; Integumentary system; Musculoskeletal system (axia Cardiovascular system; Nervous system (brain and cranervous system); Endocrine system; Respiratory system; Digestive system; Urinary system; Reproductive system. Physiology: This part of the course covers the function of the course: Cellular Physiology: Transport action potentials, excitation and control of the course: Blood and Immunity: Red blog granulocytes, monocyte-macrinemostasis, and blood coagular 	an anatomy logically by body region for each major body I functional anatomy; and clinical anatomy. dy; I and appendicular skeleton, joints, muscles); anial nerves, spinal cord and spinal nerves, autonomic damental functional organization of the human body, he internal environment. rt of substances through cell membranes, membrane and hd contraction of skeletal and smooth muscles; bod cells, body's resistance to infection (leukocytes, ophage system, and inflammation), blood groups, ation;		

-	-											
	3.	3. Cardiovascular system: Physiology of the heart, rhythmic excitation, minute and										
		stroke y	volume, heart v	alves ar	id sounds, normal ECG, cire	culatio	n, and					
		microci	irculation, bloo	d flow,	and blood pressure;							
	4.	Respire	itory system: Pi	ulmona	ry ventilation, pulmonary ci	rculati	on, gas exch	ange				
		principles, oxygen and carbon dioxide transport in blood and tissue fluids, and										
	5	regulat	egunation of respiration;									
	Э.	Gastroi	ntestinal physic	blogy: I	ransport and mixing of foo	d, secr	etory functio	ons,				
		digestic	on and absorption	on in th	e gastrointestinal tract, and	the fur	ictions of sa	livary				
	6	giands,	liver, and panc	reas;	ustion along mulan filtration	tubul	angenetica	and				
	0.	reabaar	mtion asmolali	ne prou	lation, glomerular intration	i, tubul	ar secretion	and				
	7	Thorma	ption, osmolall	Notob	ation, and acid-base balance	e; mnore	tura hunath	ormaio				
	1.	and hy	pegulation and	Metabo	Siisiii. Kegulatioli ol body te	mpera	aure, nypou	lemma				
	8	Endocr	ine system: Piti	uitary h	ormones hypothalamus thy	roid a	nd parathyro	vid				
	0.	hormor	ne system. i tu ses adrenocorti	cal hor	mones pancreatic hormones	and t	the nineal of	and				
	9	Reprod	uctive system:	Structu	re of the male and female re	enrodu	ctive system	s and the				
		influen	ce of sex horm	ones in	both men and women:	produ	ent e system	s und the				
	10.	Nervou	s system: Phys	iology a	and organization of the nerv	ous sv	stem, divisio	on, motor				
		functio	ns of the spinal	cord, b	rain stem, and cerebral cort	ex, spi	nal reflexes,	,				
		intellec	tual brain funct	tion, and	d automatic nervous system	;	,					
	11.	Sensor	y system: Senso	ory phys	siology, including the senses	s of to	uch, position	i, pain,				
		sight, h	earing, taste, ar	nd smel	1.							
	Study	methods	5:									
12.	Lecture	es, consu	ltations, indepe	endent l	earning, hands-on practice r	elated	to the topic,					
	laborat	ory exer	cises, including	: demo	nstrations, individual work,	and gr	oup particip	ation.				
13.	Total a	mount o	f time available	;	6 ECTS x 30 hours = 180	hours	(3+2)					
14.	Distrib	ution of	tasks		45+30+15+45+45							
	Types of learning/teaching activities		15.1.	Lectures – theory		45 hours						
15.			15.2	Tutorials (laboratory,		30 hours						
		•••		10.2	auditory), seminars, teamy	vork	50 110 415					
		Other types of activities		16.1.	Projects		15 hours					
16.	Other t			16.2.	Individual tasks		45 hours					
				16.3.	Home study – tasks		45 hours					
	Evalua	$\frac{100}{-}$	sessment metho	ods								
1.7	17.1.	Tests	1.1.1.				40 points					
Γ7.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)		10 points					
	17.3.	Activity	y and participat	1011			20 points					
	17.4.	Final ex	kam		TT 4 50		30 points					
					Up to 50 points		3 (five) (F)					
					51 - 60 points		$\frac{6(s_1x)(E)}{7(c_1)(E)}$					
18.	Assess	ment crit	teria (points / gi	rade)	61 - 70 points		/ (seven) (D)				
			ч с	,	71 - 80 points		$\frac{8 \text{ (eight) (C)}}{2 \text{ (eight) (C)}}$)				
					81 - 90 points		9 (nine) (B)				
	T-1 · · 1 ·	1.4 0	• • • • • •	•	91 - 100 points		10 (ten) (A)				
10	Eligibi	lity for s	ignature and tal	king	60% realization of pre-exa	im acti	v_{1} vities, i.e., 4	$\frac{1}{2}$ points				
19.	the fina	11 exam			rom two tests, seminary c	or prac	ucal work, a	110				
20	Longer	and of the	a study me and	0	Finalish	: organ	nzeu activiti	CS .				
∠0.	Ouality		c suuy program	u the								
21.	teachin	assulall		uite	Self-evaluation							
	Literat	ure	00									
22	Literat	Manda	tory literature									
	22.1.	No	Author		Title	P11	blisher	Year				

	1.	Guyton, A. C., Hall, J. E.	Textbook of Medical Physiology	Elsevier	2016
	2.	Rhoades, R. A., Bell, D. R.	Medical Physiology	Wolters Kluwer India Pvt Ltd	2018
	3.	Karthikeyan, K.	A Textbook of Human Anatomy & Physiology-I, B. Pharmacy (PCI)	Sia Publishers And Distributors Pvt ltd	2017
	4.	Tortora, G. J., Derrickson, B.	Principles of Anatomy and Physiology	Wiley	2014
	Additi	onal literature			
	No.	Author	Title	Publisher	Year
	1.	Boron, W. F., Boulpaep, E. L.	Medical Physiology	Elsevier	2017
22.2.	2.	Pocock, G., Richards, C. D., Richards, D. A.	Human Physiology	Oxford University Press	2018
	3.	Netter, F. H.	Netter's Atlas of Human Anatomy	Elsevier	2022

	Appendix 3 No. 9	Study program fo	or into ycle o	egrated first a f studies	and second			
1.	Name of the course	MOLECULAR BIO)LOG	GY AND GEN	ETICS			
2.	Code	3FMN192725						
3.	Study program	Pharmacy						
4	Study program organizer	Faculty of Medical S	cience	es,				
4.	(department, institute, branch)	Goce Delcev Univers	sity, S	tip				
5.	Degree (first, second, third cycle)	Integrated first and se	econd	cycle of studi	es			
6.	Academic year / semester	First year / Second semester	7.	Number of ECTS	5			
8.	Professor	Full Prof. Dr.sc. Tod	or Ars	SOV				
9	Pre-conditions for course	Enrolled in second se	emeste	er of studies				
7.	registration		mesu	er of studies				
10.	Aims of the study program (compet	ences):						
	Understanding the principles of molec	ular biology and gener	tics.					
	Content of the study program (appl	ies both for theoretic	al anc	l practical pai	rt):			
	Theoretical part:		<i>.</i>	1 4	11 1			
	1. Prokaryotic and eukaryotic ce	d abromagamag Mala	netic 1	$\frac{1}{1}$	ell division,			
	central dogma of molecular biology;							
2. Human chromosome anomalies:								
	2 Biomacromolecules Chemistry structure and functions of DNA DNA and protein							
5. Diomacromolecules. Chemistry, structure and functions of DIVA, RIVA and Human ganome, ganes and alleles, ganatic variation in the nonulation:								
	4 Molecular biology of replicati	ion transcription and t	ransla	tion Types of	genetic			
	variants and the effect of path	ogenic genetic variants	s on n	rotein structur	e and			
	function. Molecular basis of n	nonogenic conditions:	on p		e unu			
	5. Molecular biology techniques	used in cytogenetics a	and mo	olecular cytog	enetics:			
	conventional karyotype, fluor	escent in situ hybridiza	ent in situ hybridization, chromosomal microarray					
	technologies;							
	6. Molecular biology techniques	s used in molecular genetics. Extraction of nucleic acids,						
	PCR, RT-PCR, real time PCR	R, Sanger sequencing, genomics (next-generation						
	sequencing);							
11	7. Genetic contribution to human	n disease: rare monoge	nic ar	nd common co	mplex			
11.	polygenic conditions. Monogo	enic conditions and Me	endeli	an inheritance:	: autosomal			
	dominant, recessive and X-lin	iked;						
	8. Violations of Mendelian inher	ritance in monogenic c	onditi	ons: mitochon	drial			
	inheritance, dynamic mutation	ns, imprinting. Commo	on con	nplex condition	ns and			
	polygenic inneritance;	Diagnostia prodictivos	ndaa	rooning gonati	a tasts			
	9. Genetic testing in the clinic. I	d diagnostic) Types of	f sore	ning tests:				
	10 Molecular biology of cancer	cell cycle DNA repair	nrot	o-oncogenesis	and tumor			
	suppressor genes.	cen cycle, DNA lepan	, prou	0-oncogenesis				
	11. Pharmacogenomics. Treatmet	nt of genetic diseases:						
	12. New frontiers in genomic med	dicine. new tests. new t	treatm	ents. Biotechr	ology and			
	manufacturing biologic medic	cations. Gene therapy.			8,			
	Practical part:	1.5						
	1. Construction of a pedigree;							
	2. Types of biological material i	n molecular biology (g	enetic	c) laboratory. H	Basic			
	principles of working in mole	cular biology (genetic)	labo1	atory;				
	3. Extraction, quantification and	visualization of nucle	ic acio	ls and proteins	;			
	4. Electrophoresis (agarose and	polyacrylamide gel);						
	5. Blotting techniques (Southern	, Western, Northern bl	ot);					

	6. Polymerase chain reaction principles, qPCR, real-time PCR, QF-PCR, RT-PCR;									
	7.	 Sanger sequencing, analysis of sequences; Conventional karvotype. Analysis of karvograms; 								
	8.	8. Conventional karyotype. Analysis of karyograms;								
	9.	 Fluorescent in situ hybridization and microarray; 								
	10.	10. Pedigree analysis – types of inheritance. Inheritance of blood groups;								
	11.	Biointo	ormatics and co	mmonly	y used molecular biology	database	s;			
	12.	Bioinfo	ormatics and co	mmonly	y used molecular biology	database	es.			
	Study	method	S:		4. 1	· ·	· · · · · · · · · · · · · · · · · · ·	1' .		
10	Interact	ive lect	ures, group lect	ures wit	in discussion and student	participa	tion; multin			
12.	2. support; literature search; E-learning – online molecular biology databases; individual an									
	analysi	onsulta		work,	analysis of molecular bio	logy ics	and peu	igitt		
13	Total a	nount o	f time available		5 ECTS x 30 hours = 15	0 hours	(2+2)			
14.	Distrib	ution of	tasks	·	30+30+15+10+65	0 HOUID	(2 · 2)			
	E.		······	15.1.	Lectures – theory		30 hours			
15.	Types of	of learni	ng/teaching	15.0	Tutorials (laboratory,		20.1			
	activities		15.2.	auditory), seminars, tear	nwork	30 hours				
				16.1.	Projects		15 hours			
16.	Other t	ypes of a	activities	16.2.	Individual tasks		10 hours			
		16.3.		16.3.	Home study – tasks		65 hours			
	Evaluat	tion / as	sessment metho	ds						
17.	17.1. Tests					40 points				
	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)	10 points			
	17.3.	Activit	y and participat	ion			20 points			
	17.4.	Final e	xam		1		30 points			
				Up to 50 points		5 (five) (F)				
					51-60 points		6 (six) (E)			
18.	Assess	nent cri	teria (points / g	rade)	61 - 70 points		7 (seven) (D)		
10.	1 100 0001	Assessment enterna (points / grade)			71 - 80 points		8 (eight) (C	<u></u>		
					81 – 90 points	9 (nine) (E)		
	T1' '1 '1	·	• • • • • •	•	91 – 100 points 10 (ten) (A)			.)		
10	Eligibil	ity for s	ignature and tal	sing	60% realization of pre-e	xam act	1V1t1es, 1.e., 4	2 points		
19.	the fina	li exam			from two tests, seminary	or prac	tical work, a	na		
20	Longuo	go of th	a study program	2	Finalish	ne organ		es.		
20.	Quality	ge of th	e study program	1 tha	Eligiisii					
21.	teachin	g proces		line	Self-evaluation					
	Literati	<u>s proces</u> ire	55							
	Literat	Manda	atory literature							
		No.	Author		Title	Pu	blisher	Year		
			Turnpenny, P.	. D.,						
	22.1.	1.	Ellard, S., Cle	aver,	Emery's Elements of	Elsevi	er	2021		
22			R.		medical Genetics					
22.		2	Iwasa, J., Mar	shall,	Karp's Cell and	Wilow		2016		
		۷.	W.		Molecular Biology	wney		2010		
		Additi	onal literature		Γ	1				
	22.2	No.	Author		Title	Pu	blisher	Year		
		1.	Strachan, T., I	Read,	Human Molecular	CRC F	ress	2018		
	1.		A. P.		Genetics	Taylor	& Francis	2010		

	Appendix 3 No. 10	Study program for integrated first and second cycle of studies						
1.	Name of the course	BIOCHEMISTRY 1						
2.	Code	3FMN192825						
3.	Study program	Pharmacy						
	Study program organizer	Faculty of Medical Sciences,						
4.	(department, institute, branch)	Goce Delcev University, Stip						
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies						
6.	Academic year / semester	First year / Second semester7.Number of ECTS6						
8.	Professor	Full Prof. Dr.sc. Danijela Janikjevikj Ivanovska Adj. Ass. Prof. Dr.sc. Marija Atanasova Lazareva						
9.	Pre-conditions for course registration	Enrolled in second semester of studies						
	Aims of the study program (compet	ences):						
	Students will gain comprehensive kn	owledge of biological macromolecules (carbohydrates,						
	lipids, proteins, and enzymes), for	bllowed by learning their chemical structures and						
10.	understanding the role of biological i	nacromolecules in the context of living organisms and						
	cellular environment;							
	Gaining basic experience in experime	ntal laboratory work by conducting qualitative and						
	quantitative analyses of the main bion	blecules in the human body.						
	 Theoretical part: Basics of biochemistry (definition and tasks, biochemistry as an independent discipline, and as an interdisciplinary science); Water and inorganic salts (metabolism of water and inorganic salts, buffers in the 							
	human body and acid-base ba	lance):						
	3. Amino acids (chemical struct)	ure and reactions, classification, biological roles);						
	4. Peptides (nomenclature, biom	nedical significance of peptides) and proteins (protein ctions, plasma proteins); rides (classification, chemical structures and function);						
	structure, properties and funct							
	5. Carbohydrates: monosacchari							
	6. Carbohydrates: oligosaccharid	les (disaccharides and oligosaccharides) and						
	7. Lipids: triglycerides and fatty	acids, phospholipids, glycolipids (chemical structures						
	and function); 8. Lipids: steroids and carotenoids:							
11	9. Enzymes (chemical structure	and classification);						
11.	10. Mechanism and kinetics of en	zymatic reactions, regulatory enzymes;						
	11. Nucleic acids (structure and f	unction);						
	12. Water-soluble and fat-soluble	vitamins (main sources, chemical structures and						
	biological roles, metabolism,	deficiencies and medical usage).						
	Practical part:							
	1. Basic biochemical laboratory laboratory equipment and che	principles and safety precautions: basic rules, micals;						
	2. Important procedures in bioch	nemical laboratory: filtration, centrifugation,						
	3 Solutions: preparation and cal	culations:						
	4 Examination of the physicoch	emical properties of proteins: tests based on						
	precipitation reactions of prot	eins and color reactions of proteins.						
	5. Reactions of monosaccharide	s: reduction of monosaccharides, reactions of						
	monosaccharides with bases a	ind mineral acids:						
	6. Analysis of disaccharides and	polysaccharides;						
	 7. Examination of general properties of lipids: solubility, emulsification and hydrolysis; 							

-										
	8. Qualitative analysis of lipids: glycerol, fatty acids, cholesterol;									
	9. Analysis of general properties of enzymes: catalytic action and substrate specificity;									
	10. Analysis of general properties of enzymes: impact of the temperature and the									
	effectors on the enzymatic activity;									
	11. The basic principles of nucleic acids:									
	12.	Qualita	ative reactions of	of water	-soluble and fat-soluble vi	tamins.				
	Study	method	s:							
12.	Lecture	es with 1	arge group of st	tudents.	laboratory practical work	with sn	hall group of	students,		
	individ	ual cons	sultations and co	onsultat	ions with small group of s	tudents.	8 1	,		
13.	Total a	mount o	of time available	2	6 ECTS x 30 hours = 18	0 hours	(3+2)			
14.	Distrib	ution of	tasks	-	45+30+0+45+60		()			
				15.1.	Lectures – theory		45 hours			
15.	Types	of learni	ng/teaching		Tutorials (laboratory.					
10.	activiti	es		15.2.	auditory) seminars tear	nwork	30 hours			
				16.1	Projects	intern	0 hours			
16	Other t	vnes of	activities	16.2	Individual tasks		45 hours			
10.	othert	.jp e s er	activities	16.3	Home study – tasks		60 hours			
	Evalua	tion / as	sessment metho	10.5.	Home study tasks		00 110013			
	17 1	Tests	sessment methe	<i>us</i>			10 points			
17	17.1.	$\frac{1}{17.2} \text{Iests} \\ \frac{17.2}{10.2} \text{Iest} \frac{1}{10.2} \frac{1}{$			contation, written and aral)	10 points			
1/.	17.2.	Individual tasks / project (pre			semation. written and orar)	10 points			
	17.3.	Activit Einel a	y and participat	1011			20 points			
	17.4.	Final e	xam		II. to 50 mainta		50 points			
	Assessment criteria (points / grade)				51 60 points		$\frac{J(\text{IIVe})(\Gamma)}{L(\text{cirr})(\Gamma)}$			
					51 - 60 points		$6(s_{1}x)(E)$			
18.				rade)	61 - 70 points		/ (seven) (D)		
10.				,	71 – 80 points		8 (eight) (C	<u></u>		
				81 – 90 points		9 (nine) (B)			
					91 – 100 points		10 (ten) (A	.)		
	Eligibi	lity for s	signature and tal	king	60% realization of pre-e	xam act	ivities, i.e., 4	2 points		
19.	the fina	al exam			from two tests, seminary	or prac	tical work, a	ind		
					regular participation to t	he orgar	nized activiti	es.		
20.	Langua	age of th	e study progran	n	English					
21	Quality	/ assurar	nce methods of	the	Self-evaluation					
	teachin	ig proces	SS		Sen evaluation					
	Literat	ure								
		Manda	atory literature		1					
		No.	Author		Title	Pu	blisher	Year		
		1	Nelson, D. L.	, Cox,	Lehninger Principles	W.H.]	Freeman &	2017		
		1.	M. M.		of Biochemistry	Compa	any	2017		
	22.1		Murry, R. K.,							
	22.1.	2.	Granner, D. K	.,	Harper's Biochemistry	McGra	aw Hill	2009		
			Rodwell, V. V	V.						
					Nutritional	Cambr	idae			
22.		3.	Bender, D. A.		Biochemistry of the	Univer	noridge 2003			
					Vitamins	Univer	niversity Press			
		Additi	onal literature							
		No.	Author		Title	Pu	blisher	Year		
					Practical Textbook of					
	22.2	1	Vasudevan, D	О. М.,	Biochemistry for	Jaypee	Brothers	2013		
	<i>LL</i> . <i>L</i> .	1.	Das, S. K.		Medical Students (2 nd	Medic	al Pub	2013		
					Edition)					
		2	Mohanty, S.,		Practical Clinical	Jaypee	Brothers	2012		
		∠.	Verma, A.		Biochemistrv	Medic	al Pub	2013		

	Appendix 3 No. 11	Study program for integrated first and second cycle of studies					
1.	Name of the course	BIOCHEMISTRY 2					
2.	Code	3FMN192925					
3.	Study program	Pharmacy					
Δ	Study program organizer	Faculty of Medical Sciences,					
ч.	(department, institute, branch)	Goce Delcev University, Stip					
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies					
6.	Academic year / semester	Second year / Third semester7.Number of ECTS6					
8.	Professor	Prof. Dr.sc. Tatjana Rushkovska					
9.	Pre-conditions for course	Enrolled in third semester of studies					
	Aims of the study program (compet	ences):					
10.	The main goal of the Biochemistry 2 course is to provide an in-depth study of metabolic processes in the human body, an understanding of their regulation and integration, as well as knowledge about cell signaling. After defining the concept of metabolism and introducing the basic principles of bioenergetics, all metabolic pathways of carbohydrate metabolism will be studied in detail, as well as the metabolic fate of pyruvate in anaerobic and aerobic conditions. In this part, special attention is given to the mechanisms of regulation and coordination of these metabolic processes. Furthermore, all chemical reactions of the citric acid cycle, as well as the process of oxidative phosphorylation, are studied in detail. Next, the catabolism of fatty acids and amino acids, along with the biosynthesis of lipids and compounds derived from amino acids, as well as the biosynthesis and degradation of nucleotides, are thoroughly explored. The metabolism of lipoproteins in blood plasma is also studied in detail. Lastly, the basic principles of cell signaling, as well as the principles of hormonal regulation and integration of metabolism, are covered. By successfully mastering the course content provided in this program, students will acquire a high level of knowledge and understanding of cellular metabolic pathways and cycles, with a						
11.	Content of the study program (appl 1. Metabolism and bioenergetics Anabolism; Organization of (Biological energy transforma endergonic reactions, free energy; Energy supply from a In this chapter, students will be introdu of metabolism and exploring the basic 2. Glycolysis, gluconeogenesis absorption of carbohydratess reactions (Phases of glycolysi of pyruvate under anaerobic an – definition, cellular localiza glycolysis; Energy consumpt cycle); Pentose-phosphate pa (Roles of the pentose-phosp Glucose 6-phosphate dehydro In this chapter, students will study in glycolysis, gluconeogenesis, and the pentose-phosp	ies both for theoretical and practical part): s: Concept of metabolism and classification (Catabolism; the metabolic pathways); Principles of bioenergetics ations obey the laws of thermodynamics; Exergonic and ergy; Principle of additivity of changes in standard free denosine triphosphate 'ATP' by group transfers). uced to the Biochemistry 2 course by defining the concept e principles of bioenergetics. s, and pentose-phosphate pathway: Digestion and s; Glycolysis – definition, cellular localization, and s; ATP yield from glycolysis; Metabolic transformations and aerobic conditions; Warburg effect); Gluconeogenesis tion, and reactions (Bypassing irreversible reactions of tion of gluconeogenesis; Glucogenic compounds; Cori thway – definition, cellular localization, and reactions hate pathway; Phases of pentose-phosphate pathway; genase deficiency). n detail all the reactions of the metabolic pathways of pentose-phosphate pathway, as well as the enzymes that					

catalyze each reaction. Additionally, students will learn about the biological role of each of these metabolic pathways.

3. Glycogen metabolism: Glycogenolysis – definition, cellular localization, and reactions; Glycogenesis – definition, cellular localization, and reactions (Glycogenin); Glycogen storage diseases.

In this chapter, students will study in detail all the reactions of the metabolic pathways of glycogenolysis and glycogenesis, as well as the enzymes that catalyze each reaction. Additionally, students will learn about the biological role of these metabolic pathways.

4. Principles of metabolic regulation: Coordinated regulation of glycolysis and gluconeogenesis (Regulation of hexokinase in the liver and skeletal muscles; Complex allosteric regulation of phosphofructokinase-1; Fructose 2,6-bisphosphate as a regulator of glycolysis and gluconeogenesis; Allosteric regulation of pyruvate kinase; Xylulose 5-phosphate as a key regulator of carbohydrate and lipid metabolism); Coordinated regulation of glycogenolysis and glycogenesis (Hormonal and allosteric regulation of glycogen phosphorylase; Regulation of glycogen synthase by phosphorylation and dephosphorylation).

By mastering the content of this chapter, students will gain an in-depth understanding of the regulation and coordination of metabolic pathways, biological processes essential for the survival of living organisms.

5. Citric acid cycle – definition, cellular localization, and reactions: Oxidative decarboxylation of pyruvate (Pyruvate dehydrogenase complex); Reactions of the citric acid cycle; ATP yield from the citric acid cycle; Regulation of the citric acid cycle.

In this chapter, students will study in detail all the reactions of the citric acid cycle, the enzymes that catalyze each reaction, as well as all the products of the cycle, while also recognizing its central role in cellular metabolism.

6. Oxidative phosphorylation – definition, cellular localization, and detailed description of the process: Components of the respiratory chain; Chemiosmotic theory, protonmotive force; Synthesis of ATP (Rotational catalysis); ATP yield from the complete oxidation of glucose; Regulation of oxidative phosphorylation; Heat production in brown adipose tissue; Production of free radicals at the level of the respiratory chain and antioxidant protection systems.

In this chapter, students will study in detail the process of oxidative phosphorylation as the final stage of catabolism in aerobic organisms, as well as associated process: heat production in brown adipose tissue and the production of free radicals in mitochondria.

7. Fatty acid catabolism: Digestion and absorption of lipids; Mobilization of stored triglycerides; Beta-oxidation of saturated fatty acids with an even number of carbon atoms, in the mitochondria; ATP yield from the complete oxidation of palmitic acid; Beta-oxidation of unsaturated fatty acids; Beta-oxidation of fatty acids with an odd number of carbon atoms; Other types of fatty acid oxidation (Beta-oxidation in peroxisomes; Omega-oxidation in the endoplasmic reticulum; Alpha-oxidation in peroxisomes); Ketogenesis.

In this chapter, students will study in detail all the reactions of the metabolic pathways of betaoxidation of fatty acids and ketogenesis, the enzymes that catalyze each reaction, as well as the energy contribution from the complete oxidation of palmitic acid, a saturated fatty acid with an even number of carbon atoms. Additionally, students will learn about the biological role of these metabolic pathways.

8. Amino acid oxidation and the urea cycle: Digestion and absorption of proteins; Transamination; Oxidative deamination of glutamate; Glutamine; Glucose-alanine cycle; Urea cycle – definition, cellular localization, and reactions; Pathways of amino acid degradation (Glucogenic and ketogenic amino acids; Some human diseases resulting from genetic defects of enzymes involved in amino acid catabolism – phenylketonuria, alkaptonuria, maple syrup urine disease).

In this chapter, students will gain a high level of knowledge and understanding of amino acid catabolism, its complexity, and its connections to other metabolic pathways and processes in

cellular metabolism. Furthermore, students will study in detail all the reactions of the urea cycle and acquire knowledge about the biological role of this cycle.

9. Lipid biosynthesis: Fatty acid biosynthesis (Palmitic acid biosynthesis; Elongation and desaturation of fatty acids; Regulation of fatty acid biosynthesis and beta-oxidation); Eicosanoid biosynthesis; Triglyceride biosynthesis; Biosynthesis of membrane phospholipids; Cholesterol biosynthesis and its derivatives – bile acids, steroid hormones, vitamin D (Regulation of cholesterol biosynthesis).

By mastering the content of this chapter, students will acquire in-depth knowledge of the biosynthetic pathways of lipids, a highly heterogeneous class of biomolecules with storage, structural, and signaling functions.

10. Structure and metabolism of plasma lipoproteins: Metabolism of chylomicrons; Metabolism of VLDL particles; Metabolism of LDL particles; Metabolism of HDL particles.

By mastering the content of this chapter, students will gain knowledge of the structure and metabolism of circulating lipoprotein particles and their roles in lipid transport and metabolism.

11. Biosynthesis of amino acids and nucleotides: Biosynthesis of molecules derived from amino acids (Biosynthesis of porphyrins, bilirubin; Biosynthesis of creatine; Biosynthesis of glutathione; Biological amines, products of amino acid decarboxylation: Dopamine, Norepinephrine, Epinephrine, Gamma-aminobutyric acid 'GABA', Histamine, Serotonin; Biosynthesis of nitric oxide); Biosynthesis (*de novo* and *salvage*) and degradation of nucleotides (Purine nucleotide biosynthesis; Pyrimidine nucleotide biosynthesis; Ribonucleotides as precursors of deoxyribonucleotides; Degradation of purine and pyrimidine nucleotides to uric acid and urea, respectively).

By mastering the content of this chapter, students will acquire general knowledge about the biosynthesis of amino acids. Additionally, they will become familiar with the biosynthesis of important biomolecules derived from amino acids, as well as the biosynthesis and degradation of nucleotides.

12. Biosignaling: Gated ion channels (Ligand-gated ion channels; Voltage-gated ion channels); Receptor enzymes (Receptor enzymes with tyrosine kinase activity; Receptor enzymes with guanylyl cyclase activity); G-protein coupled receptors (Action through adenylyl cyclase; Action through phospholipase C); Sensory transduction; Regulation of transcription by steroid hormones; Regulation of the cell cycle by protein kinases; Oncogenes, tumor suppressor genes, and apoptosis.

By mastering the content of this chapter, students will gain basic knowledge about the mechanisms of cell signaling that are important for cellular metabolism and functions.

13. Hormonal regulation and integration of metabolism: Tissue-specific metabolism – liver, adipose tissue, skeletal muscles, brain, blood; Hormonal regulation of energy metabolism.

By mastering the content of this chapter, students will gain a comprehensive understanding of how individual metabolic pathways integrate across entire organism. This knowledge will consolidate what they have learned in Biochemistry 1 and Biochemistry 2, providing a strong foundation for future courses.

	ioundation for future courses.							
12	Study methods:							
12.	Theoretical lectures, classroom	n practic	ce, video presentations, project tas	sks.				
13.	Total amount of time available	;	6 ECTS x 30 hours = 180 hours	(3+2)				
14.	Distribution of tasks		45+30+30+30+45					
	Types of learning/teaching activities	15.1.	Lectures – theory	45 hours				
15.		15.2.	Tutorials (laboratory,	30 hours				
			auditory), seminars, teamwork	50 110015				
		16.1.	Projects	30 hours				
16.	Other types of activities	16.2.	Individual tasks	30 hours				
	16.3.		Home study – tasks	45 hours				
17.	Evaluation / assessment metho	ds						

	17.1	Tests		40 points				
	17.2	Individ	ual tasks / project (pre	al tasks / project (presentation: written and oral)				
	17.2.	Activit	v and participation					
	17.4.	Final e	xam		30 points			
				Up to 50 points	5 (five) (F)		
				51 - 60 points	6 (six) (E)	/		
10				61 - 70 points	7 (seven) (D)		
18.	Assess	ment cri	teria (points / grade)	71 – 80 points	8 (eight) (C)		
				81 – 90 points	9 (nine) (E	3)		
				91 – 100 points	10 (ten) (A	<u>()</u>		
	Eligibility for signature and taking			60% realization of pre-exam activities, i.e., 42 points				
19.	the final exam			from two tests, seminary or practical work, and				
				regular participation to the organized activities.				
20.	Langua	age of th	e study program	English				
21.	Quality teaching	assurar	nce methods of the	Self-evaluation				
	Literat	ure		·				
		Manda	atory literature					
		No.	Author	Title	Publisher	Year		
22.	22.1.	1.	Nelson, D. L., Cox, M. M.	Lehninger Principles of Biochemistry (5 th Edition)	W.H. Freeman & Company	2008		
		Additi	onal literature					
	22.2.	No.	Author	Title	Publisher	Year		
		1.	Relevant scientific pa	pers (primary literature)				

Name of the course						
	PHARMACEUTICAL BOTANY					
Code	3FMN193025					
Study program	Pharmacy					
Study program organizer	Faculty of Medical Sciences,					
(department, institute, branch)	Goce Delcev Univers	sity, S	tip			
Degree (first, second, third cycle)	Integrated first and se	econd	cycle of studie	es		
Academic year / semester	Second year / Third semester	7.	Number of ECTS	6		
Professor	Assoc. Prof. Dr.sc. V	iktori	ja Maksimova			
Pre-conditions for course	Enrolled in third sem	ester o	of studies			
Aims of the study program (compet	ences):					
The main purpose of this course is acquiring basic knowledge in the fields of cytology, histology, and organography of plants, and plant systematics with special emphasis on medicinal plants, for further application of this knowledge into proper identification of medicinal plants. Training students for the proper preparation of native specimens, their microscopy, and correct identification of plant species would provide special skills for students in their pharmaceutical career, especially in herbal medicines.						
 career, especially in herbal medicines. Content of the study program (applies both for theoretical and practical part): Theoretical part: Theoretical lectures are going to comprise an introduction to botany, plant cell specifics; plant tissues, meristematic and permanent tissues (covering, parenchymal, mechanical, conductive, glandular); plant organs (anatomy and morphology), primary and secondary structure of roots and stems, morphology of leaves; anatomy of the flower, flowering, pollination, fertilization, fruit and seed formation. Basic physiological processes in plants (transpiration, photosynthesis, respiration) will enlarge the knowledge of students in further synthesis of secondary metabolites. Systematic, morphological, anatomical, study of medicinal and poisonous plants would be processed by studying plant systematics according to Linnaeus with an emphasis to plants known for their biological/pharmacological action: Systematics of lower plants, Thallophyta – algae (Algae); Systematics of lower plants – fungi (Fungi); Systematics of lower plants – lichens (Lichenes). Systematics of higher plants, Cormophyta – gymnosperms (Gymnospermae); Systematics of angiosperms (Angiospermae): monocotyledonous plants (Monocotyledones: Liliales, Iridales, Orchidales, Poales, Arales); Systematics of angiosperm dicotyledonous plants: taxa, morphology, and application (Dicotyledones: Magnoliales, Aristolohiales, Ranunculales, Papaverales, Fagales, Urticales, Caryophyllales, Polygonales, Theales, Violales, Cucurbitales, Capparales, Salicales, Ericales, Primulaes, Malvales, Euphorbiales); Systematics of dicotyledonous plants: taxa, morphology, and application (Dicotyledones: Rosales, Fabales, Myrtales, Rutales, Sapindales, Geraniales, Cornales, Rhamnales, Santalales, Oleales, Gentianales, Dipsacales, Boraginales, Scrophulariales, Lamiales, Asterales). <i>Practical part:</i> Practical engagement of students in discovering structure of plant cells and cellular organelles; cell di						
	Study program organizer (department, institute, branch) Degree (first, second, third cycle) Academic year / semester Professor Pre-conditions for course registration Aims of the study program (compet The main purpose of this course is histology, and organography of plan medicinal plants, for further applica glandular); plant organs (anatomy an	Study program organizer Faculty of Medical S (department, institute, branch) Faculty of Medical S Degree (first, second, third cycle) Integrated first and se Academic year / semester Second year / Third semester Professor Assoc. Prof. Dr.sc. V Pre-conditions for course registration Enrolled in third sem Aims of the study program (competences): The main purpose of this course is acquiring basic know histology, and organography of plants, and plant system medicinal plants. Training students for the proper preparation of native specim identification of plant species would provide special skills for career, especially in herbal medicines. Content of the study program (applies both for theoretical theoretical part: Theoretical lectures are going to comprise an introduction to tissues, meristematic and permanent tissues (covering, parer glandular); plant organs (anatomy and morphology), primary and stems, morphology of leaves; anatomy of the flower, fli fruit and seed formation. Basic physiological processes in pla respiration) will enlarge the knowledge of students in metabolites. Systematic, morphological, nantomical, study of medicinal processed by studying plant systematics according to Linr known for their biological/pharmacological action: Systemata algae (Algae); Systematics of angiosperms (Angiospe (Monocotyledones: Liliales, Iridales, Orchidales, Poales, An dicotyledonous plants: taxa, morphology, and applicatic Aristolohiales, Ranunculales, Papaverales, Fagales, Uritcal Theales, Violales, Cucurbitales, Capparales, Salicales, Euphorbiales); Systematic	Study program organizer Faculty of Medical Science (department, institute, branch) Degree (first, second, third cycle) Integrated first and second Academic year / semester Second year / Third semester 7. Professor Assoc. Prof. Dr.sc. Viktori Preconditions for course Enrolled in third semester 7. Professor Assoc. Prof. Dr.sc. Viktori Preconditions for course Enrolled in third semester 7. The main purpose of this course is acquiring basic knowledge in medicinal plants. Training students for the proper preparation of native specimens, thidentification of plant species would provide special skills for studerarer, especially in herbal medicines. Content of the study program (applies both for theoretical and Theoretical part: Theoretical part: Theoretical part: Theoretical part: Theoretical part: Theoretical part: Systematic and permanent tissues (covering, parenchym glandular); plant organs (anatomy and morphology), primary and and stems, morphology of leaves; anatomy of the flower, flowerin fruit and seed formation. Basic physiological processes in plants (trespiration) will enlarge the knowledge of students in furth metabolites. Systematic, morphological, anatomical, study of medicinal and processed by studying plant systematics according to Linnaeus known for their biological/pharmacological action: Systematics of algae (Algae); Systematics of angiosperms (Angiospermae) (Monocotyledones: Linales, Iridales, O	Study program organizer Faculty of Medical Sciences, Goce Delev University, Stip Degree (first, second, third cycle) Integrated first and second cycle of studit Academic year / semester Professor Assoc. Prof. Dr.sc. Viktorija Maksimova Pre-conditions for course registration Aims of the study program (competences): The main purpose of this course is acquiring basic knowledge in the fields histology, and organography of plants, and plant systematics with special medicinal plants, for further application of this knowledge into proper ide medicinal plants. Training students for the proper preparation of native specimens, their microscop identification of plant species would provide special skills for students in their pi career, especially in herbal medicines. Content of the study program (applies both for theoretical and practical part: Theoretical part: Theoretical part: Theoretical part: Theoretical plant systematics and permanent tissues (covering, parenchymal, mechanica glandular); plant organs (anatomy and morphology), primary and secondary stru and stems, morphology of leaves; anatomy of the flower, flowering, pollination fruit and seed formation. Basic physiological processes in plants (transpiration, pl respiration) will enlarge the knowledge of students in further synthesis metabolites. Systematic, morphological, anatomical, study of medicinal and poisonous pla processed by studying plant systematics of lower plants, algae (Algae); Systematics of lower plants – fungi (Fungi); Systematics of lo lichens (Lichenes). Systematics of angiospermae; (Angiospermae); Systematics of dicotyl		

	specimens. Systematics of angiosperm dicotyledonous plants, representative specimens of medicinal plants								
	Study methods:								
	Lecture	es theor	etical and practi	ical lab	oratory exercises consults	ations of	roup and ind	ividual	
12	12. work (project assignments with oral presentations). Three days fieldwork seminars aimed at recognizing and identifying medicinal plants from national flora. Individual work for							nimed at	
12.								anneu ai	
	nrenara	ation of	herbarium	cultina	i plants nom national nore	a. marvi		1	
13	Total a	mount c	of time available		6 FCTS x 30 hours = 18	0 hours	(2+3)		
14	Distrib	ution of	tasks	,	30+45+15+30+60	0 nouis	(2+3)		
17.	Distrit	ution of	usks	15.1	Lectures – theory		30 hours		
15	Types	of learni	ing/teaching	10.11	Tutorials (laboratory	Tutorials (laboratory			
	activities 15.2.			15.2.	auditory), seminars, tear	nwork	45 hours		
				16.1.	Projects		15 hours		
16.	Other t	vpes of	activities	16.2.	Individual tasks		30 hours		
_		51		16.3.	Home study – tasks		60 hours		
-	Evalua	tion / as	sessment metho	ds					
17.1. Tests 40 points									
17.	17.2.	Individ	lual tasks / proje	ect (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participat	ion		/	20 points		
	17.4.	Final e	xam				30 points		
					Up to 50 points		5 (five) (F)		
	Assessment criteria (points / grade)				51 – 60 points		6 (six) (E)		
10				61 – 70 points		7 (seven) (D)		
18.				71 – 80 points		8 (eight) (0	C)		
				81 – 90 points		9 (nine) (B)		
				91 – 100 points		10 (ten) (A	.)		
	Eligibi	lity for s	signature and tal	king	60% realization of pre-e	xam act	ivities, i.e., 4	2 points	
19.	the fina	al exam	C	e	from two tests, seminary	or prac	tical work, a	ind	
					regular participation to t	he orgar	nized activiti	es.	
20.	Langua	age of th	e study progran	n	English				
21	Quality	/ assurai	nce methods of	the	Self evaluation				
21.	teachin	ig proce	SS		Self-evaluation				
	Literat	ure							
		Manda	atory literature		1				
		No.	Author		Title	Pu	blisher	Year	
						Minot	State		
		1.	Shipunov, A.		Introduction to botany	Unive	rsity,	2021	
						North	Dakota		
	22.1.	2.	Youngken, H.	W.	Pharmaceutical	Kessir	iger	2019	
22			<i>6</i> ,		Botany	Publis	hing		
22.				1	American Herbal	CDCI	`		
		3.	Upton, R. et a $(\mathbf{E}_{\mathbf{A}})$	1.	Pharmacopoeia,		ress	2011	
		(Editors)			Dolunical Pharmacognosy	<i>Sotanical</i> Taylor & Fra			
		Additi	onal literatura		1 nurmucognosy				
		No	Author		Title	Du	blisher	Vear	
	22.2	110.	Autior		Rotany: An	ru		i cai	
	<i></i> . <i>_</i> .	1.	Mauseth I D		Introduction to Plant	Jones	& Bartlett	2019	
		1. Iviauseui, J. D.		-	Biology Learning		ng	2017	

	Appendix 3 No. 13	Study program for integrated first and second cycle of studies					
1.	Name of the course	BIOORGANIC CHEMISTRY					
2.	Code	3FMN193125					
3.	Study program	Pharmacy					
4.	Study program organizer (department, institute, branch)	Faculty of Medical Sciences, Goce Delcev University, Stip					
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies					
6.	Academic year / semester	Second year / Third semester7.Number of ECTS7					
8.	Professor	Ass. Prof. Dr.sc. Marija Arev					
9.	Pre-conditions for course	Enrolled in third semester of studies					
	Aims of the study program (compet	ences):					
10.	 The primary objective of this curriculum is to enhance and deepen students understanding of organic chemistry by introducing advanced topics specifically related to biologically and pharmacologically active substances. This course will provide an exploration of the structures, physical properties, chemical reactions, and synthesis methods of these compounds. This curriculum is designed to prepare students for more specialized fields such as pharmaceutical chemistry and analytical chemistry focused on drugs. In addition to theoretical knowledge, the curriculum will emphasize practical applications, enabling students to engage in laboratory experiments that demonstrate the principles of organic chemistry. 						
11.	 Theoretical part: Ethers and epoxides: definition, reactions; Thiols and sulfides: structure, pr Carboxylic acids and nitriles: che carboxylic acids, nomenclature, Derivatives of carboxylic acids: chemistry and structure of esters synthesis and chemical reactivity Mechanisms of carbonyl alpha s reactions: keto-enol tautomerism formation of enolates and enolat Amines and nitro compounds: d and reactions; Biomolecules - Proteins: Amino amino acids; isoelectric point; ti Hasselbalch equation; synthesis nomenclature; structure and properties of some importance; classification of proprimary, secondary, tertiary and and properties of some importantes; structures of careactions of monosaccharides; E disaccharides; polysaccharides - Displayates; Classification of carbohydrates; Classificaticlas; Classificaticlas; Clashydrates; Clashydrates; Classifica	nomenclature, structure, properties, synthesis and roperties, reactions and preparation; memistry of nitriles, structure and properties of synthesis and reactions; mechanisms of nucleophilic acyl substitution reactions, s, amides, acid halides and anhydrides; nomenclature, y properties of derivatives of carboxylic acids: substitutional reactions and carbonyl condensation n, acidity of alpha hydrogen in carbonyl compound and te ions; efinition, nomenclature, structure, properties, synthesis acids - definition and importance; classification of tration curves and ionic equilibrium; Henderson– of α -amino acids; Peptides - definition and perties of the peptide bond; determination of the peptide f peptides; Proteins – definition and biological teins; levels of structural organization of proteins; structure at proteins; definition, occurrence and function of carbohydrates; stereochemistry of carbohydrates; Fischer projection rbohydrates; anomers and mutarotation; chemical Disaccharides - type of joining and some important - classification and some important polysaccharides;					

	9. Biomolecules – Lipids: definition, function and importance of lipids; classification fatty							
		acids, waxes; triglyceride	es; soap	s; phospholipids; prostaglandins;	terpenoids; steroids -			
		natural and synthetic;						
	10.	10. Heterocyclic compounds: definition and importance; aromaticity and aromatic and						
		nonaromatic heterocyclic compounds; five membered aromatic heterocyclic rings -						
		preparation, structure, chemical reactions; examples of pharmaceutically important						
		five membered rings with	n one ai	nd two heteroatoms; six membered	d rings – structure,			
		properties, chemical reac	tions; e	xamples of pharmaceutically im	portant six membered			
		rings with one and two h	eteroato	oms; six membered rings and with	fused aromatic rings;			
	11.	Nucleic acids: definition	of nucl	eoside, nucleotide and nucleic aci	d, consistency and			
		nomenclature; chemical	bonds in	n nucleic acids; levels of structura	l organization of			
	10	DNA and RNA; heredity	– repli	cation, transcription, translation, I	PCR technics;			
	12.	Metabolic pathways: Cat	abolisn	n of lipids, proteins, and carbohyd	rates; Krebs cycle			
	Dua	(Chric acid cycle); Anab	onsm o	i fatty acids, amino acids and giud	cose.			
	1 Prac	Introduction to laborator	u work	aquinment ennerotus sefetu				
	1. 2	Synthesis isolation and r	y work:	tion of organic compounds: calcul	ation of percent			
	۷.	reaction yield;	Juinca	tion of organic compounds, calcu	lation of percent			
	3.	Chromatographic separat	tion of o	organic compounds – thin-layer cl	nromatography;			
	4.	Column chromatography	-size	exclusion chromatography;				
	5.	Titration of amino acids	(glycine	e);				
	6.	Construction of the titrat	ion curv	ve;				
	7.	Enzymes; Catalase;						
	8.	Determination of citric a	cid in b	ubble gum by titration;				
	9. 10	Synthesis of aspirin;		11:				
	10.	Purification of aspirin by	recryst	califization and calculation of perce	ent reaction yield;			
	11.	Durification of acetanilid	a and a	abulation of percent reaction viel	4			
	Study	v methods.		alculation of percent reaction yield	u.			
12.	Lectu	res. exercises. theoretical	and pr	actical activities, seminars, consul	tation and individual			
	learni	ng.	I					
13.	Total	amount of time available		7 ECTS x 30 hours = 210 hours	(3+3)			
14.	Distri	bution of tasks		45+45+15+25+80				
	Type	s of learning/teaching	15.1.	Lectures – theory	45 hours			
15.	activities		15.2	Tutorials (laboratory,	45 hours			
	uetivi		13.2.	auditory), seminars, teamwork	10 110015			
			16.1.	Projects	15 hours			
16.	Other	types of activities	16.2.	Individual tasks	25 hours			
	F 1		16.3.	Home study – tasks	80 hours			
	Evalu	ation / assessment metho	ds		40			
17	17.2	I ests	at (······································	40 points			
1/.	17.2	A ativity and partiainat	ct (pres	sentation: written and oral)	10 points			
	17.4	Activity and participat	lon		20 points			
	1/.4.	r mai exam		Up to 50 points	50 points			
				51 60 points	$5 (\text{live}) (\Gamma)$ $6 (\text{civ}) (\Gamma)$			
				51 - 60 points	$\frac{0}{(\text{SIX})}$ (E)			
18.	Asses	ssment criteria (points / gi	ade)	71 - 70 points	7 (seven) (D) 8 (eight) (C)			
				$\frac{81}{90}$ points	θ (eight) (C) θ (nine) (B)			
				91 - 100 points	$10 (ten) (\Delta)$			
	Fligit	vility for signature and tal	ring	60% realization of pre-exam act	$10 (wn) (\Lambda)$			
19	the fi	nal exam	ung	from two tests, seminary or prac	tical work. and			
17.				regular participation to the organ	nized activities.			
20.	Lang	uage of the study program	1	English				
		<u> </u>						

21.	Quality assurance methods of the teaching process			Self-evaluation			
	Literatu	ıre					
		Manda					
		No.	Author	Title	Publisher	Year	
	22.1	1.	McMurry, J. E.	Organic Chemistry (6 th Edition)	Brooks Cole	2003	
	22.1.	2.	Vollhardt, P., Schore, N.	Organic Chemistry: Structure and Function	Macmillan Learning	2018	
		3.	Wade, L., Simek, J. W.	Organic Chemistry	Pearson	2016	
		Additional literature					
22.		No.	Author	Title	Publisher	Year	
	22.2	1.	Soderberg, T.	Organic Chemistry with a Biological Emphasis	University of Minnesota Morris Digital Well	2016	
	22.2.	2.	Clayden, J., Greeves, N., Warren, S.	Organic Chemistry	OUP Oxford	2012	
		3.	Carey, F. A., Sundberg, R. J.	Advanced Organic Chemistry: Structure and Mechanisms	Springer	2017	

	Appendix 3 No. 14	Study program for integrated first and second cycle of studies							
1.	Name of the course	ANALYTICAL CHEMISTRY 1							
2.	Code	3FMN193225							
3.	Study program	Pharmacy							
4	Study program organizer	Faculty of Medical Sciences,							
4.	(department, institute, branch)	Goce Delcev University, Stip							
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies							
6.	Academic year / semester	Second year / Third semester7.Number of ECTS6							
8.	Professor	Full Prof. Dr.sc. Rubin Gulaboski Ass. Prof. Dr.sc. Milkica Arsova							
9.	Pre-conditions for course registration	Enrolled in third semester of studies							
	Aims of the study program (compet	ences):							
	Upon completion of this course, the st	tudents will be able to:							
	 understand the basic theoretic 	al principles of analytical chemistry;							
	- understand the properties of the solutions, and knowing how to prepare and dilute								
	solutions;								
	- account the concept of pH and applying it for measuring pH of strong acids and								
	strong bases;								
	- understand the equilibrium processes and applying the principle of Le Chatelier;								
	 understand the concept of pH and applying it for measuring pH of drugs that are weak bases or weak acids; 								
	weak bases of weak actus, — understand the equilibria related to creation of sparingly soluble salts and applying								
10.	the principles of Le Chatelier to predict the precipitation of various drugs:								
	 understand the principles of covalent coordination bonding and knowing to read 								
	various complex substances in which coordinate bonds exist:								
	 understand the principles of equilibria in complexation reactions of various drugs; 								
	 be familiar with basic experimental methodology of voltammetry in the area of drug analysis: 								
	 understand the principles of e 	quilibria by drug-drug interactions:							
	- solve theoretical exercises relation	ated to all equilibria in which given drug can be							
	involved;	1 6 6							
	 apply commercially available 	tools to solve mathematical problems in analytical							
	chemistry related to equilibria	n of various drugs.							
	Content of the study program (appl	ies both for theoretical and practical part):							
	 Introduction to analytical cher 	mistry							
	 Concept of amount of substan 	ice, mole, molar mass;							
	 Solutions; classification of so 	lutions; properties of solutions;							
	- Expressing the quantitative co	ontent in solutions;							
	 Acids and bases, concept of st bases, Concept of st 	trong acids (monoprotic and polyprotic) and strong							
	Chemical aquilibria annial to	pri in these systems;							
11.	 — Chemical equilibria applied to — Principle of Le Chatelier and 	practical aspects of this law applied in various druces							
	- Fauilibria by weak acid (mon	oprotic and polyprotic) and weak bases and applying							
	the concept of pH by these sy	stems;							
	 Solubility product and equilib 	ria in systems of sparingly soluble salts;							
	 Complexes with coordinative 	chemical bonds; basics of coordination chemistry;							
	nomenclature of coordinative	complexes;							
1	 Equilibria in the reaction of contract 	omplexes with coordinative chemical bonds and							

	 Concept of chemical equilibria in drug-drug interactions and applying the Principle 							
	of Le Chatelier;							
	 Exploring analytical tools (Excel, MATHCAD, MatLab) for solving theoretical 							
	problems in analytical chemistry.							
	Study methods:							
	All contents of the subject Anal	lytical	chemistry 1 will be presented to the	he students in several				
	manners of in-person classes:							
	- All theoretical lectures	will be	held to the whole group of stude	nts, where the				
	students will be introdu	iced to	the fundamental contents of the s	ubject. At the				
	beginning of each lectu	ire, the	main objectives of that lecture wi	Il be clearly stated. At				
	the end of each lecture,	exerci	ses and problems relevant the con	itents of particular				
	presentations and relev	ant and	lie visual materials:	ickboard, power point				
	Popular cominer works	ant auc	hold in which the students will t	focus on solving				
	numerical problems and	d pract	ical problems related to the mater	ial elaborated in the				
	course:	a prace	fear problems related to the mater					
10	 Tutorial platform will b 	be creat	ted in order to make a discussion l	link between the				
12.	students with the teacher	ers, in o	order to solve particular problems	and to answer				
	questions related to the	course	;					
	 Laboratory practices ap 	oply to	this course with 3-hour sessions e	ach week. Upon				
	ending each practical se	ession,	a short seminar will be held in or	der to discuss of the				
	results obtained by the	student	ts;					
	- In addition, via the self	 In addition, via the self-study activities, students should be given practical problems 						
	to be solved, as well as quizzes related to different topics of the subject proposed by							
	the teachers. These segments will be evaluated as independent work activities of each							
	The general objective of all activities prevised in the Analytical chemistry 1 course is that the							
	students get knowledge and experience on how to solve theoretically a given problem and to							
	apply it in the areas of drug analysis, drug activity, drug inactivation and drug-drug							
	interactions all related to different	ent che	mical equilibria.	0 0				
13.	Total amount of time available		6 ECTS x 30 hours = 180 hours	(2+3)				
14.	Distribution of tasks		30+45+30+30+45	Γ				
	Types of learning/teaching	15.1.	Lectures – theory	30 hours				
15.	activities	15.2.	Tutorials (laboratory,	45 hours				
		16.1	auditory), seminars, teamwork	201				
10		16.1.	Projects	30 hours				
16.	Other types of activities	16.2.	Individual tasks	30 hours				
	16.3. Home study – tasks			43 nours				
	17.1 Tests	18		10 points				
17	17.2 Individual tasks / project	ct (nres	entation: written and oral)	10 points				
17.	17.3 Activity and participati	on	entation: written and orary	20 points				
	17.4. Final exam	011		30 points				
			Up to 50 points	5 (five) (F)				
			51 - 60 points	6 (six) (E)				
10		1 \	61 – 70 points	7 (seven) (D)				
18.	Assessment criteria (points / gra	ade)	71 – 80 points	8 (eight) (C)				
			81 – 90 points	9 (nine) (B)				
			91 – 100 points	10 (ten) (A)				
	Eligibility for signature and tak	ing	60% realization of pre-exam act	ivities, i.e., 42 points				
19.	the final exam		from two tests, seminary or prac	tical work, and				
			regular participation to the organ	nized activities.				
20.	Language of the study program		English					

21.	Quality assurance methods of the teaching process			Self-evaluation			
	Literatu	ıre		•			
		Manda	atory literature				
		No.	Author	Title	Publisher	Year	
	22.1.	1.	Skoog, D. A., West, D. M., Holler, F. J., Crouch, S. R.	Analytical Chemistry (9 th Edition)	Brooks/Cole Cengage, UK	2014	
		2.	Miller, J., Miller, J. N. Y., Jane, C.	Statistics and Chemometrics for Analytical Chemistry	Prentice Hall	2010	
22.		Additi	onal literature				
		No.	Author	Title	Publisher	Year	
	22.2.	1.	Gulaboski, R.	Analytical Chemistry (personal authorized lectures available on <u>www.rubingulaboski.</u> <u>synthasite.com</u> and on Repository of Goce Delcev University)	Goce Delcev University, Stip	2021	

	Appendix 3 No. 15	Study program for integrated first and second cycle of studies				
1.	Name of the course	MICROBIOLOGY AND PAR	RASITOLOGY			
2.	Code	3FMN193325				
3.	Study program	Pharmacy				
4	Study program organizer	Faculty of Medical Sciences,				
т.	(department, institute, branch)	Goce Delcev University, Stip				
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies				
6.	Academic year / semester	Second year / Third semester7.Number of ECTS5				
8.	Professor	Assoc. Prof. Dr.sc. Golubinka E Ass. Prof. Dr.sc. Gorica Popova	3oshevska 1			
9.	Pre-conditions for course registration	Enrolled in third semester of studies				
10.	Aims of the study program (competences): The main goal of the course is for students to get to know and acquire solid theoretical and practical knowledge in the field of microbiology.					
11.	 practical knowledge in the field of microbiology. Content of the study program (applies both for theoretical and practical part): Theoretical part: In the general part, students are introduced to: the historical development of microbiology a science, the meaning of microorganisms, classification, taxonomic categories, nomenclatu size, shape and arrangement of bacteria; the construction of bacterial cells, the conditions their growth and reproduction, morphology of bacterial colonies and some characteris biochemical reactions. In the section in which the genetics of bacteria will be discussed, i topics of phenotypic and genotypic variations of bacteria as well as gene transfer will covered. Pathogenicity and virulence in microorganisms, non-specific and specific defeit (immunity) in humans, immunotherapy and immunoprophylaxis, antibiotics a chemotherapeutics will also be covered. In the special section, students are introduced to the most important bacteria, viruses, fungi a parasites: aerobic and anaerobic Gram-positive and negative cocci, the most important Gran negative bacilli, Gram-positive bacilli (sporogenous and non-sporogenous), spiral bacteri rickettsia, mycobacteria, chlamydia; morphology, structure, classification and reproduction viruses, significance of viral infections, most important DNA and RNA viruses; morpholo, structure, classification and reproduction of fungi, the most important causes of superficial a systemic mycoses; morphology, structure, classification and significance of certain parasite. Principles of safety at work in a microbiological laboratory; Taking, packing and send material for microorganisms; Identification of bacteria (classical biochemical reactio automatic identification systems); Examination of the sensitivity of bacteria chemotherapeutic agents; Classic serological reactions, rapid tests, immunonenzyma methods; Blood cultures; Microbiological diagnosis of wo					
12.	Staty mountais	1				
13.	Total amount of time available	5 ECTS x 30 hours = 150 hours	(2+2)			
14.	Distribution of tasks	30+30+0+30+60				
15.	15.1.	Lectures – theory	30 hours			

Faculty of Medical Sciences, Goce Delcev University

	Types of learning/teaching		15.2	Tutorials (laboratory,	30 hours				
	activiti	activities		13.2.	auditory), seminars, teamwork		50 110013		
				16.1.	Projects		0 hours		
16.	Other t	ypes of	activities	16.2.	Individual tasks		30 hours		
				16.3.	Home study – tasks		60 hours		
	Evalua	tion / as	sessment metho	ods			•		
	17.1.	Tests					40 points		
17.	17.2.	Individ	lual tasks / proje	ect (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participat	ion			20 points		
	17.4.	4. Final exam					30 points		
					Up to 50 points		5 (five) (F))	
					51 – 60 points		6 (six) (E)		
19	Access	mont ori	toria (nainta / a	rada)	61 – 70 points		7 (seven) (D)	
10.	A35035		terra (pornts / g	laue)	71 – 80 points	71 – 80 points		8 (eight) (C)	
					81 – 90 points	– 90 points		9 (nine) (B)	
					91 – 100 points		10 (ten) (A	()	
	Eligibility for signature and taking				60% realization of pre-e	xam act	ivities, i.e., 4	42 points	
19.	the fina	al exam			from two tests, seminary or pract		tical work, a	und	
					regular participation to t	he orgar	nized activiti	ies.	
20.	Langua	age of th	e study program	n	English				
21	Quality	/ assurar	nce methods of	the	Self-evaluation				
21.	teachin	ig proces	SS						
	Literat	ure							
		Manda	atory literature						
		No.	Author		Title	Pu	ıblısher	Year	
	22.1		Brooks, G. F.	,	Jawetz. Melnick &				
	22.1.	1	Carroll, K. C.	,	Adelberg's Medical		TT'11	0010	
22		1.	Butel, J. S.,		Microbiology	McGra	aw H1ll	2013	
22.			Morse, S. A.,		$(26^{th} Edition)$				
		A 11.	Mietzner, I. A	1 .					
		Additi	onal literature		77:4	n		* 7	
	22.2	No.	Author		Title	Pu	blisher	Year	
	22.2.	1	Murray, P. R.	,	Medical Microbiology	F1 .		2016	
		1.	Rosental, K. S	».,	(8 th Edition)	Elsevier		2016	
1	1	1	i rialier ivi. A.			1		1	

	Appendix 3 No. 16		Study program for integrated first and second cycle of studies					
1.	Name of the course		INSTRUMENTAL PHARMACE ANALYSIS	EUTICAL				
2.	Code		3FMN193425					
3.	Study program		Pharmacy					
4.	Study program organizer (department, institute, branch))	Faculty of Medical Sciences, Goce Delcev University, Stip					
5.	Degree (first, second, third cy	cle)	Integrated first and second cycle of	studies				
6.	Academic year / semester		Second year / Fourth semester7.Number of ECTS6					
8.	Professor		Full Prof. Dr.sc. Zorica Arsova Sarafinovska Ass. Prof. Dr.sc. Milkica Arsova					
9.	Pre-conditions for course registration		Enrolled in fourth semester of studi	ies				
10.	Aims of the study program (competences): The course aims to provide comprehensive knowledge of modern instrumental methods and techniques used for qualitative and quantitative analysis across various fields of pharmacy. Upon successful completion, students will have a solid understanding of the principles behind these instrumental methods, commonly applied in pharmaceutical analyses, along with skills in statistical calculation and result evaluation.							
11.	Content of the study program (applies both for theoretical and practical part): <i>Theoretical part:</i> Sampling and analysis; Statistical processing and data analysis; Spectroscopic techniques and their application in pharmaceutical analyses; Molecular spectrometry: ultraviolet/visible spectrometry; Fluorescence spectrometry; Infrared spectrometry; Nuclear magnetic resonance (NMR) spectroscopy; Mass spectrometry; Atomic spectrometry: atomic absorption spectrometry; atomic emission spectrometry; Separation techniques and their application in pharmaceutical analyses: gas chromatography; liquid chromatography; thin-layer chromatography; electrophoresis; Electroanalytical techniques (potentiometry, voltammetry) and their application in pharmaceutical analyses; Statistical processing and evaluation of data from analytical tests. <i>Practical part:</i>							
12.	Study methods: Theoretical part: Interactive te consultations with students an Practical part: Laboratory practical	eaching id grou	g, multimedia instruction, e-learning up consultations; in small groups of 10 students.	, individual				
13.	Total amount of time available	e	6 ECTS x 30 hours = 180 hours (2-	+3)				
14.	Distribution of tasks		30+45+0+45+60	<u></u>				
15.	Types of learning/teaching15.1activities15.2		Lectures – theory Tutorials (laboratory, auditory), seminars, teamwork	30 hours 45 hours				
		16.1.	Projects	0 hours				
16.	Other types of activities	16.2.	Individual tasks	45 hours				
		16.3.	Home study – tasks	60 hours				
	Evaluation / assessment method	ods						
	17.1. Tests			40 points				
17.	17.2. Individual tasks / proi	ect (pr	resentation: written and oral)	10 points				
	17.3. Activity and participa	tion		20 points				
	17.4. Final exam			30 points				
10	Assessment criteria (points /		Up to 50 points	5 (five) (F)				
18.	grade)		51 – 60 points	6 (six) (E)				
				61 – 70 points		7 (seven) (D)		
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				71 – 80 points		8 (eight) (C)		
				81 – 90 points		9 (nine) (B)		
				91 – 100 points		10 (ten) (A	A)	
	Eligibil	ity for s	ignature and taking	60% realization of pre-exan	n activit	ies, i.e., 42	points	
19.	the fina	l exam	-	from two tests, seminary or practical work, and regular participation to the organized activities.				
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	English							
21.	Quality assurance methods of the teaching process			Self-evaluation				
	Literatu	ıre						
-		Manda	Mandatory literature					
		No.	Author	Title	Pu	blisher	Year	
22.	22.1.	1.	Gulaboski, R., Maksimova, V., Ivanova Petropulos, V.	Instrumental pharmaceutical analyses (textbook)	Goce I Unive	Delcev rsity, Stip	2019	
		2.	Skoog, D. A., Holler, F. J., Nieman, T. A.	Principles of Instrumental Analysis	Saund Colleg Publis	ers ge hing	2018	
		Additi	onal literature					
	22.2.	No.	Author	Title	Pu	blisher	Year	
		1.						

	Appendix 3 No. 17		Study program fo cy	or inte cle of	egrated first a f studies	and second	
1.	Name of the course		PATHOPHYSIOLO)GY V	WITH PATH	OLOGY	
2.	Code		3FMN193525				
3.	Study program		Pharmacy				
4	Study program organizer		Faculty of Medical So	cience	es,		
4.	(department, institute, branch)		Goce Delcev Univers	sity, St	tip		
5.	Degree (first, second, third cyc	ele)	Integrated first and se	econd	cycle of studi	es	
6.	Academic year / semester		Second year / Fourth semester	7.	Number of ECTS	5	
8.	Professor		Adj. Assoc. Prof. Dr.s. Adj. Ass. Prof. Dr.sc.	sc. Dj . Tanja	engis Jashar a Angjusheva		
9.	Pre-conditions for course registration		Enrolled in fourth ser	nester	of studies		
10.	 Introduction to the etiology, pathogenesis and morphological changes in the cells and tissues of the organism under the influence of pathological agents and their diagnostics using various techniques; Introduction to the basic cellular and tissue response to damage caused by various causes; Introduction to the main mechanisms of acute and chronic inflammation, tissue regeneration and repair; Learning the basic concepts of hemodynamic disorders, blood disorders, and the immunopathology; Introduction to the main diseases of connective tissue, aka autoimmune disorders, as well as amyloidosis; Introduction to the main concept of neoplastic growth, staging of the tumors, tumor types and molecular basis of carcinogenesis; Introduction to organ specific diseases by drug abuse and remedies; Introduction to general disorders of function and pathophysiological processes of the 						
11.	 Content of the study program (applies both for theoretical and practical part): <i>Pathophysiology (theoretical part):</i> Disorders of energy metabolism and metabolism of essential nutrients; Hypoxia; Disturbances in water and electrolyte flow; Pathophysiology of the immune system; Inflammation, sepsis; Mechanisms of shock; Pathophysiology of the cardiovascular system; Pathophysiology of the respiratory system; Pathophysiology of the hepato-gastrointestinal system; Pathophysiology of the urinary system; Acid-base balance disorder. <i>Pathology (theoretical part):</i> General pathology: cellular damage, adaptations and death; Acute and chronic inflammations; Specific inflammations; Regeneration and repair of tissues; Hemodynamic disorders; Immunopathology; Neoplasia; Tissue damages caused by drugs. <i>Practical part:</i> 						
12.	Study methods: Presentation of theoretical lect	ures, in	teractive presentations,	, pract	ice.		
13.	Total amount of time available	;	5 ECTS x 30 hours =	150 h	ours (2+2)		
14.	Distribution of tasks		30+30+10+30+50		× /		
	Types of learning/tagahing	<u>15.</u> 1.	Lectures – theory		30 hour	rs	
15.	activities	15.2.	Tutorials (laboratory, auditory), seminars, t	eamw	ork 30 hour	rs	
		16.1.	Projects		10 hou	rs	
16.	Other types of activities	16.2.	Individual tasks		30 hou	rs	
		16.3.	Home study – tasks		50 hour	rs	

	Evalua	tion / as	sessment methods					
	17.1.	Tests				40 points		
17.	17.2.	Individ	lual tasks / project (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participation		,	20 points		
	17.4.	Final e	xam			30 points		
				Up to 50 points		5 (five) (F)	
				51 – 60 points		6 (six) (E)		
10		, .		61 – 70 points		7 (seven) ((D)	
18.	Assess	ment cri	teria (points / grade)	71-80 points		8 (eight) (C)	
				81 – 90 points		9 (nine) (E	3)	
				91 – 100 points	10 (ten) (A		A)	
	Eligibi	lity for s	signature and taking	60% realization of pre-e	xam act	ivities, i.e.,	42 points	
19.	the fina	al exam	0 0	from two tests, seminary	or prac	tical work, a	and	
				regular participation to the organized activities.				
20.	Langua	age of th	e study program	English				
21	Quality	/ assurar	nce methods of the					
21.	teaching process							
	Literat	ure						
		Manda	atory literature					
		No.	Author	Title	Pu	blisher	Year	
			Kumar, V., Abbas,	Robbins & Cotran				
		1.	A. K., Aster, J. C.	Pathologic Basis of	Elsevi	er	2018	
			(Editors)	Disease (10 th Edition)				
		2.		Robbins & Cortan				
			Klatt, E. K. (Editor)	Atlas of Pathology (4 th	Elsevier 202		2020	
	22.1.			Edition)				
				Essentials of human				
			McCorry I K	physiology and				
		3.	Zdanowicz M M	pathophysiology for	Routle	edge	2019	
22.			Zauno wież, wi. wi.	pharmacy and allied				
				health				
		4.	Huether, S. E.,	Understanding	Elsevi	er	2017	
			McCance, K. L.	pathophysiology				
		Addıtı	onal literature					
		No.	Author	Title	Pu	blisher	Year	
		1	Kumar, V., Abbas,	Robbins Basic			2017	
	22.2	1.	A. K., Aster, J. C.	Pathology (10 th	Elsevi	er	2017	
	22.2.	-	(Editors)	Edition)	T · ·			
			Harold, J.,	100 Cases in	Lippin	cott	2000	
		2.	Bryuere, J. R.	pathophysiology	Willia Willia	Williams & 2		
		2	http://www.a.l.a		w likir	18 diant a tra-	tion	
1		J.	$\parallel mups.//www.mu01010s$	cience.com/products/0101	uciua-ine	Juicai-educa	uon	

	Appendix 3 No. 18	Study program for integrated first and second cycle of studies							
1.	Name of the course	ANALYTICAL CHEMISTRY 2							
2.	Code	3FMN193625							
3.	Study program	Pharmacy							
4	Study program organizer	Faculty of Medical Sciences,							
4.	(department, institute, branch)	Goce Delcev University, Stip							
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies							
6.	Academic year / semester	Second year / Fourth semester7.Number of ECTS6							
8.	Professor	Full Prof. Dr.sc. Rubin Gulaboski Ass. Prof. Dr.sc. Milkica Arsova							
9.	Pre-conditions for course registration	Enrolled in fourth semester of studies							
	Aims of the study program (compet	ences):							
	Upon completion of this course, the st	udents will be able to:							
	 give examples of typical issues 	of analytical chemical nature in the development and							
	analytical control of pharmaceuticals;								
	 account for the validation procession 	account for the validation procedure of an analytical method and will be able to use the							
	most common concepts that are analyses;	most common concepts that are included in the validation protocol; errors in chemical analyses;							
	 describe the parts and operating 	manner of an electrochemical cell and account for its							
	application for pH determination	n and for the determination of drugs having acidic or							
10.	alkaline properties;								
	 describe the conductometric dev 	rice and account for its application for conductometric							
	use the principle for the titrimet	ria quantitativa analyzis of nharmacautical substances							
	- account for quantitative analysis	 account for quantitative analysis of drug molecules with potentiometric techniques: 							
	 account for quantitative analysis account for quantitative analysis 	- account for quantitative analysis of drug molecules with potentiometric techniques,							
	 account for quantitative analysis 	- account for quantitative analysis of drug molecules with conductometric techniques;							
	techniques;	techniques;							
	— get familiar with basic experime	- get familiar with basic experimental methodology of voltammetry in the area of drug							
	analysis.								
	Content of the study program (appl	ies both for theoretical and practical part):							
	 Introduction to Qualitative analy 	tical chemistry; sample and sample preparation;							
	classification of separation meth	iods;							
	 Qualitative analytical chemistry 	: Qualitative analysis of inorganic cations;							
	– Qualitative analytical chemistry	: Qualitative analysis of inorganic anions;							
	- Introduction to Quantitative ana	lytical chemistry;							
	- Chemometrics – Statistical data calibration. Statistical parameter	rs relevant to analytical chemistry;							
	 Introduction to the methods of the second sec	trations in quantitative analytical chemistry;							
11.	 Acid-base titrations; redox titrat titrations; 	ions; titrations with precipitations; complexometric							
	 Basic principles of Potentiometr 	V;							
	 Potentiometric titrations; 	-							
	- Basic principle of conductometr	у;							
	 Conductometric titrations; 								
	- Basics of voltametric techniques	s in drug analysis;							
	– Application of voltammetry for	quantitative analysis of drugs;							
	– Application of voltammetry for	studying of drug-drug interactions;							
	 Basics of paper chromatography 	and its application for drug quantification.							

	Study	methods	5:							
	All cor	ntents of	the subject Ana	lytical	chemistry 2 will be presente	ed to th	e students in	n several		
	manne	rs of in-p	erson classes:	•						
	— A	All theore	etical lectures w	vill be h	eld to the whole group of st	udents	, where the s	students		
	will be introduced to the fundamental contents of the subject. At the beginning of each									
	lecture, the main objectives of that lecture will be clearly stated. At the end of each									
	lecture, exercises and problems relevant the contents of particular lecture will be									
	presented. The lectures will be held using the blackboard, power point presentations and									
	relevant audio-visual materials:									
	 Regular seminar works will be held, in which the students will focus on solving 									
	numerical problems and practical problems related to the material elaborated in the									
	C C	ourse.	problems and	praetiet	in problems related to the ma	ateriar	clubbluted i			
12	T	Sutorial n	latform will be	created	l in order to make a discussi	ion linl	z between th	e		
12.	- 1 c	tudente v	der to solve particular proble	ome an	d to answer	questions				
	related to the course:									
	T	aborator	une course,	ly to the	is course with 2 hour cossie	n a 2021	woolt Uno	n andina		
	- 1	ach prac	y practices app	short se	minar will be held in order	to disc	ii week. Opu	n chung		
	C	btoined l	by the students:	SHOTT SC	initial will be held in order		uss of the re	suits		
	U L	n additio	by the students,	tudy og	tivition students should be	aivon r	matical prol	aloma to		
	— 1 h		in, via tile sen-s	rudy ac	ated to different toniog of th	given p	nactical pro	by the		
	U t	e solveu	, as well as quiz	zzes ten	area to different topics of the	e subje	ct proposed	by the		
	u a	tudont	These segments	s will be	e evaluated as independent v	work a		acii		
	s The ce	neral obj	ective of all act	tivitios	prevised in the Analytical d	homist	ry 2 course i	s that the		
students get knowledge and experience on how to apply analytical methods and to solve										
	nroble	ns in the	areas such as o	hemica	l analysis or pharmaceutical	l analy				
13	Total a	mount of	f time available		$6 \text{ ECTS x 30 hours} = 180^{\circ}$	hours ((2+3)			
14	Distrib	ution of	tasks	, ,	30+45+30+30+45	nouis	2+3)			
17.	Distribution of tasks		15.1	I = theory		30 hours				
15	Types of learning/teaching activities		13.1.	Tutorials (laboratory		50 110013				
15.			15.2.	auditory) seminars teamy	vork	45 hours				
				16.1	Projects	WOIK	30 hours			
16	Other t	vnes of a	activities	16.1	Individual tasks		30 hours			
10.	ouior	<i>ypes of t</i>		16.3	Home study – tasks		45 hours			
	Fyalua	tion / ass	sessment metho	10.5. ds	Home Study tusks		10 Hours			
	17 1	Tests		us			40 points			
17	17.1.	Individu	ual tasks / proje	ect (pres	sentation: written and oral)		10 points			
17.	17.2.	Activity	and participat	ion	sentation: written and orary		20 points			
	17.3.	Final ex	y and participat				30 points			
	1 /		Xaiii		Up to 50 points		$\frac{50 \text{ points}}{5 \text{ (five)}(\text{F})}$			
					51 60 points		$\frac{J(\Pi V C)(\Gamma)}{6(civ)(\Gamma)}$			
					51 - 60 points		$\frac{0}{3}$ (six) (E)			
18.	Assess	ment crit	teria (points / gi	rade)	01 - 70 points		$\frac{7}{(\text{seven})}$) ''		
					71 - 80 points		$\frac{8}{(\text{eignt})}$ (C	<i>.)</i>		
					81 - 90 points		9 (nine) (B)		
	F1 1 .	1:4 0	• • • • • •	•	91 - 100 points		10 (ten) (A)		
10	Eligibi	lity for s	ignature and tal	ang	60% realization of pre-exa	im acti	$v_{111}e_{$	2 points		
19.	the fina	al exam			from two tests, seminary o	or pract	ical work, a	nd		
20	т	C (1	. 1		regular participation to the	e organ	ized activiti	es.		
20.	Langua	age of the	e study program	1	English					
21.	Quality	/ assuran	ce methods of f	tne	Self-evaluation					
	teachir	ig proces	5							
22	Literat	ure	4							
22.	22.1.	Ivlanda	nory interature		· · · 1	"	L11.1	V		
		INO.	Author		I itle	Pu	DIISNET	y ear		

		1.	Skoog, D. A., West, D. M., Holler, F. J., Crouch, S. R.	Analytical Chemistry (9 th Edition)	Brooks/Cole Cengage, UK	2014			
		2.	Miller, J., Miller, J. N. Y., Jane, C.	Statistics and Chemometrics for Analytical Chemistry	Prentice Hall	2010			
		Additional literature							
		No.	Author	Title	Publisher	Year			
	22.2.	1.	Gulaboski, R.	Analytical Chemistry (personal authorized lectures available on www.rubingulaboski. synthasite.com and on Repository of Goce Delcev University)	Goce Delcev University, Stip	2021			

	Appendix 3 No. 19	Study program fo	or int ycle o	egrated first a f studies	and second		
1.	Name of the course	PHARMACOGNO	SY				
2.	Code	3FMN193725					
3.	Study program	Pharmacy					
4	Study program organizer	Faculty of Medical S	cience	es,			
4.	(department, institute, branch)	Goce Delcev Univers	sity, S	tip			
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies					
6.	Academic year / semester	Second year / Fourth semester	7.	Number of ECTS	6		
8.	Professor	Assoc. Prof. Dr.sc. V	iktori	ja Maksimova			
9.	Pre-conditions for course	Enrolled in fourth semester of studies					
	Aims of the study program (compet	ences).					
10.	Aims of the study program (competences): Promote the acquisition of knowledge about medicinal plants, crude drugs obtained from medicinal plants and animals and their biologically active substances. Acquire basic theory and practical methods to determine herbal drug identity and purity. Through the course, students should become familiar with the most important natural raw materials (pharmacognostic drugs) that are significant for medicine and pharmacy. Students will study the definitions and morphological characteristics of drugs according to pharmacopeial regulations, as well as the pharmacological effects and uses of the main active components in drugs and their pharmaceutical applications.						
11.	<i>Theoretical part:</i> Definition and subject of pharmacogno Drugs containing carbohydrates (sim polysaccharides derived from sea alg proteins, proteids, peptides, or enzyme Drugs with glycosylates; Drugs w compounds, phenolic heterosides; Dru quinones (drugs with naphthodianthro and phloroglucinol; Drugs with flav sesqui-, tri- and tetraterpenes), essenti and steroid saponins; Drugs with cardid Vitamin drugs; Drugs with organic aci by biosynthetic origin). <i>Practical part:</i> Application of methods for determinat and microscopic characterizations of c and fatty drugs; drugs containing cya compounds, phenolic heterosides; dru quinones (drugs with naphthodianthro and phloroglucinol; drugs with flavon tri- and tetraterpenes), essential oils, steroid saponins; drugs with organic acid by their biosynthetic origin).	by research, history, properties both for theoretical posy research, history, properties of the sulfur and complex, he are, plant gums, mucila es; Fatty drugs; Drugs c ith sulfur and thiohed gs containing coumaring one and anthraquinone conoids; Drugs with the al oils, iridoids, valepo totonic heterosides; Drugs ds; Drugs containing a ion of herbal drug, their drug containing carboh anogenic and sulfuric gs containing coumaring one and anthraquinone oids; drugs with terpen iridoids, valepotriates onic heterosides; drug ds; drugs containing al	r iden ydrate heterosi ins; Dr heterosi terpen triate ugs w lkaloi hetero ns; dr hetero hetero s, etc. s wit kaloid	tion and cultiva and heteropol us drugs); Dru ning cyanogeni ides; Drugs v ugs with tannir rosides); Drugs the compounds s, etc.; Drugs v ith tetraterpene ds (various gro tity and purity. es; drugs conta osides; drugs ugs with tannir rosides); drugs pounds (mono ; drugs with t h tetraterpenes ds (various gro	ation of drugs; lysaccharides, gs containing ic heterosides; with phenolic ns; Drugs with s with orcinol (mono-, di-, with triterpene es (carotenes); pups classified . Macroscopic ining proteins with phenolic ns; drugs with s with orcinol -, di-, sesqui-, riterpene and s (carotenes); pups classified		
12.	Study methods: Lectures, practical laboratory exercise with oral presentations); three days ser identifying medicinal plants and pharm	s, consultations, group ninars in the form of fi nacognostic drugs.	and ir eldwo	ndividual work ork aimed at rec	(project tasks cognizing and		
13.	Total amount of time available	$6 ECTS \times 30 hours =$	1801	nours $(2+3)$			
14.	Distribution of tasks	30+45+15+30+60		(2 0)			

Faculty of Medical Sciences, Goce Delcev University

	Tunos	ofloorni	ng/tagahing	15.1.	Lectures – theory		30 hours		
15.	1 ypes o		ng/teaching	15.2	Tutorials (laboratory,		15 hours		
	activiti	68		13.2.	auditory), seminars, tear	nwork	45 110018		
				16.1.	Projects		15 hours		
16.	Other t	ypes of a	activities	16.2.	Individual tasks		30 hours		
				16.3.	Home study – tasks		60 hours		
	Evalua	tion / ass	sessment metho	ods					
	17.1.	Tests					40 points		
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participat	ion			20 points		
	17.4.	Final ex	xam				30 points		
					Up to 50 points		5 (five) (F)		
					51 – 60 points		6 (six) (E)		
10	Accord	mont ori	toria (nainta / a	rada)	61 – 70 points		7 (seven) (D)	
10.	Assess		teria (points / g	raue)	71 – 80 points		8 (eight) (0	C)	
					81 – 90 points		9 (nine) (B	5)	
					91 – 100 points	oints		10 (ten) (A)	
	Eligibility for signature and tak			king	60% realization of pre-exam activities, i.e., 42 poin				
19.	19. the final exam			from two tests, seminary	or prac	tical work, a	ind		
				regular participation to t	he orgar	nized activiti	es.		
20.	Langua	ige of th	e study progran	n	English				
21.	Quality	assurar	nce methods of	the	Self-evaluation				
	Literat	ig proces	55						
	Literati	Manda	atory literature						
		No	Author		Title	P11	blisher	Year	
		110.	- Tutiloi		American Herbal	14	onsher	1 cui	
			Upton, R. et a	1.	Pharmacopoeia.	CRC Press			
		1.	(Editors)		Botanical	Taylor	& Francis	2011	
	22.1.		()		Pharmacognosy				
			E W.C		Trace and Evans	F1 ·		2000	
		2.	Evans, W. C.		Pharmacognosy	Elsevi	er	2009	
22.		2	Haensel, R.,		Pharmacognosy –	а ·		2007	
		3.	Sticher, O.		Phytopharmacy	Spring	er	2007	
		Additi	onal literature		· · ·				
		No.	Author		Title	Pu	blisher	Year	
						Michig	gan		
	22.2				Laboratory	Techn	ological		
	22.2.	1	Glime, J. M.,		Tachniques: Slide	Univer	rsity and	2017	
		1.	Wagner, D. H		Preparation and Stains	Interna	ational	2017	
						Associ	iation of		
						Bryold	ogists		

	Appendix 3 No. 20	Study program fo	or inte ycle of	egrated first a f studies	and second	
1.	Name of the course	PHARMACEUTIC	AL C	HEMISTRY	1	
2.	Code	3FMN193825				
3.	Study program	Pharmacy				
4	Study program organizer	Faculty of Medical S	cience	es,		
4.	(department, institute, branch)	Goce Delcev Univers	sity, S	tip		
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies				
6.	Academic year / semester	Second year / Fourth semester	7.	Number of ECTS	7	
8.	Professor	Full Prof. Dr.sc. Emi Ass. Prof. Dr.sc. Mar	lija Ja rija Ar	nevikj-Ivanov rev	ska	
9.	Pre-conditions for course registration	Enrolled in fourth ser	nester	r of studies		
10.	The goal of the Harmaceutical substa properties of pharmaceutical substa fundamental knowledge of the physic substances, the target sites of drug act their biotransformation. The course also explains how specifi substances, work, and evaluates their introduction to inorganic medicinal su Students are expected to obtain k pharmacologically active molecules, t and metabolic stability of medicines. effects at the molecular level, and properties, and the effects of medicine After passing the exam, students wi knowledge of inorganic compounds w	stry recourse is to infre- inces and metabolites cochemical properties icon, as well as the basis ic drugs or drug classe potential value for ind ibstances. cnowledge about the he reactivity of their fu They will understand the analyze the relationsh es. Il also be able to app <u>with therapeutic effects.</u>	s. The of me ic med es, inclividua physe inction the target hips b oly the	e course aim edicinal and pl chanisms of dr cluding inorga als and popula sicochemical nal groups, and gets and mecha between chemi eir theoretical	s to provide harmaceutical ug action and nic medicinal tions, with an properties of the chemical nisms of drug cal structure, and practical	
11.	 Introduction to Pharmaceutica Drug Structure Physicochemical Factors Drug Target Molecules Medicines: Structure and Drug Transport Structure and Function of Nucleic Acids: Structure at Physicochemical Factors Nucleic Acids: Structure at Physicochemical Factors Receptors as Drug Targets Structure and Function of Transduction Types of Receptors (Ion Occupied Receptors, Enzy) The Role of Receptors in the Activity Relationships Enzymes as Drug Targets Enzymes as Drug Targets Enzymes as Drug Targets Drug Discovery, Design, and 	Affecting the Biological Function of Biological Proteins and Function urgets Carbohydrates `Receptors and Their F Channels, Transmembr me/Catalytic Receptors Quantitative Determina	al Act Mem Role in ane R s, Nuc ation o	n Drug Transpo ecceptors, G-Pr elear Receptors of Drug Conce	beir Role in fort and Signal rotein s) ntration-	
	 Drug Discovery, Design, and Drug Design: Optimizing 	Target Interactions	nig a	rarget molect		

	7	– Dr	ug Design: Opti	imizing	Target Access			
	7.		mbinatorial and	, Desigi Paralle	l al Synthesis			
	8	Ontimi	zation of Pharm	nacokin	etic Parameters			
	9. 9	Prodru	zation of 1 nam	lacokin	ette i didilletets			
). 10	Ouanti	5° tative Structure	-Activit	v Relationshins (OSAR)			
	11.	Classif	ication and Nor	nenclat	ure of Drugs			
	12	Radion	harmaceuticals	and Co	ontrast Agents			
		- Ra	diopharmaceuti	cals for	Diagnostics (SPECT, PE	T) and T	herapy	
		- Pro	duction (Labeli	ing. Svi	nthesis) and Quality Contr	rol	incrup)	
		- Pri	nciples of Biodi	istributi	ion and Clinical Application	ons		
		- Co	ntrast Agents: S	Structur	e and Application	0110		
	13.	Medici	nes of Inorgani	c Origin	1			
		– Cla	assification of D	Drugs A	ccording to Their Elemen	tal Com	position and	Clinical
		Us	e]	[
12.	Study I	method	S:	aangul	tations cominants			
12	Tetal	s, labor	f time exercises,	consul	$\frac{1}{7}$ ECTS x 20 hours = 21	0 h a una	(2 + 2)	
13.	Distrila	nount o	toglyg	;	7 ECTS x 50 hours - 21	0 nours	(3+3)	
14.	Distrib		lasks	15 1	43+43+13+23+80		15 hours	
15	Types of	of learni	ng/teaching	13.1.	Tutorials (laboratory		45 110015	
15.	activities			15.2.	auditory) seminars tear	nwork	45 hours	
				16.1	Projects	IWOIK	WORK 15 hours	
16.	Other types of activities		16.1	Individual tasks		25 hours		
		ypes 01 (16.3	Home study – tasks		80 hours	
	Evaluation / assessment methods			frome study tublis		oo nourb		
	17.1. Tests						40 points	
17.	17.2. Individual tasks / project (pres				sentation: written and oral)	10 points	
	17.3. Activity and participation						20 points	
	17.4.	Final ex	xam		30 points			
					Up to 50 points		5 (five) (F)	
					51 – 60 points		6 (six) (E)	
18	Assess	nent cri	teria (noints / g	rade)	61 – 70 points		7 (seven) (D)	
10.	1 1000000			iuue)	71 – 80 points		8 (eight) (0	C)
					81 – 90 points		9 (nine) (B)
					91 – 100 points		10 (ten) (A	.)
1.0	Eligibil	ity for s	ignature and tal	king	60% realization of pre-e	xam act	ivities, i.e., ²	2 points
19.	the fina	l exam			from two tests, seminary	or prac	tical work, a	ind
20	T	0.1	. 1		regular participation to t	he orgar	nized activiti	es.
20.	Langua	ge of th	e study program	1	English			
21.	Quality	assurar	ice methods of t	the	Self-evaluation			
	teachin	g proces	SS					
	Literati	Ire	tom literatura					
		No	Author		Title	Du	blichar	Voor
		110.	Autior		1 ше Фарманаетска	ru	01151161	1 car
			Janevik Ivano	weba	Фирмицевтски	Gocal	Delcev	
22.	22.1	1.	F	vska,	Pharmacoutical	Univer	rsity Stin	2014
	<i>22</i> ,1,		L.		chemistry 1)		uny, oup	
					An Introduction to			
		2.	Patrick. G. L.		Medicinal Chemistrv	Oxfore	1	2023
					(7 th Edition)	Univer	rsity Press	

		3.	Lemke, T. L., Williams, D. A., Roche, V. F., Zito, S. W. (Editors)	Foye's principles of medicinal chemistry (8 th Edition)	Lippincott Williams & Wilkins	2019				
		Additional literature								
		No.	Author	Title	Publisher	Year				
	22.2.	1.	Harrold, M. W., Zavod, R. M.	Basic concepts in medicinal chemistry (3 rd Edition)	American Society of Health-System Pharmacists (issuing body)	2023				
		2.	Alagarsamy, V.	Textbook of Medicinal Chemistry Volume I	Elsevier	2010				
		3.	Campos Rosa, J. M.	Pharmaceutical Chemistry (Volume 1): Drug Design and Action (2 nd Edition)	Walter de Gruyter GmbH	2024				

	Appendix 3 No. 21		Study program fo	or inte vcle of	egrated first a f studies	and second	
1.	Name of the course		PHYTOCHEMIST	RY			
2.	Code		3FMN193925				
3.	Study program		Pharmacy				
4	Study program organizer		Faculty of Medical Se	cience	es,		
4.	(department, institute, branch)		Goce Delcev Univers	sity, St	tip		
5.	Degree (first, second, third cyc	ele)	Integrated first and se	econd	cycle of studi	es	
6.	Academic year / semester		Third year / Fifth semester	7.	Number of ECTS	5	
8.	Professor		Assoc. Prof. Dr.sc. Viktorija Maksimova				
9.	Pre-conditions for course		Enrolled in fifth seme	ester o	of studies		
	Aims of the study program (amnat	(anaag).				
	Students will:	compet	ences).				
10.	 acquire knowledge on the physicochemical properties and structures of bioactive substances of natural origin (primary and secondary plant metabolites); acquire knowledge on the procedures for extracting active components from plant material, their identification and determination in plant material and herbal preparations (color reactions precipitate reactions; spectrophotometric techniques; thin-layer 						
	chromatography, liquid and gas chromatography):						
	 familiarize with basic analytical techniques for testing of herbal drugs: 						
	 be able to browse through scientific and professional literature related to methods for the 						
	analysis of phytochemica	als.	1				
11.	Theoretical part: The course enhances the know secondary metabolism in plant Secondary metabolites importa their properties); phenolic co tannins, anthraquinones, flav compounds); Alkaloids: conce of phenylalanine and tyrosine; alkaloids; Steroid alkaloids, th formation, assays for identific course. <i>Practical part:</i> The practical part of the course observing physicochemical pri- and secondary plant metabolite	wledge s. ant in m ompoun onoids, pt, class derivat: heir occ cation a se will operties es cover	of the students on differences of the students on differences and phenols and phenols and phenols iffication; derivatives of histidine, purine currence, chemical structure of quantification are solved and quantification and quantification and quantification and quantification are solved and quantification and quantificaticaticat	fferent fferent l as gl nolic : mon ff ornit e bases ucture going skills titativ urt.	t pathways of ycosides (clas acids, couma no-, di-, tri- thine and lysir s; Pseudoalkal c, biosynthetic to be studied on the extrac e determinatio	F primary and sification and rins, lignans, tetraterpene e; derivatives oids; Terpene pathways of through this tion methods, on of primary	
	Study methods:						
12.	Lectures, theoretical and practi work (project assignments with	ical labo <u>1 oral p</u>	pratory exercises, constructions).	ultatio	ons, group and	individual	
13.	Total amount of time available		5 ECTS x 30 hours =	150 h	ours (2+2)		
14.	Distribution of tasks		30+30+15+15+60				
	Types of learning/teaching	15.1.	Lectures – theory		30 hour	S	
15.	activities	15.2.	Tutorials (laboratory,	aamu	ork 30 hour	°S	
		16.1	Projects	callfW	15 hou	'S	
16	Other types of activities	16.2	Individual tasks		15 hou	'S	
10.	Sher Gres of derivities	16.3.	Home study – tasks		60 hou	°S	
	Evaluation / assessment metho	ds	stary works		00 1100		
17.	17.1. Tests				40 poin	ts	

	17.2.	Individ	lual tasks / project (pres	10 points				
	17.3.	Activit	y and participation	20 points				
	17.4.	Final e	xam			30 points	30 points	
				Up to 50 points		5 (five) (F)		
				51 – 60 points		6 (six) (E)		
10	1	mant ani	tonia (nainta / anada)	61 – 70 points		7 (seven) (D)	
10.	Assess		teria (points / grade)	71 – 80 points		8 (eight) (0	C)	
				81 – 90 points		9 (nine) (B	5)	
				91 – 100 points		10 (ten) (A	.)	
	Eligibi	lity for s	signature and taking	60% realization of pre-e	xam act	ivities, i.e., 4	12 points	
19.	the fina	al exam		from two tests, seminary	or prac	tical work, a	ind	
				regular participation to t	he organ	nized activiti	es.	
20.	Langua	age of th	e study program	English				
21	Quality	/ assurar	nce methods of the	Self evaluation				
21.	teachin	ig proces	SS					
	Literat	ure						
		Manda	atory literature	1			1	
		No.	Author	Title	Pu	blisher	Year	
		1.	Ganora, L.	Herbal Constituents	HerbalChem Press			
				(2 nd Edition):			2021	
				Foundations of			2021	
				Phytochemistry				
	22.1.		Chukwuebuka, E.,	Phytochemistry				
			Chinenve Ifemeie.	(Volume I):	Apple	Academic	2010	
22.		2.	J., Chidi Udedi, S.,	Fundamentals,	Press		2019	
			Kumar, S.	Modern Techniques,				
		-		and Applications				
		2	Arnason, J. 1.,	Phytochemistry of	Series		1005	
		5.	T	Medicinal Plants	Spring	er	1995	
		Additi	onal literature					
		No		Title	Pu	hlisher	Vear	
	22.2	110.	Fattorusso F	110	10		1 001	
		1	Taglialatela-Scafati	Modern Alkaloids	Wiley	-VCH	2008	
		1.	O (Editors)	11040111 1111410143	wiley-vCn		2000	
L		1			1			

	Appendix 3 No. 22	Study program for integrated first and second cycle of studies						
1.	Name of the course	PHARMACEUTICAL TECH	NOLOGY 1					
2.	Code	3FMN194025						
3.	Study program	Pharmacy						
1	Study program organizer	Faculty of Medical Sciences,						
4.	(department, institute, branch)	Goce Delcev University, Stip						
5.	Degree (first, second, third cycle)	Integrated first and second cycle	e of studies					
6.	Academic year / semester	Third year / Fifth semester7.Nur ECT	mber of ΓS 7					
8.	Professor	Assoc. Prof. Dr.sc. Elena Draka	lska Sersemova					
9.	Pre-conditions for course	Enrolled in fifth semester of stud	dies					
	Aims of the study program (compet	ences):						
10.	Understanding of the fundamental employed during manufacturing, and for assessing pharmaceutical dosage f	principles of formation, the te the pharmaceutical-technologica	chnological processes al evaluations essential					
	Content of the study program (applies both for theoretical and practical part):							
Theoretical part:								
	1. Definition of the course, mean	ning and essential terminology;						
	2. Types and classifications of p	harmaceutical dosage forms;						
	3. Evaluation of Pharmacopoeia;							
	4. Pharmacy, Prescription, Dosage of Drugs, Manufacturing, and Dispensing of Drugs;							
	5. Pharmaceutical Milling and Sieving Technologies, Fundamentals of Pharmaceutical							
	MIXING; 6 Heat operations Fundamental principles of drying:							
	 b. Heat operations, Fundamental principles of drying; 7 Definition, process and techniques of filtration. Compression: 							
	8 Introduction and general cons	iderations of sterile manufacture.	Stability monitoring:					
	9. Rheological characterization	of pharmaceutical formulations:	<i></i>					
	10. Characterization, classificatio	n and advantages of pharmaceutic	cal powders;					
	11. Properties, types and quality of	of solutions;	•					
11	12. Classification and application	s of pharmaceutical excipients.						
11.	Practical part:							
	1. Introduction / Comparative O	verview of Pharmacopoeias;						
	2. Prescription and Pharmacy Pr	actice;	·					
	3. Pharmaceutical-Technologica	Devidence Characterization of Rev	ing, Dissolving;					
	4. Commution and Steving of 5. Particle Size Analysis:	Fowders, Characterization of Fow	vuers,					
	6 Powder Mixing – Homogenei	ty Testing of a Mixture:						
	7. Solution Phenomena: Dissolu	tion Process of Solids: Measurem	ent of Tablet					
	Dissolution;	,						
	8. Solution Phenomena; Diffusion	on – Determination of the Partition	n Coefficient of					
	Salicylic Acid in a Water/Chl	oroform Solvent System;						
	9. Interfacial Processes; Filtratic	on;						
	10. Drying – Determination of the	e Drying Rate of Solid Material (I	Powder, Granulate);					
	11. Extraction – Non-aqueous Ex	traction Procedures;						
	12. Aqueous Extraction Preparati	OIIS.						
12.	Lectures interactive teaching and rese	earch work						
13	Total amount of time available	7 ECTS x 30 hours = 210 hours	(3+3)					
14.	Distribution of tasks	45+45+0+90+30						
15.	15.1.	Lectures – theory	45 hours					

Individual tasks Individual tasks 16. Other types of activities 16.1. 16. Other types of activities 16.1. 16.1. Projects 0 hours 16.2. Individual tasks 90 hours 16.3. Home study – tasks 30 hours 17.1. Tests 40 points 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
16. Projects 0 hours 16. Other types of activities 16.1. Projects 0 hours 16. Individual tasks 90 hours 16.3. Individual tasks 90 hours 16. Individual tasks 90 hours 30 hours 16.3. Home study – tasks 30 hours 17. Tests 40 points 40 points 17. Individual tasks / project (presentation: written and oral) 10 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
16. Other types of activities 16.2. Individual tasks 90 hours 16.3. Home study – tasks 30 hours 17.1. Tests 40 points 17.1. Tests 40 points 17.1. Tests 20 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
16.3. Home study – tasks 30 hours Evaluation / assessment methods 40 points 17. Tests 40 points 17. Individual tasks / project (presentation: written and oral) 10 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
Evaluation / assessment methods 17.1. Tests 40 points 17.1. Tests 10 points 17.1. Tests 20 points 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
17.1. 1ests 40 points 17. 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
17. 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.3. Activity and participation 20 points 17.4. Final exam 30 points				
17.3.Activity and participation20 points17.4.Final exam30 points				
1/.4. Final exam 30 points				
$\begin{array}{c c} Up \text{ to } 50 \text{ points} & 5 \text{ (five) (F)} \\ \hline 51 & (0 \text{ points} & -5 \text{ (circ) (F)} \\ \end{array}$				
$51 - 60 \text{ points} \qquad 6 \text{ (six) (E)}$				
18. Assessment criteria (points / grade) $\frac{61 - 70 \text{ points}}{71 - 90 - 100}$ $\frac{71 - 90 - 100 \text{ (seven) (D)}}{71 - 90 - 100 \text{ (seven) (D)}}$				
$\frac{1}{1-80 \text{ points}} = \frac{8 \text{ (eight) (C)}}{8 \text{ (eight) (C)}}$				
81 - 90 points 9 (nine) (B)				
91 - 100 points 10 (ten) (A)	• ,			
Eligibility for signature and taking 60% realization of pre-exam activities, i.e., 42 p	oints			
19. the final exam	tical work, and			
regular participation to the organized activities.	regular participation to the organized activities.			
20. Language of the study program English				
21. Quality assurance methods of the Self-evaluation				
Mandatory literature				
No Author Title Publisher	Vear			
Angelovska B Pharmaceutical-	1 Cui			
1 Drakalska F technological Goce Delcev 20)15			
Cvetkovski A <i>operations</i> (script)	2010			
22.1. Vuleta G. Milic Faculty of				
2 L. Primorac M. Pharmaceutical Pharmacy 20)19			
Savic, S. <i>technology I</i> Belgrade	2017			
Aulton's				
3. Taylor, K. M. G. <i>Pharmaceutics (6th</i> Elsevier 20)21			
Edition)				
22. Additional literature				
No. Author Title Publisher	Year			
Semalty, A., Essentials of Dharmanad				
1. Semalty, M., <i>Pharmaceutical</i> Pharmaceutical 20)11			
Rawat, M. S. M. <i>Technology</i>				
Handbook of Lap Lambert				
22.2.2.Bhatt, P.PharmaceuticalAcademic20)21			
<i>Technology</i> Publishing				
Ansel's				
Pharmaceutical Lippincott				
3. Kluwer, V. Dosage Forms and Williams & 20)11			
Drug Delivery Systems Wilkins				

	Appendix 3 No. 23	Study program for integrated first and second cycle of studies					
1.	Name of the course	PHARMACEUTICAL CHEMISTRY 2					
2.	Code	3FMN194125					
3.	Study program	Pharmacy					
4	Study program organizer	Faculty of Medical Sciences,					
4.	(department, institute, branch)	Goce Delcev University, Stip					
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies					
6.	Academic year / semester	Third year / Fifth semester7.Number of ECTS7					
8.	Professor	Full Prof. Dr.sc. Emilija Janevikj-Ivanovska Ass. Prof. Dr.sc. Marija Arev					
9.	Pre-conditions for course registration	Enrolled in fifth semester of studies					
10.	 The objective of the course Pharmaceutical chemistry 2 is the chemical study of drugs and the active ingredients of drugs in order to determine the relationship between chemical structure physicochemical properties, reactivity, chemical structure-biological activity relationship drug-drug interactions, drug-receptor interactions, chemical aspect of drug metabolism are biological response, with the ultimate aim of providing the knowledge necessary for the creation of new drugs. Students are expected to: understand the interrelation between structure, physicochemical propertied pharmacological activity, and therapeutic utility; know the methods and strategies used in the generation of drugs; know the interactions between drugs and their biological targets; know the general methods and the synthetic strategies for the properties of the drugs; know the analytical and spectroscopic methods applicable to the structure identification and elucidation of drugs, and related compounds; be able to name and formulate a drug in accordance with the systematic IUPA nomenclature; know and become able to predict the transformation of drugs in the body; know and be able to estimate the risks associated with the use of reagents, solvents are the development of processes in the chemical laboratory; 						
11.	 Drugs affecting the processes Antiaggregating drugs / A Anticoagulant drugs Antihemorrhagic drugs Plasma expanders Medicines that act on the procediseases Trace elements / Oligoelement Vitamins and related compound Water-soluble vitamins Fat-soluble vitamins Related compounds Medicines that affect hormona Drugs with a protein struct Drugs with a steroid struct 	The soun for theoretical and practical part): of haemostasis and thrombosis antiplatelet drugs cesses of calcium homeostasis and treatment of bone ats nds al systems cture cture					

	6. Medicines that affect the processes of the gastrointestinal system									
	 Antiulcer Drugs Antidiarrheal Drugs 									
		 Antidiarrheal Drugs Madiaina fan Unastabiliare Dianaar 								
		 Medicine for Hepatobiliary Diseases 								
	7. Medicines that affect inflammatory processes and allergic reactions									
		– Antihistamines								
		– Prostaglandins								
	- Analgesics									
		- Antipyretics	. ~							
	0	- Non-steroidal anti	-inflam	matory drugs – NSAIDs						
	8.	Medicines that affect i	nfectioi	18						
		- Antibiotics	1 -							
		- Quinolone Antibac	cterial I	Drugs						
		- Antibacterial Sulle	onamide	es						
		- Antitubercular Dru	ıgs							
		- Antinungal Drugs								
		- Antivital Diugs	a c							
		- Antimalarial Drug	gs c							
		 Anthelmintics 	3							
		 Antileprotic Drugs 	2							
	9.	Antineoplastic drugs	,							
		 Antimetabolites 								
		 Antitubulin Drugs 								
		- Nucleic Acids as 7	Therape	utic Targets and Drugs						
		- Small-Molecule T	argeted	Therapies						
		- Antibody-Based T	herapie	s s						
		- Endocrine Therapi	ies							
		- Immunomodulator	y Thera	apies						
		 Alternative Tumor 	-Target	ting Strategies						
		- Chemopreventive	Agents							
12	Study	methods:								
12.	Lecture	es, laboratory exercises,	consult	tations, seminars.						
13.	Total a	mount of time available	:	7 EC1S x 30 hours = 210 hours (3+3)						
14.	Distrib	ution of tasks	15 1	45+45+15+25+80	45.1					
15	Types of	of learning/teaching	15.1.	Lectures – theory	45 hours					
15.	activiti	es	15.2.	i utoriais (laboratory,	45 hours					
			16.1	Projects	15 hours					
16	Other t	vnes of activities	16.1.	Individual tasks	25 hours					
10.	Other t	ypes of activities	16.2.	Home study – tasks	80 hours					
	Fyalua	tion / assessment metho	10.5. ds	Home study tusks	00 110013					
	17.1	Tests	us		40 points					
17	17.2	Individual tasks / proje	10 points							
17.	17.3.	Activity and participat	ion		20 points					
	17.4.	Final exam	1011		30 points					
				Up to 50 points	5 (five) (F)					
				51 – 60 points	6 (six) (E)					
10				61 – 70 points	7 (seven) (D)					
18.	Assessi	ment criteria (points / gi	rade)	71 – 80 points	8 (eight) (C)					
				81 – 90 points	9 (nine) (B)					
			91 - 100 points	10 (ten) (A)						

19.	Eligibility for signature and taking the final exam			60% realization of pre-exam activities, i.e., 42 points from two tests, seminary or practical work, and regular participation to the organized activities			
20	Langua	nge of th	e study program	English	ine organized activiti	105.	
21.	Quality teachin	assuration and a solution of the solution of t	nce methods of the ss	Self-evaluation			
	Literat	ure					
		Manda	atory literature	1		1	
		No.	Author	Title	Publisher	Year	
	22.1.	1.	Patrick, G. L.	An Introduction to Medicinal Chemistry (7 th Edition)	Oxford University Press	2023	
		2.	Lemke, T. L., Williams, D. A., Roche, V. F., Zito, S. W. (Editors)	Foye's principles of medicinal chemistry (8 th Edition)	Lippincott Williams & Wilkins	2019	
22		3.	Alagarsamy, V.	Textbook of Medicinal Chemistry Volume II (2 nd Edition)	Elsevier	2010	
22.		Additional literature					
		No.	Author	Title	Publisher	Year	
		1.	Harrold, M. W., Zavod, R. M.	Basic concepts in medicinal chemistry (3 rd Edition)	American Society of Health-System Pharmacists (issuing body)	2023	
	22.2.	2.	Bhattacharjee, M. K.	Chemistry of Antibiotics and Related Drugs (2 nd Edition)	Springer	2022	
		3.	Thurston, D. E., Pysz, I.	Chemistry and Pharmacology of Anticancer Drugs	CRC Press Taylor & Francis	2021	

Appendix 3 No. 24			Study program for integrated first and second cycle of studies							
1.	Name	of the course		PHARMACOLOGY 1						
2.	Code			3FMN194225	3FMN194225					
3.	Study	program		Pharmacy						
4	Study	program organizer		Faculty of Medical Scie	ences,					
4.	(depar	tment, institute, branch)		Goce Delcev University	y, Stip					
5.	Degree	e (first, second, third cy	cle)	Integrated first and seco	ond cycl	e of studie	es			
6.	Acade	mic year / semester		Third year /7Fifth semester7	. Nui EC	mber of TS	5			
8.	Profes	sor		Assoc. Prof. Dr.sc. Mar	ija Dark	ovska Sei	rafimovska			
9.	Pre-co registr	nditions for course ation		Enrolled in fifth semest	er of stu	dies				
10.	Aims Acquir well as	of the study program (ring knowledge of gener s adverse effects on drug	compet al pharr s, drug a	ences): nacology (pharmacokinet addiction, doses and dosin	tics and p ng of dru	pharmaco gs and bas	dynamics), as sic knowledge			
11.	Of toxicology.Content of the study program (applies both for theoretical and practical part):Theoretical part:Introduction to pharmacology; Development of a new drug; Pharmacokinetics (absorption, distribution, metabolism and elimination of medicines); Pharmacodynamics (the mechanism of action of medicines); Synergism, antagonism, drug interactions, accumulation and tolerance; The concept of dose, dosing of drugs, dependence of the effect of the drug on the dose; Adverse effects of medicines; Addiction to medicines. Practical part: Recipe and recipe parts. Students will learn how to prescribe medications and gain an understanding of all									
12.	pharm Study	aceutical dosage forms. methods:								
12	Lectur	es, exercises, group disc	cussion :	methods, individual work $5 \text{ ECTS} \times 20 \text{ hours} = 14$	50 hours	(2+2)				
13.	Distrik	uniouni of theke	5	$3 \pm 20 \pm 30 \pm 30 \pm 30 \pm 30 \pm 30 \pm 30 \pm 3$	50 nours	5 (272)				
14.	Distili	Jution of tasks	15.1	Lectures theory		30 hour	20			
15.	Types activit	of learning/teaching ies	15.2.	Tutorials (laboratory, auditory), seminars, tea	mwork	30 hour	s			
			16.1.	Projects		30 hour	S			
16.	Other	types of activities	16.2.	Individual tasks		30 hour	·S			
			16.3.	Home study – tasks		30 hour	S			
	Evalua	ation / assessment metho	ods			•				
	17.1.	Tests				40 poin	ts			
17.	17.2.	Individual tasks / proj	ect (pres	sentation: written and ora	.1)	10 poin	ts			
	17.3.	Activity and participat	tion			20 poin	ts			
	17.4.	Final exam				30 poin	ts			
				Up to 50 points		5 (five)	(F)			
				51 – 60 points		6 (six) ((E)			
10	1	montonitonio (nointa / a	ma da)	61 – 70 points		7 (sever	n) (D)			
10.	Assess	sment criteria (points / g	rade)	71 – 80 points		8 (eight	(C)			
				81 – 90 points		9 (nine)	(B)			
				91 – 100 points 10 (ten) (A)						
	Eligibi	ility for signature and ta	king	60% realization of pre-e	exam ac	tivities, i.e	e., 42 points			
19.	the fin	al exam	-	from two tests, seminar	y or pra	ctical wor	k, and			
				regular participation to	the orga	nized acti	vities.			
20.	Langu	age of the study program	n	English	~~~~		English			

21	Quality assurance methods of the			Self evaluation				
21.	teachin	g proces	5S	Self-evaluation				
	Literatu	ıre						
		Mandatory literature						
		No.	Author	Title	Publisher	Year		
22		1.	Darkovska Serafmovska, M.	Authorized lectures	Goce Delcev University, Stip	2024		
	22.1.	2.	Ritter, J. M., Flower, R. J., Henderson, G., Loke, Y. K., MacEwan, D., Rang, H. P.	Rang & Dale's Pharmacology (9 th Edition)	Elsevier	2020		
		3.	Trevor, A. J., Katzung, B. G., Knuidering-Hall, M.	Katzung & Trevor's Pharmacology: Examination & Board Review (12 th Edition)	McGraw Hill	2019		
		Additi	onal literature					
		No.	Author	Title	Publisher	Year		
	22.2.	1.	Brunton, L. L., Knollmann, B. C.	Goodman & Gilman's: The Pharmacological Basis of Therapeutics (14 th Edition)	McGraw Hill	2022		

	Appendix 3 No. 25	Study program for integrated first and second cycle of studies							
1.	Name of the course	IMMUNOLOGY AND	IMMUNOCHEMISTRY						
2.	Code	3FMN194325							
3.	Study program	Pharmacy							
4	Study program organizer	Faculty of Medical Scien	nces,						
4.	(department, institute, branch)	Goce Delcev University	, Stip						
5.	Degree (first, second, third cycle)	Integrated first and second	nd cycle of studies						
6.	Academic year / semester	Third year /7.Fifth semester7.	Number of ECTS6						
8.	Professor	Assoc. Prof. Dr.sc. Darin	nka Gjorgieva Ackova						
9.	Pre-conditions for course registration	Enrolled in fifth semeste	er of studies						
	Aims of the study program (compet	ences):							
	The subject enables students to obta	in theoretical and practic	cal knowledge in the field of						
10.	immunology; Special attention is paid	I to the understanding of i	immunological mechanisms in						
	the development of the immune resp	onse in health and diseas	se, the types of immune cells						
involved in its development, immunochemical reactions and methods in immunoc									
	Content of the study program (appl	ies both for theoretical a	and practical part).						
	Theoretical part:		ing practical part).						
	1. Introduction to immunology;								
	2. Cells, tissues and organs invo	lved in the immune system	n;						
	3. Innate (non-specific) immunity;								
	4. Acquired (specific) immunity. Cellular and humoral immunity;								
	5. Antigens and antibodies;								
	6. Acquisition, generation and presentation of antigens;								
	7. Cytokines;								
	8. Complement system;								
	9. Immune tolerance, autoimmunity and autoimmune diseases;								
	10. Hypersensitivity reactions;								
	12. Immune response to non-infe	ctious antigens (carcinoge	ns):						
11.	13. Vaccines and active/passive in	nmunization.							
	Practical part:								
	1. Cells and organs of the immu	ne system;							
	2. Blood smear; Microscopic pre	eparations of lymphoid cel	lls and tissues;						
	3. Immunological techniques an	d methods for isolating an	d purifying immune cells;						
	4. Agglutination reactions (non-precipitating antibodies);								
	5. Immunoprecipitation and imm	nunodiffusion;							
	7 Tests based on the lytic activity	ty of complement:							
	8 Immunoassays using different	markers (RIA_FLISA).						
	9. Immunofluorescence:),						
	10. Flow cytometry;								
	11. Serums and vaccines;								
	12. Selected protocols for perform	ning various immunologic	cal tests.						
	Study methods:								
12.	Lectures, theoretical and laboratory ex	ercises, project assignment	nts, consultations.						
	Laboratory exercises are performed in	small groups of up to 10	students.						
13.	Total amount of time available	$6 ECTS \times 30 \text{ hours} = 18$	0 hours (2+3)						
14.	Distribution of tasks	30+45+30+30+45	201						
13.	15.1.	Lectures – theory	30 nours						

	Types of learning/teaching		15.2.	Tutorials (laboratory,		45 hours		
	activities		16.1	auditory), seminars, tear	nwork	20.1		
	Other types of activities			16.1.	Projects		30 hours	
16.				16.2.	Individual tasks		30 hours	
				16.3.	Home study – tasks		45 hours	
	Evalua	tion / as	sessment metho	ods			r	
	17.1.	Tests					40 points	
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)	10 points	
	17.3.	Activit	y and participat	ion			20 points	
	17.4.	Final e	xam				30 points	
					Up to 50 points		5 (five) (F)	
					51 – 60 points		6 (six) (E)	
10					61 – 70 points		7 (seven) (D)
18.	Assess	ment cri	teria (points / g	rade)	71 – 80 points		8 (eight) (C)
					81 – 90 points		9 (nine) (B	5)
					91 - 100 points		10 (ten) (A)
	Elioihi	lity for s	ionature and tal	kino	60% realization of pre-e	xam act	ivities i e 4	12 points
19	the fina	al exam	ignature und ta	ung	from two tests seminary	v or prac	tical work a	nd
17.		ii exuiii			regular participation to t	he organ	nized activities	
20	Language of the study program				Fnglish	ne organ		
20.	Quality	v assurar	ce methods of i	the	Linghish			
21.	teachin	g proces	ree methods of	the	Self-evaluation			
, F	Literati	Mande	tory literature					
		No	Author		Titla	Du	hlichan	Voor
		INO.	Aution	Dr	I Itte			Tear
		1.	Uwen, J. A., f	sunt,	Kuby Immunology (/	W. П.	Freeman	2013
	22.1		J., Stramoru,	5. A.			ompany	
	22.1.	2. Murphy, L., 2. Weaver, C.,		Janeway s	W. W.	Norton &	2022	
			weaver, C., B	serg,	Edition	Company		
		L.		1	Edition)		-	
		3.	Gjorgieva Ac	kova	Authorized lectures	Goce	Delcev	2024
			D.			Universi		
		Addıtı	onal literature					
		No.	Author		Title	Pu	blisher	Year
22					Immunochemistry and			
22.		1	Del Valle, L.		immunocytochemistry:	Huma	na Press	2022
			(Editor)		Methods and protocols			
					(1 st Edition)			
			O'Gorman, M	I. R.	Handbook of human			
		2.	G., Donnenbe	rg, A.	immunology (2 nd	CRC I	Press	2008
	22.2.		D. (Editors)		Edition)			
					Manual of basic			
		3	World Health		techniques for a health	World Health		2012
		^{3.} (Organization		laboratory (2 nd	Organ	ization	2012
					Edition)			
					Immunochemistry and			
		1	Gjorgieva Ac	kova,	immunology	Goce	Delcev	2022
		4. D.	D.		(Имунохемија со	University, Stip		2022
					имунологија)	•·· •		

	Appendix 3 No. 26	Study program for integrated first and second cycle of studies							
1.	Name of the course	PHARMACEUTICAL TECHNOLOGY 2							
2.	Code	3FMN194425							
3.	Study program	Pharmacy							
4.	Study program organizer	Faculty of Medical Sciences,							
-	(department, institute, branch)	Goce Delcev University, Stip							
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies							
6.	Academic year / semester	Sixth semester 7. Number of ECTS 7							
8.	Professor	Assoc. Prof. Dr.sc. Elena Drakalska Sersemova							
9.	Pre-conditions for course registration	Enrolled in sixth semester of studies							
	Aims of the study program (compet	ences):							
10	Understanding of the fundamental p	principles of formulation, and technological processes							
10.	employed during manufacturing, and	the pharmaceutical-technological evaluations essential							
	for assessing pharmaceutical dosage f	orms.							
Content of the study program (applies both for theoretical and practical part): <i>Theoretical part</i>									
	1 Characteristics of Polyphasic	Systems							
	2 Physicochemical aspects of si	systems, spensions Approaches to suspension formulation							
	2. Physicochemical aspects of suspensions, Approaches to suspension formulation, Stability determination:								
	3. Emulsions (Types of Emulsions, Formulation, Factors Affecting Viscosity, Testing.								
	and Biopharmaceutical Aspects);								
	4. Emulsifiers (Types of Emulsifiers, HLB Value, Chemical groups of surface-active								
	agents, Mixed Emulsifiers, Polymeric Emulsifiers);								
	5. Classification and properties of semisolid preparations for topical application, Selection of bases for formulation;								
	6. Creams (Lipophilic and hydrophilic creams, Preparation, Pharmaceutical-								
	7 Ointments (Preparation Type	s of aintment bases (haracterization).							
	 7. Ointments (Preparation, Types of ointment bases, Characterization); 8. Structure of cole (Preparation, Testing, and Use of Used and the of the structure bills); 								
	9. Characterization and evaluation	on of medical pastes:							
	10. Pharmaceutical forms for app	lication in body cavities;							
11.	11. Suppositories, Vaginal Tablet	s, Ocular Inserts (Preparation, characterization, and							
	Pharmaceutical-technological	testing);							
	12. Testing for active substance re	elease from semisolid preparations and stability							
	assessment.								
	1 Preparation of suspensions st	ability monitoring and storage:							
	2. Emulsion Preparation. Stabili	zation. Types of Emulsion:							
	3. Classification and Evaluation	of Inhalations, Types of Preparations, Propellants, and							
	Storage;								
	4. Ointment Preparation, Classif	ication of Ointment Bases;							
	5. Types of creams, Preparation,	, and Applications;							
	6. Medical Gels, Characterizatio	n and Storage;							
	/. Medical Pastes, Classification	and Preparation;							
	o. Characterization of Supposito	ties for Kectal Application, Calculation of							
	9 Preparation and Evaluation of	Vaginal Tablets							
	10. Preparation for Final Practical	Exercise:							
	11. Final Practical Exercise.								
12.	Study methods:								

	Lectures, interactive teaching and research work.								
13.	Total amount of time available				7 ECTS x 30 hours = 210 hours (3+3)				
14.	Distribution of tasks				45+45+0+90+30				
	Turnes of learning/teaching 15.1.			Lectures – theory		45 hours			
15.	activiti	activities 15.2.			Tutorials (laboratory, auditory), seminars, tear	nwork	45 hours		
	16.1.			Projects		0 hours			
16.	Other t	ypes of	activities	16.2.	Individual tasks		90 hours		
				16.3.	Home study – tasks		30 hours		
	Evalua	tion / as	sessment metho	ods					
	17.1.	Tests					40 points		
17.	17.2.	Individ	lual tasks / proje	ect (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participat	ion			20 points		
	17.4.	Final e	xam				30 points		
					Up to 50 points		5 (five) (F))	
					51 – 60 points		6 (six) (E)		
10	Accord	mont ori	torio (nointa / a	rada)	61 – 70 points		7 (seven) (D)	
10.	Assess	ment cri	teria (points / gi	rade)	71 – 80 points		8 (eight) (0	C)	
					81 – 90 points		9 (nine) (B	3)	
					91 – 100 points		10 (ten) (A	<u>,</u>	
	Eligibi	lity for s	signature and tal	king	60% realization of pre-exam activities. i.e., 42 points				
19.	the final exam				from two tests, seminary or practical work, and				
					regular participation to t	he orgar	nized activiti	ies.	
20.	Langua	age of th	e study progran	n	English	Ŭ			
21	Quality	/ assurar	nce methods of t	the	Self evaluation				
21.	teachin	g proces	SS		Self-evaluation				
	Literature								
		Manda	atory literature		Γ	1		1	
		No.	Author		Title	Pu	blisher	Year	
			Drakalska						
		1. Se	Sersemova, E	•,	Pharmaceutical Technology 2 (Book)	Goce I	Delcev	2024	
			Angelovska, I	3.,		Univer	rsity, Stip	2021	
	22.1.		Cvetkovski, A	<u>.</u>					
		2.	Vuleta, G., M	ilic,	Pharmaceutical	harmaceutical Faculty of			
			J., Primorac, I	М.,	Technology 1 Phar		acy,	2019	
			Savic, S.			Belgrade			
				~	Aulton's			0.001	
		3.	Taylor, K. M. G.		Pharmaceutics (6 ^m	Elsevier 2		2021	
22.		A ddit:	anal litanatura		Eallion)				
		No	Author		Title	Du	blichor	Voor	
		INO.	Aution Somoltry A		Eggoutials of	ru	Ulisiei	I cai	
		1	Semalty, A.,		Dhammacoutical	Pharm	amed	2011	
		1.	Dowot M S	м	Tachnology	Press		2011	
			Kawat, M. S.	I VI.	Handbook of	LanL	mbert		
	22.2	2	Rhatt P		Pharmacoutical	Lap La	mic	2021	
	22.2.	2.	Dilati, I.		Technology	Public	hina	2021	
					Angol's	1 40115	unig		
					Pharmacoutical	I innin	cott		
		3	Kluwer V		Dosage Forms and	Willia	ms &	2011	
		3.			Dryo Delivery Systems	Wilkir	115 00	2011	
					(9 th Edition)	** IIKII	10		

	Appendix 3 No. 27	Study program for integrated first and second cycle of studies
1.	Name of the course	PHARMACEUTICAL CHEMISTRY 3
2.	Code	3FMN194525
3.	Study program	Pharmacy
Λ	Study program organizer	Faculty of Medical Sciences,
ч.	(department, institute, branch)	Goce Delcev University, Stip
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies
6.	Academic year / semester	Third year / Sixth semester7.Number of ECTS7
8.	Professor	Full Prof. Dr.sc. Emilija Janevik-Ivanovska Ass. Prof. Dr.sc. Marija Arev
9.	Pre-conditions for course registration	Enrolled in sixth semester of studies
10.	 Aims of the study program (competent The objective of the course Pharmace active ingredients of drugs in order to physicochemical properties, reactivited drug-drug interactions, drug-receptor biological response, with the ultimatic creation of new drugs. Students are expected to: understand the interrelation pharmacological activity, and know the methods and strateg know the interactions between know the general methods and elucidation be able to name and formul nomenclature; know and become able to predimenses 	rences): utical chemistry 3 is the chemical study of drugs and the o determine the relationship between chemical structure, cy, chemical structure-biological activity relationships, interactions, chemical aspect of drug metabolism and te aim of providing the knowledge necessary for the on between structure, physicochemical properties, therapeutic utility; gies used in the generation of drugs; n drugs and their biological targets; ral modifications that affect the properties of the drugs; d the synthetic strategies for the preparation of drugs; spectroscopic methods applicable to the structural of drugs, and related compounds; late a drug in accordance with the systematic IUPAC dict the transformation of drugs in the body; the risks associated with the use of reagents, solvents and in the chemical laboratory; tion related to drugs.
11.	 Medicines that affect the imm Immunosuppressives Immunostimulatory Drugs affecting the central ne Sedatives Hypnotics Tranquilizers Antidepressants CNS stimulants Narcotic analgesics Anticonvulsants Drugs for Parkinson's dis Skeletal muscle relaxants Drugs for Alzheimer's dis 	rvous system

		– Ge	neral anesthetic	s					
		– Lo	cal anesthetics						
	3.	Medici	nes that affect t	he perij	oheral nervous system				
		— Ad	renergic drugs						
		- Ch	olinergic drugs						
		— Ad							
		 Anticholinergic drugs 							
	4.	4. Medicines affecting the cardiovascular system							
		– An	tihypertensive of	drugs					
		– An	tiarrhythmic dr	ugs					
		– An	tianginal drugs						
		– An	tihyperlipidemi	c drugs					
	5.	Medici	nes that affect t	he geni	tourinary system				
		– Dit	uretics						
	6.	Medici	nes that affect t	he ocul	ar, nasal and pulmonary s	ystems			
		— Exp	pectorants						
		– An	titussives						
	7.	Manag	ement of diseas	e states	- rheumatoid arthritis, ob	esity			
	8.	Biologi	ical preparation	s used i	n the treatment of diseases	s			
	9.	Perform	nance enhancin	g drugs	and doping				
12	Study 1	methods	5:						
12.	Lectures, laboratory exercises, consultations, seminars.								
13.	13.Total amount of time available $7 \text{ ECTS x } 30 \text{ hours} = 210 \text{ hours} (3+3)$								
14.	. Distribution of tasks				45+45+15+25+80				
	Types	floarni	ng/teaching	15.1.	Lectures – theory		45 hours		
15.	1 ypes (ing/teaching	15.2	Tutorials (laboratory,		15 hours		
	activitie	-3		13.2.	auditory), seminars, tean	nwork	45 110015		
				16.1.	Projects		15 hours		
16.	Other t	ypes of a	activities	16.2.	Individual tasks		25 hours		
				16.3.	Home study – tasks		80 hours		
	Evaluat	tion / ass	sessment metho	ods					
	17.1.	Tests			40 points				
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)		10 points		
	17.3.	Activity	y and participat	ion		20 points			
	17.4.	Final ex	xam				30 points		
					Up to 50 points		5 (five) (F)		
					51 – 60 points		6 (six) (E)		
10	1	n out oui	tonia (nainta / a	na da)	61 – 70 points		7 (seven) (D)	
10.	Assessi	nent cri	teria (points / gi	rade)	71 – 80 points		8 (eight) (0	C)	
					81 – 90 points		9 (nine) (B)	
					91 – 100 points		10 (ten) (A	.)	
	Eligibil	ity for s	ignature and tal	king	60% realization of pre-ex	xam acti	vities, i.e., 4	2 points	
19.	the fina	l exam	0	C	from two tests, seminary	or prac	tical work, a	ind	
					regular participation to the	he organ	nized activiti	es.	
20.	Langua	ge of th	e study progran	n	English				
21	Quality	assuran	ce methods of	the	Calf analystic				
21.	teachin	g proces	s		Self-evaluation				
	Literatu	ire							
		Manda	tory literature						
22		No.	Author		Title	Pu	blisher	Year	
22.	22.1.				An Introduction to	0.0	1		
		1.	Patrick, G. L.		Medicinal Chemistry	Oxford	1 	2023	
		·····, ·· ··			(7 th Edition)	University Press			

		2.	Lemke, T. L., Williams, D. A., Roche, V. F., Zito, S. W. (Editors)	Foye's principles of medicinal chemistry (8 th Edition)	Lippincott Williams & Wilkins	2019				
		3.	Alagarsamy, V.	<i>Textbook of Medicinal</i> <i>Chemistry Volume II</i> (2 nd Edition)	Elsevier	2010				
		Additional literature								
	22.2.	No.	Author	Title	Publisher	Year				
		1.	Harrold, M. W., Zavod, R. M.	Basic concepts in medicinal chemistry (3 rd Edition)	American Society of Health-System Pharmacists (issuing body)	2023				
		2.	Bhattacharjee, M. K.	Chemistry of Antibiotics and Related Drugs (2 nd Edition)	Springer	2022				
		3.	Thurston, D. E., Pysz, I.	Chemistry and Pharmacology of Anticancer Drugs	CRC Press Taylor & Francis	2021				

	Appendix 3 No. 28		Study program for integrated first and second cycle of studies				
1.	Name of the course		PHARMACOLOGY	2			
2.	Code		3FMN194625				
3.	Study program		Pharmacy				
4	Study program organizer		Faculty of Medical Sci	ience	es,		
4.	(department, institute, branch))	Goce Delcev Universit	ty, St	tip		
5.	Degree (first, second, third cy	cle)	Integrated first and sec	ond	cycle of studie	es	
6.	Academic year / semester		Third year / Sixth semester	7.	Number of ECTS	6	
8.	Professor		Assoc. Prof. Dr.sc. Ma	irija l	Darkovska Ser	rafimovska	
9.	Pre-conditions for course registration		Enrolled in sixth semes	ster o	of studies;		
	Aims of the study program (compet	ences):				
10.	Acquiring knowledge of spec and their therapeutic areas.	ial phar	nacology, in the sense of	of the	e pharmacody	namic groups	
	Content of the study program	m (appl	ies both for theoretical	and	practical pai	rt):	
	Theoretical part:	` • •				,	
	Medicines that act on the central nervous system (anxiolytics and hypnotics, antidepressants, antiepileptics, antiparkinsonian drugs, neuroleptics, analgesics, general anesthetics, local anesthetics, relaxant drugs, drugs for the treatment of Alzheimer's disease); Medicines that cat						
	on the respiratory system; Me	dicines	that act on the cardiovas	scula	ar system (the	rapy for heart	
11.	failure, antiarrhythmics, trea	atment	for angina pectoris,	antił	nypertensives	/ diuretics),	
	Haemostasis and thrombosis, Therapy for anemia, Hematology; Medicines acting on the						
	digestive system; Medicines	acting o	n the urinary system; H	lorm	ones; Antimic	crobial drugs;	
	Medicines in the therapy of m	alignant	diseases.				
	Practical part:	a denna	for different about ooth		autia anauna i	with analoial	
	reference to indications, mech	e urugs anism o	faction and side effects	ierap	eutic groups,	with special	
	Study methods:		r detroit, and side effects				
12.	Lectures, exercises, group disc	cussion	methods, individual wor	·k.			
13.	Total amount of time available	e	6 ECTS x 30 hours = 1	80 h	ours $(3+2)$		
14.	Distribution of tasks		45+30+15+30+30		(-)		
	T 01 · / 1·	15.1.	Lectures – theory		45 hour	·S	
15.	Types of learning/teaching	15.0	Tutorials (laboratory,		20.1		
	activities	15.2.	auditory), seminars, tea	amw	ork 30 hour	S	
		16.1.	Projects		30 hour	S	
16.	Other types of activities	16.2.	Individual tasks		30 hour	S	
		16.3.	Home study – tasks		45 hour	`S	
	Evaluation / assessment method	ods					
	17.1. Tests				40 poin	ts	
17.	17.2. Individual tasks / proj	ect (pres	sentation: written and ora	al)	10 poin	ts	
	17.3. Activity and participat	tion			20 poin	ts	
	17.4. Final exam				30 poin	ts	
			Up to 50 points		5 (five)	(F)	
			51 – 60 points		6 (six) ((E)	
18	Assessment criteria (points / o	rade)	61 – 70 points		7 (sever	n) (D)	
10.	rissessment enterna (points / g	,iuuc)	71 – 80 points		8 (eight	(C)	
			81 – 90 points		9 (nine)	(B)	
			91 – 100 points		10 (ten)	(A)	
	Eligibility for signature and ta	king	60% realization of pre-	-exar	n activities, i.e	e., 42 points	
19.	the final exam	from two tests, seminar	ry or	practical wor	k, and		
		regular participation to	the	organized acti	vities.		

20.	Langua	ige of th	e study program	English				
21.	Quality teachin	assurar g proces	ace methods of the	Self-evaluation				
	Literatu	ıre						
		Mandatory literature						
		No.	Author	Title	Publisher	Year		
22.		1.	Darkovska Serafmovska, M.	Authorized lectures	Goce Delcev University, Stip	2024		
	22.1.	2.	Ritter, J. M., Flower, R. J., Henderson, G., Loke, Y. K., MacEwan, D., Rang, H. P.	Rang & Dale's Pharmacology (9 th Edition)	Elsevier	2020		
		3.	Trevor, A. J., Katzung, B. G., Knuidering-Hall, M.	Katzung & Trevor's Pharmacology: Examination & Board Review (12 th Edition)	McGraw Hill	2019		
		Additi	onal literature	1	1	1		
		No.	Author	Title	Publisher	Year		
	22.2.	1.	Brunton, L. L., Knollmann, B. C.	Goodman & Gilman's: The Pharmacological Basis of Therapeutics (14 th Edition)	McGraw Hill	2022		

	Appendix 3	Study program for integrated first and second				
	NO. 29	BASICS OF SCIENTIFIC RESEARCH AND				
1.	Name of the course	BIOSTATISTICS				
2.	Code	3FMN194725				
3.	Study program	Pharmacy				
4	Study program organizer	Faculty of Medical Sciences,				
4.	(department, institute, branch)	Goce Delcev University, Stip				
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies				
6.	Academic year / semester	Third year / Sixth semester7.Number of ECTS4				
8.	Professor	Full Prof. Dr. sc. Milka Zdravkovska Ass. Prof. Dr.sc. Stefan Arsov				
9.	Pre-conditions for course registration	Enrolled in sixth semester of studies				
	Aims of the study program (compet	ences):				
10	Acquiring knowledge about the basi	ics of medical biostatistics - ways of collecting data,				
10.	grouping the data series and their sta	tistical table and graph. Learning basic parametric and				
	nonparametric tests, demographic and	vital statistics.				
	Content of the study program (appl	ies both for theoretical and practical part):				
	Theoretical part:					
	1. Concept and development of	biostatistics; Statistical table, sample units, types and				
	2 Tabular and graphical present	ation of statistical series. Analysis of the structure of				
	2. Tabular and graphical present	auon of statistical series. Analysis of the structure of				
	3 Analysis of the structure of th	e series with numerical characteristics (mean median				
	mode):	e series with numerical characteristics (mean, meanin,				
	4. Measures of variability: mean	deviation, variance and standard deviation, coefficient				
	5. Hypothesis / testing of hypoth	esis, analysis of statistical relationships (chi-square				
	6. Analysis of the relationships i	in series with numerical characters (Pearson correlation				
	coefficient t, Spearman t rank	correlation coefficient, and multiple correlation);				
	7. Testing the significance of dif	ferences between two environments and arithmetic				
	between two proportions (Stu	dent t-test for independent and dependent samples);				
11	8. Examination of the dynamics	of phenomena (trend, seasonal index);				
11.	9. Vital Statistics, Concepts and 10. Types of studies (descriptive)	and analytical studies):				
	11 Experimental study (randomiz	zation control and test group):				
	12. Structure of scientific paper (i	introduction, results, methods, and discussion).				
	Practical part:					
	1. Plan for statistic research;					
	2. Indices dynamics with constant	nt and variable basis;				
	3. Calculating the arithmetic me	an in non-grouped data, grouped in the interval group				
	and the group without groupe	d interval;				
	4. Calculating the median and th	e mode non-grouped and grouped data;				
	5. Standard deviation in non-gro	uped and grouped data; Coefficient of variation;				
	6. Pearson correlation coefficien	t of t in non-group data;				
	7. Estimation of parameters of the 8. Student t test for two indepen	the sample (π parameter and the parameter μ);				
	9 Linear trend of time series (fo	r odd and even number of years) seasonal indev:				
	10 Analysis of a scientific paper	(nart 1).				
	11. Analysis of a scientific paper	(part 2):				
	12. Analysis of a scientific paper	(part 3).				

12	Study methods:								
12.	Small g	group wo	ork, homework,	, practic	al work, project assignme	nts, disc	ussion.		
13.	Total a	mount o	f time available	e	4 ECTS x 30 hours = 120 hours (2+1)				
14.	Distrib	ution of	tasks		30+15+15+30+30		•		
	Tunes	Types of learning/teaching 15.			Lectures – theory		30 hours		
15.	activiti	es	ng/teaching	15.2.	Tutorials (laboratory, auditory), seminars, tear	Tutorials (laboratory, auditory), seminars, teamwork			
				16.1.	Projects		15 hours		
16.	Other types of activities 16.2. 16.3.			Individual tasks		30 hours			
				Home study – tasks	30 hours				
	Evalua	tion / ass	sessment metho	ods			•		
	17.1. Tests						40 points		
17.	17.2.	17.2. Individual tasks / project (pre			sentation: written and oral)	10 points		
	17.3.	Activity	y and participat	tion			20 points		
	17.4.	Final ex	xam				30 points		
					Up to 50 points	ts			
					51 – 60 points		6 (six) (E)		
10			hania (nainta / a	(a h a u	61 – 70 points		7 (seven) (D)	
18.	Assess	Assessment cifteria (points / grade)			71 – 80 points		8 (eight) (0	C)	
					81 – 90 points		9 (nine) (B)	
					91 – 100 points		10 (ten) (A	.)	
	Eligibi	lity for s	ignature and tal	king	60% realization of pre-exam activities, i.e., 42 points				
19.	the fina	al exam			from two tests, seminary or practical work, and				
					regular participation to the organized activities.				
20.	Langua	age of th	e study progran	n	English				
21.	Quality teachin	assuran g proces	ice methods of s	the	Self-evaluation				
	Literat	ure							
		Manda	tory literature						
		No.	Author		Title	Pu	ıblisher	Year	
	22.1.		Jekel, J. F., K	atz,	Epidemiology,				
22.		1. D. L., Elmore		, J. G,	Biostatistics, and	Elsevier 2007		2007	
			Wild, D.		Preventive Medicine				
		Additi	onal literature						
	22.2.	No.	Author		Title	Pu	blisher	Year	
		1.							

	Appendix 3 No. 30		Study program for integrated first and second cycle of studies					
1.	Name of the course		PHYTOTHERAPY					
2.	Code		3FMN194825					
3.	Study program		Pharmacy					
4	Study program organizer		Faculty of Medical Sci	ience	s,			
4.	(department, institute, branch)		Goce Delcev Universit	ty, St	ip			
5.	Degree (first, second, third cyc	ele)	Integrated first and sec	cond o	cycle of stud	ies		
6.	Academic year / semester		Third year / , Sixth semester	7.	Number of ECTS	6		
8.	Professor		Assoc. Prof. Dr.sc. Vik	ktorij	a Maksimov	a		
9.	Pre-conditions for course registration		Enrolled in sixth semes	ster c	of studies			
	Aims of the study program (compet	ences):					
	Familiarizing students with the	e basics	of rational phytotherap	oy, its	role in prin	nary healthcare		
	and self-medication; current r	egulatio	ons for herbal products	(regu	ulations in the	ne Republic of		
	North Macedonia; European	regula	tions, Expanded Comn	nissi	on E Mond	graphs, WHO		
10.	monographs); indications, cont	traindic	ations, side effects, and i	intera	actions of he	rbal medicines;		
	monograph of officinal herbal	drugs; 1	dentification and determ	ninati	ion of active	components in		
	herbal medicines; efficacy and mechanism of action of herbal medicines on the gastrointestinal							
	tract, cardiovascular system, respiratory system, nervous system, reproductive system, urinary system, and skin system							
	Content of the study program	n (annl	ies both for theoretical	and	nractical n	art)•		
	Theoretical part	ո (արթւ	ies both for theoretical	anu	practical p	ai t <i>j</i> .		
	Concept of rational phytotherapy, herbal preparations, and herbal medicines, relevant legal							
	regulations; Herbal preparations and diseases of the nervous system; Herbal preparations and							
	diseases of the cardiovascular system; Herbal preparations and diseases of the respiratory							
	system; Herbal preparations and diseases of the digestive system; Herbal preparations and							
	diseases of the liver and biliary system; Herbal preparations and diseases of the reproductive							
11.	system; Herbal preparations and diseases of the urogenital system; Herbal preparations as							
	adaptogenic drugs; Herbal pre	paration	al and quality of herbal propagations					
	efficacy of herbal preparations; Control and quality of herbal preparations.							
	Fractional phytotherapy, FMA (European Medicines Agency) monographs: Using monographs							
	from the European Pharmacopoeia for checking the quality of herbal drugs. Using monographs							
	from the World Health Organization related to herbal substances (drugs); Other exercises							
	correspond to the thematic of	chapters	from the theoretical	part,	in the con	text of herbal		
	preparations and their effects of	n diffei	ent organ systems.					
	Study methods:							
12.	Lectures, theoretical and practi	ical exe	rcises, consultations; pre	epara	tion of an in	dependent		
10	seminar paper; practical labora	itory an	d classroom exercises in	$\frac{1}{1001}$	Il groups of	10 students.		
13.	I otal amount of time available		6 ECTS x 30 hours = 1	180 h	ours $(3+2)$			
14.	Distribution of tasks	15.1	45+30+30+30+45		45 ho	140		
15	Types of learning/teaching	13.1.	Tutorials (laboratory		43 110	41.9		
15.	activities	15.2.	auditory) seminars te	amw	ork 30 ho	ırs		
		16.1	Projects	amvv	30 ho	Irs		
16.	Other types of activities	16.2.	Individual tasks		30 ho	urs		
	J1	16.3.	Home study – tasks		45 ho	ırs		
<u> </u>	Evaluation / assessment metho	ds	, <u>, , , , , , , , , , , , , , , , , , </u>					
17	17.1. Tests				40 poi	nts		
17.	17.2. Individual tasks / proje	ect (pres	sentation: written and ora	al)	10 poi	nts		
	17.3. Activity and participat	ion			20 poi	nts		

	17.4.	Final e	xam		30 points			
				Up to 50 points	5 (five) (F)		
				51 – 60 points	6 (six) (E)			
10	1	n ant ani	tonia (nainta / anada)	61 – 70 points	7 (seven) ((D)		
10.	Assessi		terra (points / grade)	71 – 80 points	8 (eight) (0	C)		
				81 – 90 points	9 (nine) (E	8)		
				91 – 100 points	10 (ten) (A	N)		
	Eligibil	ity for s	ignature and taking	60% realization of pre-e	xam activities, i.e., 4	42 points		
19.	the fina	ıl exam		from two tests, seminary or practical work, and				
				regular participation to t	he organized activiti	ies.		
20.	Langua	ige of th	e study program	English				
21.	Quality	assurar	nce methods of the	Self-evaluation				
	Literot	g proces	58					
	Literati	Mandatory literature						
		No	Author	Title	Publisher	Vear		
		110.	Autioi	New Look to	1 donisher	Tear		
			Khan M S A	Phytomedicine				
		1	Ahmad H	Advancements in	Flsevier	2018		
		1.	Chattonadhyay, D.	Herbal Products as		2010		
			•	Novel Drug Leads				
				Rational				
	22.1		Schulz, V., Hansel, R., Blumenthal, M., Tyler, V.	Phytotherapy: A				
	22.1.			Reference Guide for	Springer	2004		
		Ζ.		Physicians &		2004		
22				Pharmacists (5 th				
22.				Edition)				
			Duke, J. A.,					
			Bogenschutz	Handbook of				
		3.	Godwin, M. J.,	medicinal herbs	CRC Press	2002		
			Cellier, J. D., Duke,	medicinal neros				
			P. A.					
		Additi	onal literature					
		No.	Author	Title	Publisher	Year		
	22.2.	1.	Chevallier, A.	<i>Encyclopedia of herbal</i> <i>medicines (3rd Edition)</i>	Penguin Random House	2016		
				European	Council of			
		2. C	Council of Europe	Pharmacopoeia (8 th	Council of	2014		
				Edition)	Europe			

		Appendix 3 No. 31	Study program for integrated first and second cycle of studies											
1.	Name o	f the course	PHARMACEUTIC	AL T	ECHNOLOG	GY 3								
2.	Code		3FMN194925											
3.	Study p	rogram	Pharmacy											
4	Study p	rogram organizer	Faculty of Medical S	cience	es,									
4.	(departi	nent, institute, branch)	Goce Delcev Univers	sity, S	tip									
5.	Degree	(first, second, third cycle)	Integrated first and se	econd	cycle of studi	es								
6.	Academ	nic year / semester	Fourth year / Seventh semester	7.	Number of ECTS	7								
8.	Profess	or	Assoc. Prof. Dr.sc. A	leksa	ndar Cvetkovs	ki								
9	Pre-con	ditions for course	Enrolled in seventh s	emest	er of studies									
).	registra	tion		cificst	er of studies									
	Aims o	f the study program (compet	ences):											
1.0	Acquiri	ng knowledge in the basic pr	rinciples in the develo	opmer	nt of formulat	ions for solid								
10.	dosage	forms, parenteral preparations	and dosage forms for 1	mmur	iization, as we	ll as for blood								
	and blo	od derivatives, technological	procedures during the	ir pro	duction and q	uality control								
	parame	ters during production process	es and final products.	-1										
Content of the study program (applies both for theoretical and practical part):														
	1 neorei	Solid pharmaceutical dosage f	forme granules:											
	1.	Tablets	ionnis, granules,											
	2.	Cansules:												
	3. 4	Coated pharmaceutical dosage	e forms											
	5.	Sterile pharmaceutical dosage	forms:											
	6.	Isotonic solutions, buffer solu	tions:											
	7.	Parenteral preparations, inject	ions;											
	8.	Infusions;	,											
	9.	Solutions for hemodialysis an	d peritoneal dialysis;											
	10.	Eye preparations;												
	11.	Immunobiological dosage for	ms;											
	12.	Blood and blood derivatives d	losage forms.											
	Practice	al part:												
	1.	Techniques for making basic	granulate (<i>Granulatum</i>	i simp	<i>lex</i>), and recip	es for								
1.1	2	Carbonis medicinalis granula	<i>te</i> , and effervescent gr	anula	te;									
11.	2.	Pharmaceutical-technological	tests for powdered ma	terial	(analysis of pa	article size –								
		ine analysis; density of powd	ers – real and apparent	turo i	n granulata):	,								
	3	Technological procedures for	making tablets and ph	armac	eutical techno	logical tests								
	5.	of tablets according to Ph. Fu	r (making a dissolution	n nrof	ile of a conver	ntional								
		tablet).	. (making a dissolutio	ii pioi		ntional								
	4	Technological procedures for	making capsules and r	harm	aceutical-tech	nological								
		tests of capsules according to	Ph. Eur. (making a dis	soluti	on profile of a	conventional								
		capsule):	8		F									
	5.	Creation of a dissolution profi	ile of a conventional so	olid do	sage form and	l a dosage								
		form with a modified release a	and their comparison (in vitr	o monitoring of	of the release								
		rate of medicinal substances f	rom solid dosage form	s);	2									
	6.	Testing of sterility and testing	of the presence of pyr	ogens	in a pharmace	eutical								
		dosage form (LAL-test);												
	7.	Production of parenteral solut	ions in laboratory;											
	8.	Production of ophthalmic prep	parations in laboratory	;										
	9.	Seminar project for pharmace	utical-technological op	peration	ons in the prod	uction of								
		immunobiological preparation	ıs;			immunobiological preparations;								

	10. Training for the final laboratory task;							
	Study	method		or prepa	aning a solid dosage form	Iomuna		
12.	Lecture	es, semir	nars, exercises,	individu	ual assignments, collabora	tive lect	ures, metho	ds of
	group d	liscussic	ons.		C ,		,	
13.	Total a	mount o	f time available	;	7 ECTS x 30 hours = 21	0 hours	(3+3)	
14.	Distrib	ution of	tasks		45+45+30+45+45			
	Types	ofloomi	ng/teaching	15.1.	Lectures – theory		45 hours	
15.	activiti	es	ng/teaching	15.2.	Tutorials (laboratory, auditory) seminars teamwork		45 hours	
				16.1.	Projects		30 hours	
16.	Other t	ypes of a	activities	16.2.	Individual tasks		45 hours	
		16.3			Home study – tasks		45 hours	
	Evaluat	tion / as	sessment metho	ds				
	17.1.	Tests					40 points	
17.	17.2. Individual tasks / project (pre				sentation: written and oral)	10 points	
	17.3. Activity and participation			ion			20 points	
	17.4.	Final e	xam				30 points	
					Up to 50 points		5 (five) (F)	
					51 – 60 points		6 (six) (E)	
18	Access	mont ori	taria (nainta / a	rada)	61 – 70 points		7 (seven) (D)
10.	A350351		terra (pornts / g	laue)	71 – 80 points		8 (eight) (0	C)
					81 – 90 points		9 (nine) (B)
					91 – 100 points		10 (ten) (A	.)
	Eligibility for signature and taking			60% realization of pre-e	xam act	ivities, i.e., 4	2 points	
19.	the final exam				from two tests, seminary	or prac	tical work, a	nd
• •	-				regular participation to t	he orgar	nized activiti	es.
20.	Langua	ige of th	e study program	<u>n</u>	English			
21.	Quality teachin	g proces	ss	the	Self-evaluation			
	Literatu	ure						
		Manda	atory literature		1	1		
		No.	Author		Title	Pu	blisher	Year
	22.1.	1.	Khar, R. K., V S. P.	/yas,	Lachman/Lieberman's The Theory and Practice of Industrial Pharmacy (4 th Edition)	CBS F & Dist Pvt Lt	Publishers tributors d	2015
22.		2.	Sinko, P. J. (E	Editor)	Martin's Physical Pharmacy and Pharmaceutical Sciences (7 th Edition)	Wolter India I	rs Kluwer Pvt Ltd	2020
		Additi	onal literature			I		_
		No.	Author		Title	Pu	blisher	Year
	22.2.	1.	Allen, L., McPherson, T	Ъ.В.	Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems (12 th Edition)	Lippin Willia Wilkir	cott ms & 1s	2021

		2.	Gibson, M. (Editor)	Pharmaceutical Preformulation and Formulation: A Practical Guide from Candidate Drug Selection to Commercial Dosage Form (2 nd Edition)	CRC Press	2009		
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	Appendix 3 No. 32		Study program fo	or inte cle of	egrate f stud	ed first a ies	nd second	
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1.	Name of the course		CLINICAL BIOCH	EMIS	STRY	7		
2.	Code		3FMN195025					
3.	Study program		Pharmacy					
	Study program organizer		Faculty of Medical Second	cience	es,			
4.	(department, institute, branch)		Goce Delcev University, Stip					
5.	Degree (first, second, third cyc	ele)	Integrated first and se	econd	cycle	of studie	es	
6.	Academic year / semester		Fourth year / Seventh semester7.Number of ECTS5					
8.	Professor		Adj. Ass. Prof. Dr.sc. Ljubica Adji Andov					
0	Pre-conditions for course		Enrolled in goverth of	omost	or of c	tudios		
9.	registration		Enrolled in seventh se	emesu	er of s	studies		
	Aims of the study program (compet	ences):					
	– Gaining knowledge	about	different methods an	d tec	hniqu	es used	for clinical	
	biochemistry paramete	er deteri	nination;					
	 Organization of all lab 	boratory	y phases and gaining k	cnowl	edge a	about sev	veral medical	
10.	disorders and how bio	ochemic	al parameters and lab	orator	y met	thods are	e used for the	
	investigation, diagnosi	is and n	nanagement of patients	;				
	 Developing a core kno 	wledge	and understanding of c	linica	l anal	ysis of bo	ody fluids and	
	other biological mater	ial to a	id the diagnosis, therap	by and	l mon	itoring o	of diseases, as	
	well as interpretation of analytical results to other healthcare professionals.							
	Content of the study program (applies both for theoretical and practical part):							
	Interoduction to alinical biochemistry and coining travulates for acception all alines in							
	Introduction to clinical biochemistry and gaining knowledge for organizing all phases in							
	clinical biochemistry laboratories; Biochemical methods and tests for investigation, diagnosis							
	and management of Diabetes mellitus; Biochemical methods and tests for investigation,							
	diagnosis and management of dyslipidemia; Quality control in biochemical laboratories;							
	diagnostic significance and	method	s for their determin	ation	Fund	lamental	s of clinical	
	enzymology: diagnostic sign	ificance	cance of some important enzymes: Electrolytes: calcium					
	magnesium and phosphor: Ire	on. TIE	BC, transferrin and fer	ritin:	diagn	ostic im	portance and	
11.	methods for their determinatio	n: Imm	unochemical methods.		8		T	
	Practical part:	Practical part:						
	Types of blood drawing and b	Types of blood drawing and blood drawing steps; Pipetting techniques; Photometric analysis						
	and centrifugation; Determination of serum glucose concentration with GOD-PAP and method							
	with hexokinase; Total plasma cholesterol and triglycerides determination; Plasma HDL and							
	LDL cholesterol determinatio	n; Seru	im total protein and a	lbumi	n det	erminatio	on; Urea and	
	creatinine in serum and urine	determ	ination; AST and ALT	activ	ity in	serum d	etermination;	
	Amylase activity in serum and	d urine	determination; Sodiun	n and	potas	sium coi	ncentration in	
	serum and urine determination	n; Serur	n iron and TIBC deter	minat	tion; (Cortisol o	determination	
	with WIA method; Practice ex	am.						
12.	Study methods: Theoretical							
13	Total amount of time available	•	5 ECTS x 30 hours =	150 h	ours	(2+2)		
14	Distribution of tasks		30+30+15+30+45	1001		()		
<u> </u>		15.1.	Lectures – theory			30 hour	S	
15.	Types of learning/teaching	15.0	Tutorials (laboratory.			201		
	activities	15.2.	auditory), seminars. t	eamw	ork	30 hour	S	
		16.1.	Projects			15 hour	·s	
16.	Other types of activities	16.2.	Individual tasks			30 hour	S	
	~ *	16.3.	Home study – tasks			45 hour	S	
17.	Evaluation / assessment metho	ds	· *					

	17.1.	Tests			40	points		
	17.2.	Individ	ual tasks / project (pre	sentation: written and oral) 10	points		
	17.3.	Activit	y and participation		20	points		
	17.4.	Final e	xam		30	points		
				Up to 50 points	5 ((five) (F)	1	
				51 – 60 points	6 ((six)(E)		
10	1	mant ani	tonia (mainta / anada)	61 – 70 points	7 ((seven) (D)	
10.	Assess		teria (points / grade)	71 – 80 points	8 ((eight) (C	C)	
				81 – 90 points	9 ((nine) (B)	
				91 – 100 points	10	(ten) (A	.)	
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam activiti	es, i.e., 4	2 points	
19.	the fina	al exam		from two tests, seminary or practical work, and				
				regular participation to t	he organized	d activiti	es.	
20.	Langua	age of th	e study program	English				
20.	Quality assurance methods of the			Self-evaluation				
21.	teachin	ig proces	58					
	Literat	ure						
		Manda	atory literature	-	1		r	
		No.	Author	Title	Publis	her	Year	
			Murphy, M.,	Clinical hiochemistry				
	22.1	1.	Srivastava, R.,	(7 th Edition)	Elsevier		2023	
22	22.11		Deans, K.	(7 Edition)				
			Burtis, C. A.,	Tietz Fundamentals of				
		2.	Ashwood, E. R.,	Clinical Chemistry (6^{th}	Saunders		2007	
			Bruns, D. E.	Edition)				
		Additi	onal literature		1		r	
	22.2.	No.	Author	Title	Publis	her	Year	
			1.	Research papers in t	he field of clinical biochen	nistrv		

	Appendix 3	Study program for integrated first and second						
	N0. 55	DRUG AND MEDICINAL PRODUCT						
1.	Name of the course	ANALYSIS						
2.	Code	3FMN195125						
3.	Study program	Pharmacy						
4	Study program organizer	Faculty of Medical Sciences,						
4.	(department, institute, branch)	Goce Delcev University, Stip						
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies						
6.	Academic year / semester	Fourth year / Seventh semester7.Number of ECTS7						
8.	Professor	Ass. Prof. Dr.sc. Ivana Mitrevska						
9	Pre-conditions for course	Enrolled in seventh semester of studies						
).	registration							
	Aims of the study program (competences):							
10.	aimed at providing the student with the knowledge and the practice of chemical and instrumental methods for the identification of substances reported in European Pharmacopoeia monographs, improving his critical skills in approaching analytical challenges in the pharmaceutical field. The students will be able to deal with various advanced instrumental techniques for identification, characterization, and quantification of drugs. The study program enhances the learners' awareness of regulatory and good manufacturing requirements in the Drug and Medicinal Product industries and introduces students to how scientists work and communicate. The study program objective is to demonstrate the place and importance of quality control of medicines, to discover the reference works and international standards, to take a practical approach to the analytical techniques applied to medicines during their life cycle, to finally be able to propose the quality control of a pharmaceutical form (raw materials and finished products). It provides a broad introduction to the drug and medicinal products industry, with an overview of manufacturing practices and environmental considerations. Students also learn about various							
	Content of the study program (appl	ies both for theoretical and practical part).						
	Theoretical part:	its both for theoretical and practical party.						
	1. Objectives and goals of mode	rn pharmaceutical analysis: an overview;						
	2. Combinatorial chemistry and	solid-state analysis;						
	3. Degradation and impurity ana	lysis for pharmaceutical drug candidates;						
	4. Pre-formulation (physicochen	nical parameters & excipient compatibility) tests;						
	5. Solid dosage form analysis;							
	6. Parenteral dosage forms;							
	7. New drug delivery systems;							
11	8. Compendial testing;	a abarratorization of degradation products						
11.	9. Forced degradation studies an Practical part:	a characterization of degradation products.						
	1 Interpretation of regulatory co	onsiderations and compliance with main focus on						
	 International Conference on F Quality of Medicines (EDQM Interpretation of the propertie UV/VIS spectroscopy), prope 	Iarmonization (ICH), European Directorate for the [) and regulatory authorities in the United States (FDA); s associated with the molecular level (examination of erties associated with the particulate level (examination						
	of incroscopy) and properties	associated with the bulk level (examination of particle						
	3 Examination of I C-MS meth	ods that are widely used in analysis and characterization						
	of degradation impurities;							

in-depth examination of thermal methods, Fourier transform IR (FTIR), NIR, Raman spectroscopy; 5. Identification of raw materials with NIR method according to European Pharmacopocia monograph; 6. 6. Interpretation of <i>ni vitro</i> transport experiments using heat-stripped human epidermis mounted in Franz diffusion chambers; 8. 8. Interpretation of a compendial testing for formulated products and active ingredients; 9. 9. Examination of thermal degradation on solid dosage form and characterization of unknown impurity. 12. 12. Study methods: 7 ECTS x 30 hours = 210 hours (3+3) 14. 13. Total amount of time available 7 ECTS x 30 hours = 210 hours (3+3) 14. 14. Distribution of tasks 45+45+0+60+60 15. 15. Types of leaming/teaching activities 15.1. Lectures - theory 45 hours 16. Other types of activities 16.1. Projects 0 hours 17.1. Tests 40 points 17.1. 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.1. Tests 9 points 5 (five) (f) 17.3.		4. Interpretation of an analytical techniques and instruments for pre-formulation studies,						on studies,		
spectroscopy: S. Identification of raw materials with NIR method according to European Pharmacopoeia monograph; 6. Interpretation of microbiological testing of parenteral formulations; 7. Interpretation of in viro transport experiments using heat-stripped human epidemis mounted in Fraz diffusion chambers; 8. Interpretation of a compendial testing for formulated products and active ingredients; 9. Examination of thermal degradation on solid dosage form and characterization of unknown impurity. 12. Study methods: 1 13. Total amount of time available 7 ECTS x 30 hours = 210 hours (3+3) 14. Distribution of tasks 45445+0+60+60 15. Types of learning/teaching activities 15.1. Lectures – theory 45 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.2. Individual tasks 60 hours 17.1. Tests 16.3. Home study – tasks 60 hours 17.3. Activity and participation 20 points 71.6 (pints / grade) 17.4. Final exam 30 points 5 (five) (F) 19. Eligibility for signature and taking 60% realization of pre-exam activities, i.e., 42 points 19. Eligibility for signature and taking 60% realization of pre-exam activities, i.e., 42 points			in-dept	h examination of	of therm	hal methods, Fourier trans	form IR	(FTIR), NII	R, Raman	
5. Identification of raw materials with NIR method according to European Pharmacopoeia monograph; 6. Interpretation of <i>in vitro</i> transport experiments using heat-stripped human epidermiss mounted in Franz diffusion chambers; 8. Interpretation of a compendial testing of parenteral formulations; 7. Interpretation of a compendial testing of formulated products and active ingredients; 9. Examination of thermal degradation on solid dosage form and characterization of unknown impurity. 12. Study methods: 13. Total amount of time available 7 ECTS x 30 hours = 210 hours (3+3) 14. Distribution of tasks 45+45+0+60+60 15. Types of learning/teaching activities 15.1. Lectures - theory 45 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.2. Individual tasks 60 hours 17.1. Tests 10.1. Projects 0 hours 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.1 17.4. Final exam 51 = 60 points 5 (five) (P) 18. Assessment criteria (points / grade) 51 = 60 points 9 (nine) (B) 91 = 100 points 7 (seven) (D) 71 - 80 points 9 (nine) (B) 91 = 100 points 10 (ten) (A) 60% realization of pre-exam activ		~	spectro	scopy;						
1 Priamacopoeta monograph; 6 Interpretation of microbiological testing of parenteral formulations; 7. Interpretation of <i>in vitro</i> transport experiments using heat-stripped human epidermis mounted in Franz diffusion chambers; 8. Interpretation of a compendial testing for formulated products and active ingredients; 9. Examination of thermal degradation on solid dosage form and characterization of unknown impurity. 12. Study methods: 13. Total amount of time available 7 ECTS x 30 hours = 210 hours (3+3) 14. Distribution of tasks 45+45+06+60+60 15. Types of learning/teaching activities 15.1. Lectures – theory 45 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.1. Projects 0 hours 17.1. Tests 10 goints 17.1. 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.1. 17.4. Final exam 30 points 5 (five) (F) 51-60 points 7 (seven) (D) 17.4. Final exam 50 (five appoints) 9 (nine) (B) 91-100 points		5.	Identifi	ication of raw n	haterials	s with NIR method accord	ling to E	uropean		
0. Interpretation of in uitrobiological testing of parenterial formutations; 7. Interpretation of a compendial testing for formulated products and active ingredients; 8. Interpretation of a compendial testing for formulated products and active ingredients; 9. Examination of the mail degradation on solid dosage form and characterization of unknown impurity. 12. Study methods: 13. Total amount of time available 7 ECTS x 30 hours = 210 hours (3+3) 14. Distribution of tasks 45:45:40+60+60 15. Types of learning/teaching activities 15.1. Lectures - theory 45 hours 16. Projects 0 hours 16.3. Hone study – tasks 60 hours 16. Projects 0 hours 16.3. Hone study – tasks 60 hours 17.1. Tests 40 points 17.3. Activity and participation 20 points 17.4. Final exam 19. Individual tasks / project (presentation: written and oral) 10 points 10 (ten) (A) 19. the final exam 5 (five) (F) 51 - 60 points 5 (five) (C) 19. the final exam 90 points 10 (ten) (A) 10 (ten) (A)		6	Intorna	acopoeia monog	graph;	al tasting of manantanal f				
1. Interpretation of who bases of experiments using nearestripped number sympton texperiments using nearestripped number of the string in the string interval and active ingredients; 9. Interpretation of a compendial testing for formulated products and active ingredients; 9. Examination of thermal degradation on solid dosage form and characterization of unknown impurity. 12. Study methods: 13. Total amount of time available 7 ECTS x 30 hours - 210 hours (3+3) 14. Distribution of tasks 45+45+0+60+60 15. Types of learning/teaching activities 15.1. Lectures - theory 45 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.1. Projects 0 hours 17.1. Tests 16.2. Individual tasks 60 hours 17.1. Tests 40 points 17.1. 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.1. Testa 10 points 17.4. Final exam 30 points 17.4. Final exam Up to 50 points 5 (five) (F) 51 - 60 points 6 (six) (L) 18.		0. 7	Interpre	etation of in vit	o trans	cal testing of parenteral to	of strip	ons;	nidormia	
8. Interpretation of a compendial testing for formulated products and active ingredients; 9. Examination of thermal degradation on solid dosage form and characterization of unknown impurity. 12. Study methods: 13. Total amount of time available 7 ECTS x 30 hours = 210 hours (3+3) 14. Distribution of tasks 454+50+60+60 15. activities 15.1. Lectures - theory 45 hours 16. Other types of learning/teaching activities 15.1. Lectures - theory 45 hours 16. Other types of activities 16.1. Projects 0 hours 17.1. Tests 16.2. Individual tasks 60 hours 17.2. Individual tasks / project (presentation: written and oral) 10 points 17.4. Final exam 30 points 18. Assessment criteria (points / grade) 61 - 70 points 5 (five) (F) 18. Assessment criteria (points / grade) 61 - 70 points 7 (cswen) (D) 19. the final exam 0 points 9 (nine) (B) 19. turbuty assurance methods of the taching process 60% realization of pre-exam activities, i.e., 42 points 20. Language of the study program English 20. Language of the study program English 21. turbuty assurance methods of the taching process Self-evaluation 20 council of Lurope		7.	7. Interpretation of <i>in vitro</i> transport experiments using near-supped numan epidemits							
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			Abuia S	Handbook of Modern		
		3.	Alluja, S., Sovninski S	Pharmaceutical	Academic Press	2010
			Scypiliski, S.	Analysis (2 nd Edition)		
				Pharmaceutical		
				Analysis: A Textbook		
		4.	Watson, D. G.	for Pharmacy Students	Elsevier	2020
				and Pharmaceutical		
				Chemists (5 th Edition)		
		5	Vor A	Pharmaceutical Drug	New Age	2021
		5.	Kal, A.	Analysis	International	2021
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			Pedersen-	Introduction to		
		2	Bjergaard, S.,	Pharmaceutical	Wilow	2010
		5.	Gammelgaard, B.,	Analytical Chemistry	wney	2019
			Halvorsen, T. G.	(2 nd Edition)		
		4.	Hansen, S. H.	Introduction to		
				Pharmaceutical	Wiley	2011
				Chemical Analysis (1 st	will y	2011
	22.2			Edition)		
		5.	Skoog, D., West,	Fundamentals of	Cengage	
			D., Holler, F.,	Analytical Chemistry	Learning	2021
			Crouch, S.	(10 th Edition)	Louining	
				Quality Assurance and		
				Quality Control in the		
		6	Konieczka P	Analytical Chemical	CRC Press	2018
		0.		Laboratory: A		2010
				Practical Approach		
				(2 nd Edition)		
				Quality Culture in the		
				Pharmaceutical		
		_		Industry:	Business	
		7.	Rodríguez-Pérez, J.	Implementing a	Excellence	2021
				Behavior-based	Consulting	
				Quality and		
				Compliance Culture		
				Good Manufacturing		
		8.	Bunn, G. P.	Practices for	CRC Press	2019
		0.		Pharmaceuticals (/"		_017
				Edition)		

	Appendix 3 No. 34	Study program for integrated first and second cycle of studies							
1.	Name of the course	DRUG METABOLISM							
2.	Code	3FMN195225							
3.	Study program	Pharmacy							
4	Study program organizer	Faculty of Medical Sciences,							
4.	(department, institute, branch)	Goce Delcev University, Stip							
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies							
6.	Academic year / semester	Fourth year / Seventh semester7.Number of ECTS5							
8.	Professor	Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova							
9.	Pre-conditions for course registration	Enrolled in seventh semester of studies							
10.	Aims of the study program (competences): The course provides students with the acquisition of theoretical and practical knowledge in the field of drug metabolism and biochemical modifications with the participation of specialized enzyme systems. Special attention has been paid to understanding and defining the potential toxicity of drugs and enzyme-mediated detoxification mechanisms, the activation and deactivation of drugs, drug-drug interactions and genetic polymorphisms important for determining the duration and intensity of the pharmacological effect of drugs. Possibilities of applying metabolic principles in the development of modern therapies are also discussed.								
11.	 <i>Theoretical part:</i> Introduction – chemical and e Basic principles of metabolism; Reaction of hydrolysis, reduct Cytochrome P450 (CYP enzy) Induction and inhibition of CV Enzyme induction/inhibition a Phase II of drug metabolism – sulfation, acetylation, conjuga Pharmacogenetics and individ 10. Membrane transporters/carrie Drug interactions at the level <i>Practical part:</i> Introduction; Role of the physicochemical part: Introduction; Protein binding of drugs in plate <i>In vitro</i> techniques for examin Preparation of samples for examin Immuno-tests for examination Methods for determining metabolism 	enzymatic aspects of metabolism; n of xenobiotics; tion and oxidation; mes); YP enzymes. Xenosensors; and chemical carcinogenesis; - Conjugation reactions (glucuronidation, methylation, tion with glutathione, conjugation with amino acids); hualized pharmacotherapy; rs and drug response; of drug metabolism. properties od drugs for their metabolism; asma; ning drug metabolism and drug metabolites; ing drug metabolism and drug metabolites; amination of drug metabolism; ls for examining drug metabolism; sessesment of drug metabolites; abolizing phenotype (acetylation, CYP enzymes).							
10	Study methods:	romaisas project assignments computations							
12.	Lectures, theoretical and laboratory ex	small groups of up to 10 students							
12	Total amount of time available	5 FCTS x 30 hours = 150 hours (2+2)							
14.	Distribution of tasks	30+30+15+30+45							

Faculty of Medical Sciences, Goce Delcev University

	Types of learning/teaching 15.1.			Lectures – theory		30 hours			
15.	activiti	es	ing/teaching	15.2	Tutorials (laboratory,		30 hours		
	activiti				auditory), seminars, tea	mwork	50 110015		
				16.1.	Projects		15 hours		
16.	Other t	ypes of	activities	16.2.	Individual tasks		30 hours		
-	D 1			16.3.	Home study – tasks		45 hours		
	Evalua	$\frac{t_{100}}{T}$	sessment metho	ods			40		
17	17.1.	Tests		. (1	1\	40 points		
17.	17.2.	Individ	lual tasks / proje	ect (pres	sentation: written and oral)		10 points		
	17.4	Activit	y and participat	10n			20 points		
	1/.4.	Final e	xam		Up to 50 points		50 points 5 (five) (F)	
					51 60 points		5 (live) (F))	
					51 - 00 points		$\frac{1}{7}$ (seven) ((ח	
18.	Assess	ment cri	teria (points / g	rade)	71 - 80 points		$\frac{7}{8}$ (seven) ((D)	
					71 - 80 points 81 - 90 points		9 (nine) (F	2) 2)	
					91 - 100 points		$\frac{9}{10}$ (ten) (A	<u>)</u>	
	Fligibi	lity for s	signature and tal	kina	60% realization of pre-	evam act	ivities ie	12 noints	
19	the fina	al exam	signature and ta	king	from two tests, seminar	v or prac	tical work.	and	
17.	uie iinai exam				regular participation to	the organ	nized activit	ies.	
20.	Language of the study program				English				
0.1	Quality assurance methods of the								
21.	teaching process				Self-evaluation				
	Literat	ure							
		Manda	atory literature						
		No.	Author		Title	Pu	ıblisher	Year	
		1. Pearson, P. G. Wienkers, L.		Handbook of drug					
			., C	metabolism (3 rd	CRC I	CRC Press			
				0.	Edition)				
		2. Coleman, M. (Editor)	D.	Human drug	John Wilev &		0010		
	22.1.			metabolism (2^{ma})	Sons I	Ltd	2010		
			× ,		Edition)				
					Drug metabolism (Mamabanupan ug				
			Gjorgieva Ac	kova,	(метаоолизам на	Casal	Dalaari		
22		3.	D., Janevik-		http://enripts.uad	Unive	Delcev	2018	
22.			Ivanovska, E.		edu mk/id/enrint/	Unive	isity, sup		
					212/13				
		Additi	onal literature		21245				
		No	Author		Title	Pu	blisher	Year	
		110.	7 Tutiloi		A handbook of	10	ionionei	1 cui	
		1.	Evans, G. (Ed	litor)	hioanalysis and drug	CRCI	Press	2004	
	22.2)	metabolism			200 - 1	
	22.2.		Zhang, D., Zh	iu, M.,	Drug metabolism in	Ial T	V:1 0		
		2.	Griffith		drug design and	John V	viley &	ley & 2008	
		Humphrey	Humphreys, V	<i>W</i> . G.	development	Sons I	Sons Ltd		
		2	Ionescu, C., C	Caira,	Drug metabolism –	Spring	or	2005	
		3	3. M. R.	M.R.		Current concepts	Springer		2003

	Appendix 3 No. 35	Study program for integrated first and second cycle of studies			
1.	Name of the course	BROMATOLOGY			
2.	Code	3FMN195325			
3.	Study program	Pharmacy			
4	Study program organizer	Faculty of Medical Sciences,			
4.	(department, institute, branch)	Goce Delcev University, Stip			
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6.	Academic year / semester	Fourth year / Seventh semester7.Number of ECTS6			
8.	Professor	Assoc. Prof. Dr.sc. Katarina Smilkov			
9.	Pre-conditions for course registration	Enrolled in seventh semester of studies			
10.	 Acquire foundational knowled compositional analysis of foo Develop familiarity with anal quality and safety of food pro applications; Understand the role and response of food products and drinking 	dge in bromatology, including the classification and d products and drinking water; ytical methodologies employed in the assessment of the oducts and drinking water, and their practical onsibilities of pharmacists in the evaluation and analysis g water to ensure public health safety.			
11.	 History of Bromatology: defined evelopment of bromatology, Definition and classification of categorization of nutrients; Energy value of food. Analysis products; Principles of rational human mevidence-based human nutritients Quality and health safety of d and the safety standards for p Carbohydrates: structure, classification of lipids: structure, classification of lipids. Evaluate Role of lipids as macronutrients in huter and the substance; Proteins: structure, classification of lipids. Evaluate Role of lipids as macronutrients in huter and the substance of protein of amino acids and their significance; Micronutrients: vitamins and hydrosoluble types, with emp mineral substances, including their critical importance in matrix of their functional roles, and pot 11. Genetically Modified Foods. and their health and safety aspective. 	nition and objectives. Brief overview of the historical including its definition and primary aims; of nutrients. Comprehensive definition and is of the caloric and energy content of various food nutrition. Foundational principles of balanced and on; irinking water. Examination of water quality parameters otable water; ssification, and nutritional role. Analysis of products and their quality. Role of carbohydrates as uman nutrition; n, and nutritional role. Structural composition and ation of lipid-containing food products and their quality. nts, with a focus on fatty acids and their nutritional ion, and nutritional role. Examination of protein-rich nilk, dairy products, eggs, and fish, along with their as as essential macronutrients in human nutrition. Role ficance in metabolic processes and overall nutrition; minerals. Classification of vitamins into liposoluble and hasis on their roles as vital micronutrients. Overview of macroelements and trace elements (oligoelements), and aintaining health; nsiderations. Analysis of the types of food additives, ential health implications; Definition and evaluation of genetically modified foods pects;			
	12. Health aspects of food contan microbiological, chemical, an	nination. Examination of food contamination by d radiological agents, and their impact on public health:			

	13.	Bioactive components	in food	. Analysis of bioactive compound	ls in food products and					
	Duratio	their significance in pr	omotin	g health and preventing diseases.						
	Practic	al part:	1	··· · · · · · · · · · ·						
	1.	1. Energy value of food and composition of dietary diet: Assessment of the caloric								
		content and energy balance of food, alongside the nutritional composition of a daily meal;								
	2									
	2. Determination of water content in food products: Analytical techniques for									
	quantitying water content in food products, with implications for quality and									
	2	preservation;	fata a f	1	- levels of deinteins					
	3.	Analysis and health sa		drinking water: Comprehensive an	halysis of drinking					
		water, locusing on qua	inty cor	itrol parameters and compliance v	with health safety					
	4	Standards; Drotoin analysis in foo	d n radu	ate and quality accomments Evalu	ation of protain					
	4.	Protein analysis in 100	a produ ta inali	ding methods of analysis and gu	ation of protein					
	5	Eat analysis in food nr	oducte o	ading includes of analysis and qua	linty assessment,					
	5.	auantifying and assess	ing the	quality of fats in food products:	r approaches to					
	6	Carbohydrate analysis	in food	products and quality assessment:	Methods for					
	0.	determining carbohydr	ate con	tent in food products with an emi	phasis on quality					
		evaluation.		tent in 1000 products, with an enig	onusis on quanty					
	7	Wine analysis: Chemic	cal and	sensory analysis of wine includin	g quality control and					
	<i>,</i> .	safety assessments:	un unu		5 quanty control and					
	8.	Analysis of vitamins a	nd mine	erals in food products: Ouantitativ	e and qualitative					
		analysis of vitamins an	d mine	rals, evaluating their presence and	l bioavailability in					
		food products;			•					
	9.	Food additives: Exami	nation of	of food additives, including their i	dentification,					
		functional roles, and p	otential	health impacts.						
	Study methods:									
12	Lectures, theoretical and practical exercises, consultations, self-based learning, additional									
12.	prepara	tions for exams and tes	ts.							
	Practice	e: Laboratory exercises	in smal	l groups of 10 students, auditorial	exercises.					
13.	Total a	mount of time available		6 ECTS x 30 hours = 180 hours	(3+2)					
14.	Distrib	ution of tasks		45+30+0+45+60	1					
	Types (of learning/teaching	15.1.	Lectures – theory	45 hours					
15.	activitie	es	15.2	Tutorials (laboratory,	30 hours					
	uotivitti		10.2.	auditory), seminars, teamwork	50 110015					
			16.1.	Projects	0 hours					
16.	Other t	ypes of activities	16.2.	Individual tasks	45 hours					
			16.3.	Home study – tasks	60 hours					
	Evaluat	tion / assessment metho	ds							
	17.1.	Tests			40 points					
17.	17.2.	Individual tasks / proje	ct (pres	sentation: written and oral)	10 points					
	17.3.	Activity and participat	ion		20 points					
	17.4.	Final exam			30 points					
				Up to 50 points	5 (five) (F)					
				51 – 60 points	6 (six) (E)					
18	Assess	ment criteria (noints / o	ade)	61 – 70 points	7 (seven) (D)					
10.	Assessment enterna (points / grade)			71 – 80 points	8 (eight) (C)					
				81 – 90 points	9 (nine) (B)					
				91 – 100 points	10 (ten) (A)					
	Eligibil	ity for signature and tak	king	60% realization of pre-exam act	ivities, i.e., 42 points					
19.	the fina	ıl exam		from two tests, seminary or practical work, and						
				regular participation to the organ	nized activities.					
20	Language of the study program			English						

21.	Quality assurance methods of the teaching processSelf-evaluation							
	Literatu	ure						
		Manda						
		No.	Author	Title	Publisher	Year		
		1.	Smilkov, K.	Authorized lectures	Goce Delcev University, Stip	2024		
	22.1.	2.	Nielsen, S. S. (Editor)	Food Analysis (5 th Edition)	Springer International Publishing AG	2017		
		3.	Belitz, H. D., Grosch, W., Schieberle, P.	Food Chemistry (4 th Edition, revised and extended)	Springer – Verlag Berlin, Heidelberg	2009		
22.		4.	Nielsen, S. S.	Food Analysis Laboratory Manual (3 rd Edition)	Springer International Publishing AG	2017		
		Additi	onal literature					
		No.	Author	Title	Publisher	Year		
	22.2.	1.	Hurst, W. J. (Editor)	Methods of Analysis for Functional Foods and Nutraceuticals (2 nd Edition)	CRC Press	2008		
		2.	Pearson, D.	Laboratory techniques in food analysis	National College of Food Technology, University of Reading	2001		

	Appendix 3 No. 36	Study program for integrated first and second cycle of studies				
1.	Name of the course	ADVANCED DRUG AND MEDICINAL				
2	Code	3FMN195425				
3.	Study program	Pharmacy				
4	Study program organizer	Faculty of Medical Sciences,				
4.	(department, institute, branch)	Goce Delcev University, Stip				
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies				
6.	Academic year / semester	Fourth year / Eighth semester7.Number of ECTS7				
8.	Professor	Ass. Prof. Dr.sc. Ivana Mitrevska				
9.	Pre-conditions for course registration	Enrolled in eighth semester of studies				
10.	Aims of the study program (competences): The study program is a problem, lab-based subject that mimics operations within a pharmaceutical/biopharmaceutical company. Students work in teams to analyze pharmaceutical components using international pharmacopoeias, as well as creating all relevant documentation (batch records, SOPs, quality specifications, certificates of analysis). Another aspect involves examining dissolution profiles of a range of medicinal product formulations. The students will learn how to manage and solve problems concerning qualitative drug analysis and the quality control of compounds of pharmaceutical interest and the report and discuss the results. This study program seeks to enhance the learner's knowledge of working within regulated scientific environments with a focus on fundamental concepts of quality assurance. Validation of methods are examined and detailed to ensure compliance with the regulatory authorities such as ICH, EMA and FDA. One of the main objectives of the study program is to deliver a wide range of experimental- focused analytical skills in modern laboratory settings. The program also aims to equip the graduate to pursue a career as an analytical scientist employed in the pharmaceutical and chemical sectors or to prepare the graduate to embark on further postgraduate research studies across the pharmaceutical and chemical sciences. Through successfully completing this program, the learners will acquire the competence to excel in the laboratory as an analytical					
11.	 Content of the study program (appl Theoretical part: Analytical method developme Setting specifications at differ Validation of pharmaceutical Stability studies (accelerated, formulations); Analytical methodology trans Pharmaceutical analysis docu An innovative separation plat Predictive <i>in vitro</i> dissolution Quality control in the pharma Practical part: Interpretation of analytical Doc impurities, inorganic impurities container extractables; tests of water content, content uniform content; microbial tests; disso tests for particle size and poly 	ies both for theoretical and practical part): ent through Quality by Design (QbD); rent stages of drug development; test methods; intermediate and long-term stability testing of fer; mentation; form; tools: application during formulation development; ceutical industry. DE approach of tests for organic synthetic process es, degradation products, residual solvents, and f various physicochemical properties, chiral purity, nity, and antioxidant and antimicrobial preservative lution/disintegration tests; hardness/friability tests; and morphic form;				

	2.	2. Statistical concepts employed in setting specifications and their relationship to product quality control include accidental and systemic errors, frequency								
		distribu	itions, measures	s of disj	persion, standard deviations	s, stand	ard errors, a	nd		
	3	3. Determination of method specificity to ensure "peak nurity" on the main compound								
	5.	to be determined, confirm that no related compound or product ingredient coelutes								
		and interferes with the measurement of the assaved compound.								
	4.	Evaluation and interpretation of the results obtained during stability testing of drug								
		product	products according to ICH Q1A;							
	5.	Analyst four sit	is of results/stat es simultaneous	tistical _] sly;	packages for a drug product	t poten	cy assay trar	sferred to		
	6.	Interpre	etation of a vari	ety of a	nalytical reports during pro	oduct li	fe cycle of the	ne process		
		consists	s of sequential p	phases a	and milestones;					
	7.	Interpre	etation of separ	ation of	HSV PCR-positive and PC	CR-neg	ative CSF sp	pecimens		
	0	by mici	cochip electroph	ioresis;	1	1.0		• ,		
	8.	Interpre	etation of altern	ative m	iultivariate statistical approx	ach for	in vivo-in vi	tro		
	9	Internre	etation of robus	t qualit	v control measures through	, out the	manufactur	inα		
).	process	conduct throu	oh prod	luct testing and analysis ad	here to	Good Man	ifacturing		
		Practice	es (GMP) stand	lards an	d data integrity. Role and re	espons	ibilities of a	ualified		
		persons	according to E	udraLe	ex Annex 16 (Certification b	y a Qı	alified Perso	on and		
		Batch F	Release).		×	•				
12	Study	methods	S:							
12.	Lecture	es, practi	ce, individual a	issignm	ents, and group discussions	5.				
13.	Total a	mount o	f time available		7 ECTS x 30 hours = 210	hours	(3+3)			
14.	D1str1b	ution of	tasks	1 7 1	45+45+0+60+60		451			
15	Types of learning/teaching			15.1.	Lectures – theory		45 hours			
15.	activiti	es		15.2.	auditory) seminars team	work	45 hours			
				16.1	Projects	WUIK	0 hours			
16	Other t	vpes of a	activities	16.2	Individual tasks		60 hours			
10.		/p== == =		16.3.	Home study – tasks		60 hours			
	Evaluat	tion / ass	sessment metho	ds	, <u> </u>					
	17.1.	Tests					40 points			
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral)		10 points			
	17.3.	Activity	y and participat	ion			20 points			
	17.4.	Final ex	kam				30 points			
					Up to 50 points		5 (five) (F)			
					51 - 60 points		6 (s1x) (E)			
18.	Assessi	ment crit	teria (points / gi	rade)	61 - 70 points		$\frac{1}{2}$ (seven) (D)		
				,	71 - 80 points		δ (eight) (C	_)		
					81 - 90 points		9 (nine) (B)		
	Fligibil	ity for s	ionature and tal	zina	91 - 100 points	am acti	vities i.e. A) 2 points		
19	the fina	il exam	ignature and tai	ung	from two tests seminary	or prac	tical work a	nd		
17.		ii enuill			regular participation to the	e orgar	ized activiti	es.		
20.	Langua	ge of the	e study program	1	English	<u></u>				
21	Quality	assuran	ce methods of t	the	Salf analystics					
21.	teachin	<u>g proce</u> s	S		Self-evaluation					
	Literatu	ıre								
22.	22.1	Manda	tory literature							
		No.	Author		Title	Pu	blisher	Year		

		1.	European Pharmacopoeia Commission	European Pharmacopoeia (Ph. Eur.)	Council of Europe	Current issue
		2.	The International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use	ICH Guidelines	European Medicines Agency (EMA)	Current issues
		3.	Ahuja, S., Scypinski, S.	Handbook of Modern Pharmaceutical Analysis (2 nd Edition)	Academic Press	2010
		4.	Watson, D. G.	Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists (5 th Edition)	Elsevier	2020
		5.	Kar, A.	Pharmaceutical Drug Analysis	New Age International	2021
		Additi	onal literature			
		No.	Author	Title	Publisher	Year
		1.	The British Pharmacopoeia Commission	British Pharmacopoeia (BP)	Medicines & Healthcare Products Regulatory Agency of the United Kingdom	Current issue
		2.	The United States Pharmacopeial Convention	United States Pharmacopoeia (USP)	The United States Pharmacopeial Convention	Current issue
	22.2.	3.	Pedersen- Bjergaard, S., Gammelgaard, B., Halvorsen, T. G.	Introduction to Pharmaceutical Analytical Chemistry (2 nd Edition)	Wiley	2019
		4.	Hansen, S. H.	Introduction to Pharmaceutical Chemical Analysis (1 st Edition)	Wiley	2011
		5.	Skoog, D., West, D., Holler, F., Crouch, S.	Fundamentals of Analytical Chemistry (10 th Edition)	Cengage Learning	2021
		6.	Konieczka, P.	Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach (2 nd Edition)	CRC Press	2018

	7.	Rodríguez-Pérez, J.	Quality Culture in the Pharmaceutical Industry: Implementing a Behavior-based Quality and Compliance Culture	Business Excellence Consulting	2021
	8.	Bunn, G. P.	Good Manufacturing Practices for Pharmaceuticals (7 th Edition)	CRC Press	2019

	Appendix 3 No. 37	Study program fo	or into ycle of	egrated first a f studies	and second				
1.	Name of the course	PHARMACEUTIC	AL T	OXICOLOG	Y				
2.	Code	3FMN195525							
3.	Study program	Pharmacy							
4	Study program organizer	Faculty of Medical S	cience	es,					
4.	(department, institute, branch)	Goce Delcev Univers	sity, S	tip					
5.	Degree (first, second, third cycle)	Integrated first and se	econd	cycle of studi	es				
6.	Academic year / semester	Fourth year / Eighth semester	7.	Number of ECTS	7				
8.	Professor	Assoc. Prof. Dr.sc. D	arinka	a Gjorgieva Ao	ekova				
0	Pre-conditions for course	Enrolled in eighth se	masta	r of studies					
9.	registration	Enfoned in eightil ser	meste	I OI Studies					
	Aims of the study program (compet	ences):							
	Pharmaceutical toxicology studies the	toxic or xenobiotic-re	lated a	adverse effects	s of chemicals				
	(for instance, drugs 'possessing therap	eutic values') when liv	ving b	eings are expo	sed to it.				
	The course introduces students to the	field of toxicology as a	a scier	nce, they acqui	re knowledge				
10.	about toxins and toxicants, mechan	isms of toxicity, and	l the	chemical stru	cture-toxicity				
	relationship, as well as methods for th	e detection of toxic ag	ents ir	n various samp	oles.				
	Toxicology studies are carried out of	on all substances inte	nded	to be used in	a variety of				
	applications to ensure safety. With the	tocus on different grou	ps wit	th synthetic or	natural origin,				
	the most important safety issues of xer	nobiotics are covered f	iere.		()				
	Content of the study program (appl	les doth for theoretics	ai anc	i practical pa	rt):				
	1 Concrel toxicology Introduct	ion.							
	 2. Toxic response from different organs. Systemic toxicology; 								
	3 Toxic elements – metals met	alloids non-metals:	colog.	у,					
	4 Toxic inorganic compounds (Organometals and orga	mo-m	etalloids:					
	5. Toxic organic compounds – h	vdrocarbons:		etanoras,					
	6. Toxic organic oxygen compo	unds;							
	7. Toxic organic nitrogen compo	ounds;							
	8. Toxic organic halogen compo	unds (organo-halides);	,						
	9. Toxic organic sulfur compour	nds;							
	10. Toxic organic phosphorus cor	npounds;							
	11. Toxic compounds of natural of	origin;							
	12. Analysis of toxic substances i	n different samples.							
11.	Practical part:								
	1. Introduction to the analytical 2	toxicology laboratory;							
	2. Clinical aspects of analytical 1	toxicology;							
	5. Risk assessment through exam	ipies;							
	5 Qualitative analysis of selecte	d venobiotics using co	lored	tests and snot-	analysis				
	6 Toxicity of organic solvents a	nd their derivatives. Si	nectro	photometric d	etermination				
	of phenol with 4-aminoantipy	rine: Semiquantitative	deteri	mination of ph	enol in urine:				
	7. Toxicity of organic compound	ls / drugs: Spectrophot	ometr	ric determination	on of				
	acetylsalicylic acid and other	drugs; HPLC, GC tests	s for a	nalysis;					
	8. Toxicity of organic compound	ls: TLC for identificati	on of	analgesics;					
	9. Toxicity of metals: Spectroph	otometric determination	on of r	netals (Cu ²⁺ , N	Vi ²⁺ , Cr ⁶⁺				
	through complexation) and IC	² P analysis;							
	10. Spectrophotometric determina	ation of nitrites in wate	r (Gri	ess method);					
	11. TLC for identification of toxic	c substances of natural	origin	n (alkaloids);					
	12. In vitro methodologies (NAM	's) for toxicity testing.							
12.	Study methods:								

	Lectures, theoretical and laboratory exercises, project assignments, consultations.									
10	Labora	tory exe	crcises are perfo	rmed in	small groups of up to 10	students	5. (2 + 2)			
13.	Total a	mount c	of time available	2	7 ECTS x 30 hours = 21	0 hours	(3+3)			
14.	Distrib	ution of	tasks		45+45+15+30+75					
	Types	of learni	ng/teaching	15.1.	Lectures – theory		45 hours			
15.	activiti	es		15.2.	Tutorials (laboratory, auditory), seminars, tear	nwork	45 hours			
				16.1.	Projects		15 hours			
16.	Other t	ypes of	activities	16.2.	Individual tasks		30 hours			
				16.3.	Home study – tasks		75 hours			
	Evalua	tion / as	sessment metho	ods	· · · · · ·		•			
	17.1.	Tests					40 points			
17.	17.2.	Individ	lual tasks / proje	ect (pres	sentation: written and oral	10 points				
	17.3.	Activit	y and participat	ion			20 points			
	17.4.	Final e	xam				30 points			
					Up to 50 points		5 (five) (F))		
					51 – 60 points		6 (six) (E)			
10				1 \	61-70 points		7 (seven) (D)		
18.	Assess	ment cri	teria (points / g	rade)	71 – 80 points		8 (eight) ($\overline{C)}$		
					81 – 90 points		9 (nine) (B	5)		
					91 – 100 points		10 (ten) (A)		
-	Eligibi	litv for s	signature and tal	king	60% realization of pre-exam activities, i.e., 42 points			12 points		
19.	the fina	al exam	8	0	from two tests, seminary	or prac	tical work, a	ind		
					regular participation to t	he organ	nized activiti	es.		
20.	Langua	age of th	e study progran	n	English	0				
0.1	Quality	/ assurai	nce methods of	the						
21.	teachin	g proce	SS		Self-evaluation					
	Literat	ure								
	Mandatory literature									
		No.	Author		Title	Pu	blisher	Year		
					Casarett & Doull's					
		1.	Klaassen, C. D. (Editor)		Toxicology: The Basic	McGraw Hill		2008		
					Science of Poisons (7 th			2008		
					Edition)					
			Dong Formand	07	Toxicology for the					
		2	A Evans M	D	Health and	CRCI	Drace	2022		
		۷.	A., Evalis, M.	D.,	Pharmaceutical		1035	2022		
	22.1		COOKC, WI. 5.		Sciences					
	22.1.				Toxicological					
22.		3	Manahan S I	7	chemistry and	Lewis	Publishers	2003		
		5.		_ .	biochemistry (3 rd	Lewis	1 domainers	2005		
					Edition)					
					Toxicological					
					chemistry					
		4	Gjorgieva Ac	kova,	(Токсиколошка	Goce 1	Delcev	2023		
			D.		хемија)	Unive	rsity, Stip	2023		
					<u>https://e-</u>	• · · ·				
					lib.ugd.edu.mk/1162					
		Additi	onal literature			1		I		
	22.2	No.	Author		Title	Pu	ıblisher	Year		
		1	Mulder, G. J.,		Pharmaceutical	Pharm	aceutical	2006		
				1.	Dencker, L.		toxicology	Press		2000

		2.	Gjorgieva Ackova, D.	Toxicological and clinic-toxicological analysis: protocols for laboratory work (Токсиколошки и клиничко- токсиколошки анализи: протоколи за лабораториска работа) <u>https://eprints.</u> ugd.edu.mk/22754/	Goce Delcev University, Stip	2019
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Appendix 3 No. 38	Study program fo cy	or into cle of	egrated first a f studies	and second					
Name of the course	BIOPHARMACY A	ND I	PHARMACO	KINETICS					
Code	3FMN195625								
Study program	Pharmacy								
Study program organizer	Faculty of Medical So	cience	es,						
(department, institute, branch)	Goce Delcev University, Stip								
Degree (first, second, third cycle)	Integrated first and se	cond	cycle of studie	es					
Academic year / semester	Fourth year / Eighth semester	7.	Number of ECTS	7					
Professor	Assoc. Prof. Dr.sc. Ka Adj. Ass. Prof. Dr.sc.	atarin Mari	a Smilkov ja Atanasova l	Lazareva					
Pre-conditions for course registration	Enrolled in eighth ser	neste	r of studies						
Aims of the study program (compet	ences):								
 Understanding the biopharma factors that influence drug for Deeper understanding of the I absorption, distribution, metal Understanding the pharmacok routes of administration, calcu dosage regimen, and dose adj Understanding bioavailability development and therapeutic 	ceutical principles under mulation and therapeut LADME concept: factor bolism, and elimination tinetics of drugs admini- ilations and analysis of ustment. and bioequivalence, the equivalence, and their a	erlyin tic eff rs inf i; istere `phar neir si	g drug design, icacy; luencing drug d in the body b macokinetic pa gnificance in c	, including release, by different arameters, drug					
development and therapeutic equivalence, and their assessment.									
 <i>Theoretical part:</i> Introduction to Biopharmacy LADME concept: Drug release influencing release; Drug absorber the absorption; Drug distribut distribution; Drug metabolism metabolism; Drug elimination elimination process; Compartmental pharmacokine Pharmacokinetics of a single for the stravase administration; Pharmacokinetics of extravase administration; Pharmacokinetics of multiple intravenous infusion, multiple Non-compartmental analysis; Non-linear pharmacokinetics; Bioavailability and bioequiva <i>In vitro – in vivo</i> correlation. Practical part: Mathematical fundamentals o Graphical representation in pl Protein binding study of a mo Determination and calculation of model drug; 	and pharmacokinetics; se from dosage forms, k porption, mechanisms, kinetics ion, mechanism, kinetics i, mechanism, kinetics created analysis; intravenous dose; us intravenous infusion cular administration, w -dose regimens (multip e oral dose); lence. f pharmacokinetics; del drug; nd dissolution rate of a p plasma elimination after a	cinetic inetic cs and and fa and fa ith a f le intr mode er an	cs and key fact s and factors i d factors influenc actors influenc focus on oral focus on oral ravenous bolus	tors nfluencing encing the sing the ing the s, intermittent					
	Appendix 3 No. 38 Name of the course Code Study program Study program organizer (department, institute, branch) Degree (first, second, third cycle) Academic year / semester Professor Pre-conditions for course registration Aims of the study program (compet – Understanding the biopharma factors that influence drug for – Deeper understanding of the I absorption, distribution, metal – Understanding the pharmacok routes of administration, calcu dosage regimen, and dose adj – Understanding bioavailability development and therapeutic Content of the study program (appl Theoretical part: 1. Introduction to Biopharmacy 2. LADME concept: Drug release influencing release; Drug abso the absorption; Drug distribut distribution; Drug metabolism metabolism; Drug elimination elimination process; 3. Compartmental pharmacokined 4. Pharmacokinetics of a single i 5. Pharmacokinetics of continuo 6. Pharmacokinetics of extravase administration; 7. Pharmacokinetics of multiple intravenous infusion, multiple 8. Non-compartmental analysis; 9. Non-linear pharmacokinetics; 10. Bioavailability and bioequiva 11. In vitro – in vivo correlation. Practical part: 1. Mathematical fundamentals o 2. Graphical representation in pl 3. Protein binding study of a mo 4. Determination of solubility ar 5. Simulation and calculation of model drug; 6. Simulation and calculation of	Appendix 3 No. 38Study program for cyName of the courseBIOPHARMACY ACode3FMN195625Study program organizerFaculty of Medical S(department, institute, branch)Goce Deleev UniversDegree (first, second, third cycle)Integrated first and setPorfessorAcademic year / semesterFourth year / Eighth semesterProfessorAssoc. Prof. Dr.sc. KAdit of the study program (competences):Understanding the biopharmaceutical principles und factors that influence drug formulation and therapeut-Deeper understanding of the LADME concept: facto absorption, distribution, metabolism, and eliminatior-Understanding the pharmacokinetics of drugs admini routes of administration, calculations and analysis of dosage regimen, and dose adjustmentUnderstanding bioavailability and bioequivalence, th development and therapeutic equivalence, and their aContent of the study program (applies both for theoretica Theoretical part:1Introduction to Biopharmacy and pharmacokinetics;2LADME concept: Drug release from dosage forms, I influencing release; Drug absorption, mechanism, kinetics metabolism; Drug distribution, mechanism, kinetics metabolism; Drug distribution, mechanism, kinetics metabolism; Drug distribution, we administration;7Pharmacokinetics of a single intravenous dose;8Compartmental analysis;9Non-compartmental analysis;9Pharmacokinetics of extravascular administration, w administration;7Pharmacokinetics of extravascular administration,	Appendix 3 No. 38 Study program for introcycle o Name of the course BIOPHARMACY AND I Code 3FMN195625 Study program Pharmacy Study program organizer Faculty of Medical Science (department, institute, branch) Goce Delece University, S Degree (first, second, third cycle) Academic year / semester Fourth year / Eighth semester 7. Professor Assoc. Prof. Dr.sc. Katarin Adj. Ass. Prof. Dr.sc. Marin factors that influence drug formulation and therapeutic eff - Understanding the biopharmaceutical principles underlyin factors that influence drug formulation and therapeutic eff - Deeper understanding of the LADME concept: factors inf absorption, distribution, metabolism, and elimination; - Understanding the pharmacokinetics of drugs administere routes of administration, calculations and analysis of phar dosage regimen, and dose adjustment. - Understanding bioavailability and bioequivalence, their si development and therapeutic equivalence, and their assess Content of the study program (applies both for theoretical and Theoretical part: 1. Introduction to Biopharmacy and pharmacokinetics; 2. LADME concept: Drug release from dosage forms, kinetic influencing release; Drug absorption, mechanism, kinetics and distribution; Drug distribution, mechanism, kineti	Appendix 3 No. 38 Study program for integrated first a cycle of studies Name of the course BIOPHARMACY AND PHARMACO Code 3FMN195625 Study program Pharmacy Study program organizer (department, institute, branch) Goce Delecev University, Stip Degree (first, second, third cycle) Integrated first and second cycle of studit Academic year / semester Fourth year / Eighth semester 7. Number of Eighth semester Professor Assoc. Prof. Dr.sc. Katarina Smilkov Adj. Ass. Prof. Dr.sc. Marija Atanasoval Pre-conditions for course registration Enrolled in eighth semester of studies Aims of the study program (competences): – Understanding the biopharmaceutical principles underlying drug design, factors that influence drug formulation and therapeutic efficacy; Peeper understanding of the LADME concept: factors influencing drug absorption, distribution, metabolism, and elimination; – Understanding the pharmacokinetics of drugs administered in the body 1 routes of administration, calculations and analysis of pharmacokinetic pr dosage regimen, and dose adjustment. – Understanding the pharmacokinetics of drugs administered in the body 1 routes of administration, calculations, mand analysis of pharmacokinetic pr dosage regimen, and dose adjustment. – Understanding the pharmacokinetics of					

	7. Simulation of plasma elimination after an intravenous infusion and calculation of								
		pharma	acokinetic parar	neters o	of a model drug;				
	8.	Determ	ination of phar	macoki	netic parameters of a mod	el drug t	that follows	the oral	
		one con	mpartment mod	lel;					
	9.	Calcula	ations of multip	le-dosa	ge regimens and dose adju	ustment	of a model d	rug;	
	10.	Determ	nination and cal	culation	ns of bioavailability.				
	Study	method	s:						
12	Lecture	es with l	arge groups of s	students	s, individual assignments,	group di	iscussions, h	omework,	
12.	home s	tudy and	l student semin	ars.					
	Theore	tical and	l practical labor	atory ex	xercises with small groups	s of stud	ents, practic	e exam.	
13.	Total a	mount o	<u>f time available</u>	e	7 ECTS x 30 hours = 21	0 hours	(3+3)		
14.	Distrib	ution of	tasks		45+45+0+30+90				
	Types (of learni	ng/teaching	15.1.	Lectures – theory		45 hours		
15.	activiti	ies 1		15.2.	Tutorials (laboratory,		45 hours		
					auditory), seminars, tear	nwork			
	~ 1	16.1.			Projects		0 hours		
16.	Other t	ypes of a	activities	16.2.	Individual tasks		30 hours		
		• •		16.3.	Home study – tasks		90 hours		
	Evalua	$\frac{t_{10n}}{\pi}$	sessment metho	ods			40		
17	17.1.	Tests	1.1.1.			<u></u>	40 points		
17.	17.2.	A stivity on d next single of the			sentation: written and oral)		10 points		
	17.3.	Activit	y and participat	210n			20 points		
	17.4.	Final e	xam		II. (CO. :)		30 points		
					Up to 50 points		5 (five) (F)		
					51 - 60 points		6(six)(E)		
18.	Assess	ment cri	teria (points / g	rade)	61 - 70 points		7 (seven) (D)	
			u u	<i>,</i>	71 - 80 points		$\frac{8}{(eight)}$	_)	
					81 - 90 points		9 (nine) (B)	
	Elizibility for signature of 1 to 1-in				91 - 100 points		10 (ten) (A	.)	
10	Eligibi	lity for s	ignature and tal	king	60% realization of pre-e	xam acti	1V111es, 1.e., 4	2 points	
19.	the fina	u exam			from two tests, seminary	or prac	tical work, a	ind	
20	Longue	a of th	a study program		English				
20.	Quality	ige of th	e study program	ll tha	English				
21.	Quality	assurat		the	Self-evaluation				
	Literati	<u>g proces</u> ire							
	Literati	Manda	atory literature						
		No	Author		Title	P11	blisher	Year	
		110.	Smilkov K			14	lonisher	1 cui	
		1	Atanasova		Authorized lectures	Goce I	Delcev	2024	
			Lazareva, M.			Univer	rsity, Stip	_0	
				-	Applied				
			Shargel, L., W	√u-	Biopharmaceutics &		TT'11	2016	
22.	22.1	2.	Pong, S., Yu,	А. В.	Pharmacokinetics (7 th	McGra	aw Hill	2016	
	22.1.		C.		Edition)				
					Basic				
					pharmacokinetics and				
			Rosenhoum	SF	pharmacodynamics:	John V	Viloy &		
		3. Kosenbaum, S	(Editor)	э. <u>Г</u> .	an integrated textbook	Song T	td	2017	
					and computer		7.0		
					simulations (2 nd				
					Edition)				

	4.	Taylor, K. M. G.	Aulton's Pharmaceutics (6 th Edition)	Elsevier	2021			
	5.	Steffansen, B., Brodin, B., Nielsen, C. U.	Molecular biopharmaceutics	Pharmaceutical Press	2010			
	Additional literature							
	No.	Author	Title	Publisher	Year			
	1.	Gibaldi, M., Perrier, D.	Pharmacokinetics	Informa Healthcare, New York	2007			
22.2.	2.	Cox Gad, S.	Preclinical development	Wiley	2008			
	3.	Jambhekar, S. S., Breen, P. J.	Basic pharmacokinetics	Pharmaceutical Press	2009			
	4.	Bhise, S. B., Dias, R. J., Dhawale, S. C., Mali, S. K. K.	Laboratory manual of biopharmaceutics and pharmacokinetics	Trinity Publishing House	2010			

	Appendix 3 No. 39		Study program fo	or inte ycle of	egrated first a f studies	and second			
1.	Name of the course		SOCIAL PHARMA	CY					
2.	Code		3FMN195725						
3.	Study program		Pharmacy						
4	Study program organizer		Faculty of Medical S	cience	es,				
4.	(department, institute, branch)		Goce Delcev Univers	sity, S	tip				
5.	Degree (first, second, third cyc	cle)	Integrated first and se	econd	cycle of studi	es			
6.	Academic year / semester		Fourth year / Eighth semester	7.	Number of ECTS	5			
8.	Professor		Assoc. Prof. Dr.sc. E	lena [Drakalska Sers	emova			
9.	Pre-conditions for course		Enrolled in eighth ser	mester	r of studies				
	Aims of the study program (comnet	ancas):						
	— To acquire knowledge	of the	ences). Legislation relevant to r	harm	aceutical pract	tice and the			
	structure of the pharmaceutical sector within the healthcare system of the Republic of								
10.	North Macedonia:								
100	 To understand theoretical concepts and models significant to social pharmacy. 								
	 To gain insights into p 	harmac	eutical polices and the	role c	of the pharmac	ists within			
	the healthcare sector and society.								
	Content of the study program	n (appl	ies both for theoretic	al and	l practical pa	rt):			
	Theoretical part:								
	1. Pharmaceutical System – Introduction, functions, and stakeholders in the system;								
	2. Legal tramework for the operation of the pharmaceutical system – pharmaceutical, healthcare, and economic legislation:								
	3. National Drug Policy:								
	 Medicines as entities in the pharmaceutical sector – research, innovative drugs, Good 								
	Clinical Practice (GCP), ethical aspects, manufacturing, and market release;								
	5. Drug Supply – stages, management systems, planning, procurement, monitoring, and								
	evaluation;								
1.1	6. Management of systems for range and inventory in wholesale trade – Good								
11.	Distribution Practice (GDP), j	parallel trade of medici	ines;					
	7. Drug Selection – Esse 8. Pharmaceutical Marke	ntial Me	edicines Lisis; Post-marketing surveill	ance	nharmacovigi	lance and			
	materiovigilance:	ung – I	ost-marketing survein	ance,	pharmacovigi	lance, and			
	9. Marketing of medicine	es – ethi	ical principles, informa	tion,	and advertisin	g;			
	10. Drug pricing and Price	e format	tion;	,					
	11. Financial managemen	t of the	Pharmaceutical Systen	n – fin	ancing, contro	ol, and health			
	insurance;	_							
	12. Professional Associati	ons of I	Pharmacists – ethical as	spects	, continuous e	ducation, and			
	management of pharm	aceutic	al personnel.						
	Practical part.	iaal ava	raisas on all 12 lastura	tonia					
	- Discussions and practi		icises on an 12 lecture	topics	5.				
12.	Lectures, interactive activities.	, semina	ars, and practical session	ons.					
13.	Total amount of time available $5 \text{ ECTS x } 30 \text{ hours} = 150 \text{ hours} (2+2)$								
14.	Distribution of tasks		30+30+60+15+15						
	Types of learning/teaching	15.1.	Lectures – theory		30 hour	rs			
15.	activities	15.2	Tutorials (laboratory,	,	30 hour				
		1.5.2.	auditory), seminars, t	eamw	vork				
		16.1.	Projects		60 hour	ſS			
16.	Other types of activities	16.2.	Individual tasks		15 hour	rs			
1		16.3.	Home study – tasks		15 hour	ſS			

	Evalua	tion / as	sessment methods					
	17.1.	Tests			40 points			
17.	17.2.	Individ	lual tasks / project (pre	sentation: written and oral	10 points			
	17.3.	Activit	y and participation		20 points			
	17.4.	Final e	xam		30 points			
				Up to 50 points	5 (five) (F	[•])		
				51 – 60 points	6 (six) (E)			
10	1	mant ani	toria (nainta / anada)	61 – 70 points	7 (seven)	(D)		
10.	Assess	ment cri	teria (points / grade)	71 – 80 points	8 (eight) (C)		
				81 – 90 points	9 (nine) (l	3)		
				91 – 100 points	10 (ten) (A	4)		
	Eligibi	lity for s	signature and taking	60% realization of pre-e	xam activities, i.e.,	42 points		
19.	the fina	al exam		from two tests, seminary or practical work, and				
				regular participation to t	he organized activit	ties.		
20.	Langua	age of th	e study program					
21	Quality assurance methods of the			Self-evaluation				
21.	teaching process			Sen-evaluation				
	Literature							
		Manda	atory literature	1		•		
		No.	Author	Title	Publisher	Year		
		1	Luis, M.,	Medical ethics and	Academic Press	2010		
	22.1.	1.	Tamparo, K.	bioethics	ricudennie i ress	2010		
				Social Pharmacy and	Infopharma			
		2.	Petrova, G.	Pharmaceutical	EOOD. Sofia	2010		
22.			1.1.	Legislation	,			
		Addıtı	onal literature		D 1111			
		No.	Author	litte	Publisher	Year		
	22.2	1	Werheimer, A. I.,	Pharmacy Practice,	Williams &	1000		
	22.2.	22.2. 1. Smith, M. C.		Social and Behavioral	Wilkins	1998		
		2. Lodhi, D., Golani, P.	Ladhi D. Calari	Aspecis (5 " Ealiton)	C Wilson P			
			A Fructical Text Book	S. VIKAS &	2021			
1			11.	of Social Pharmacy Company	Company	1		

	Appendix 3 No. 40	Study program fo	or into ycle o	egrated first a f studies	and second		
1.	Name of the course	PHARMACEUTIC	AL B	IOTECHNOI	LOGY		
2.	Code	3FMN195825					
3.	Study program	Pharmacy					
1	Study program organizer	Faculty of Medical Sciences,					
4.	(department, institute, branch)	Goce Delcev University, Stip					
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies					
6.	Academic year / semester	Fifth year / Ninth semester	7.	Number of ECTS	5		
8.	Professor	Assoc. Prof. Dr.sc. K	atarin	a Smilkov			
9.	Pre-conditions for course registration	Enrolled in ninth sem	nester	of studies			
10.	 Acquiring comprehensive knowledge of recombinant DNA technology and its applications in the design and development of protein-based therapeutic agents; Gaining an in-depth knowledge of gene expression systems and their utilization in pharmaceutical biotechnology for the production of therapeutic compounds; Understanding the biotechnological production process and quality control methods for pharmaceuticals produced through recombinant technology. Content of the study program (applies both for theoretical and practical part): <i>Theoretical part:</i> Introduction to Pharmaceutical biotechnology: brief historical timeline of the field and overview of the fundamental concepts and applications of biotechnology in the pharmaceutical industry: 						
11.	 Introduction to Pharmaceutical and overview of the fundament pharmaceutical industry; Nucleic acids, proteins, and references Production of recombinant the therapeutics proteins through Structure and protein synthesis biochemical processes underly Natural sources of pharmacological activity and Classes of therapeutic protein hormones, recombinant blood Production and characteristics methods, structural characteristics used in vaccine production an Gene Therapy: overview of ge applications; Cell and Tissue-Based Therap context of biotechnology; Core processes in upstream and Formulation of recombinant production of recombinant pro- formulation of recombinant pro- formulation of recombinant pro- dimensional process for methods, including regulator 	al biotechnology: brief ntal concepts and appli ecombinant DNA techn erapeutic proteins and recombinant technolog s: detailed study of pro- ying protein synthesis; ogically active substan stigation of natural southeir enhancement thro s produced by recombi- proteins, and therapeu- of monoclonal antibo stics, and applications of vaccines: overview d their functional prop- ene therapy techniques vies: overview of cell a gical production and the downstream biopharm rotein products: appro- rotein-based therapeuti- chnologically produce edical use of biotechno- pry requirements.	historication nology proces gy; otein s ces ar urces f ough r inant t titic en dies: a of mo v of bi erties; a and t is nd tis: heir cl naceut aches ic proc d drug ologica	rical timeline of as of biotechno (; sses involved i atructure and the ad application of for substances ecombinant tec- echnology: cy izymes; analysis of the noclonal antib otechnological heir therapeuti sue-based there haracteristics: of ical production and considerar ducts; ss and biosimil ally produced of loration of gen echnology, inc	of the field ology in the n obtaining ne of with chnology; tokines, production odies; l methods c apies in the overview of n; tions in the ars: overview drugs and e cluding their		

	2.	2. Polymerase Chain Reaction (PCR) characteristics: detailed examination of the							
		princip	les and characte	eristics	of PCR in amplifying DN	A seque	nces:		
	3.	Upstrea	am Processing:	focus o	n cell culturing techniques	s. cell co	ounting, cons	structing	
		cell gro	wth curves, and	d assess	ing the influence of cultur	e media	on cell grov	wth:	
	4.	Downs	tream Processir	ng: focu	s on methods for protein i	solation	. including t	he	
		application of advanced techniques for purification:							
	5.	Sample concentration techniques for concentrating samples and optimizing the							
		recover	v of recombina	nt prote	eins:	r	-18		
	6.	Determination of product potency and protein concentration: review of analytical							
		method	ls for evaluating	the po	tency and concentration o	f proteir	products;	0	
	7.	Techni	ques for identif	ving im	purities in recombinant pr	oteins: a	dvanced tec	hniques	
		for the	detection and q	uantific	ation of impurities in reco	mbinan	t protein pro	ducts;	
	8.	Pyroge	n testing in reco	ombinai	nt protein products: analyt	ical app	roaches for o	detecting	
		the pres	sence of pyroge	ens in re	combinant protein formul	ations;		U	
	9.	Formul	ation of biologi	ics (stał	oilization and lyophilizatio	n): focu	s on method	ls for	
		stabiliz	ing biologically	-derive	d drugs, with focus on lyc	philizat	ion (freeze-o	drying)	
		techniq	ues to ensure p	roduct i	integrity and shelf-life.	1	× ×		
	Study	method	5:						
12	Lecture	s, theore	etical and practi	ical exe	rcises, consultations, self-	based le	arning, addi	tional	
12.	prepara	tions for	r exams and tes	ts.			-		
	Labora	tory exe	rcises in small g	groups o	of 10 students. Auditorial	exercise	s.		
13.	Total amount of time available $5 \text{ ECTS x } 30 \text{ hours} = 150 \text{ M}$						(2+2)		
14.	Distribution of tasks				30+30+10+30+50				
	Types of learning/teaching			15.1.	Lectures – theory		30 hours		
15.	activities		15.2	Tutorials (laboratory,		20 hours			
	activities		13.2.	auditory), seminars, tean	nwork	50 nours			
		16.1.			Projects		10 hours		
16.	Other types of activities		16.2.	Individual tasks		30 hours			
				16.3.	. Home study – tasks 50 hours				
	Evaluation / assessment methods								
	17.1.	Tests					40 points		
17.	17.2.	Individ	ual tasks / proje	ect (pres	sentation: written and oral	10 points			
	17.3.	Activity	y and participat	ion		20 points			
	17.4.	Final ex	kam				30 points		
	U				Up to 50 points		5 (five) (F)		
					51-60 points		6 (six) (E)		
1.0					61 - 70 points		7 (seven) (D)	
18.	Assessi	ment cri	teria (points / gi	rade)	71 - 80 points		8 (eight) (0	$\overline{()}$	
					81 - 90 points		9 (nine) (B)	
					91 - 100 points		10 (ten) (A)	
	Eligibil	ity for s	ionature and tal	cing	60% realization of pre-e	xam acti	vities i.e. 4	2 points	
19	the fina	l exam		ing	from two tests, seminary	or prac	tical work, a	nd	
17.		ii enuilli			regular participation to t	he orgar	ized activiti	es	
20	Langua	ge of th	e study program	1	English	ne organ		•5.	
	Quality	assuran	ce methods of t	the	- I da d				
21.	teachin	g proces	is	liic	Self-evaluation				
	Literati	ire			1				
	Literati	Manda	tory literature						
22.		No.	Author		Title	Pu	blisher	Year	
	22.1.					Goce I	Delcev	1 041	
		1.	Smilkov, K.		Authorized lectures	Univer	sity, Stip	2024	

		2.	Gupta, V., Sengupta, M., Prakash, J., Tripathy, B. C.	Basic and applied aspects of Biotechnology	Springer	2017			
		3.	Crommelin, D. J. A., Sindelar, R. D., Meibohm, B. (Editor)	Pharmaceutical Biotechnology: Fundamentals and Application	Springer	2013			
		4.	Greensterin, B., Brook, D. A.	Biological Therapeutics	Pharmaceutical Press	2011			
		Additional literature							
	22.2.	No.	Author	Title	Publisher	Year			
		1.	Gutka, H. J., Yang, H., Kakar, S. (Editors)	Biosimilars: regulatory, clinical and biopharmaceutical development	AAPS / Springer	2018			
		2.	Walsh, G.	Pharmaceutical Biotechnology: Concepts and Applications	John Wiley & Sons	2007			
		3.	Cox Gad, S. (Editor)	Handbook of Pharmaceutical Biotechnology	Wiley	2007			

	Appendix 3 No. 41			Study program for integrated first and second cycle of studies				
1.	Name o	f the course		CLINICAL PHARMACY AN PHARMACOTHERAPY	D			
2.	Code			3FMN195925				
3.	Study pr	rogram		Pharmacy				
4.	Study pr (departm	rogram organizer nent, institute, branch)		Faculty of Medical Sciences, Goce Delcev University, Stip				
5.	Degree	(first, second, third cyc	cle) Integrated first and second cycle of studies					
6.	Academ	ic year / semester		Fifth year / Ninth semester7.Number of ECTS5				
8.	Professo	or		Full Prof. Dr.sc. Zorica Arsova	Sarafinovska			
9.	Pre-con- registrat	ditions for course		Enrolled in ninth semester of stu	udies			
	Aims of	f the study program (compet	ences):				
10.	various diseases and conditions, with the principles of rational pharmacotherapy and pharmaceutical care. It is expected that after successful completion of the course, the student would be able to understand and differentiate the pathophysiology, clinical manifestations, clinical course and prognosis, investigations, pharmacological and non-pharmacological treatment; to compare the ratio of therapeutic efficacy/safety of individual drugs intended for the same condition/disease and to present evidence-based information to patients and healthcare professionals.							
	Content of the study program (applies both for theoretical and practical part):							
11.	<i>Theoretical part:</i> Definition, etiology, pathology, epidemiology, clinical manifestations and treatment strategies of the most significant and common groups of diseases: lung diseases, kidney diseases, cardiovascular diseases, diseases of the gastrointestinal tract, liver diseases, neurological diseases, psychiatric diseases, endocrinological diseases (diabetes); most important groups of drugs used in the treatment of the studied diseases; practical application of individuals drugs; pharmacotherapy of vulnerable groups of patients. <i>Practical part:</i>							
	Study n	nethods:	1	4	<u> </u>			
12.	Lectures Individu of 10 stu	s – theory; Tutorials (la aal consultations with s udents.	aborator students	y), seminars, teamwork. and consultations in groups. Exe	rcises in small groups			
13.	Total an	nount of time available	2	5 ECTS x 30 hours = 150 hours	(2+2)			
14.	Distribu	tion of tasks		30+30+10+20+60				
15.	Types o activitie	f learning/teaching s	15.1. 15.2.	Lectures – theory Tutorials (laboratory,	30 hours 30 hours			
			16.1	auditory), seminars, teamwork	10 hours			
16	Oth on tr	mag	16.1.	Projects Individual tasks	20 hours			
10.	Other ty	pes of activities	16.2.	Homo study tools	20 hours			
	Evaluat	ion / assessment metho	10.3. ds	110mc study – tasks				
	17.1	Tests	100		40 points			
17	17.1.	Individual tasks / proje	ect (pres	sentation: written and oral)	10 points			
± / •	17.3	Activity and participat	ion	sentation. written und orarj	20 points			
	17.4	Final exam	1011		30 points			
<u> </u>				Up to 50 points	5 (five) (F)			
18.	Assessn	nent criteria (points / g	rade)	51 - 60 points	6 (six) (E)			
				61 – 70 points	7 (seven) (D)			

				71 – 80 points	8 (eight)	(C)	
				81 – 90 points	9 (nine) (B)	
				91 – 100 points	10 (ten) (A)	
	Eligibil	lity for s	ignature and taking	60% realization of pre-exam activities, i.e., 42 points			
19.	the fina	ıl exam		from two tests, seminary or practical work, and			
	_			regular participation to t	ne organized activi	ties.	
20.	Langua	ige of th	e study program	English			
21.	Quality assurance methods of the teaching process			Self-evaluation			
-	Literature						
		Manda	atory literature				
		No.	Author	Title	Publisher	Year	
22.	22.1.	1.	Walker, R., Whittlesea, R.	<i>Clinical Pharmacy and</i> <i>Therapeutics (5th</i> <i>Edition)</i>	Churchill Livingstone	2012	
		Additi	onal literature				
	22.2.	No.	Author	Title	Publisher	Year	
		1.	Whittlesea, C., Hodson, K.	<i>Clinical Pharmacy and</i> <i>Therapeutics (6th</i> <i>Edition)</i>	Elsevier	2018	

	Appendix 3 No. 42		Study program for integrated first and second cycle of studies				
1.	Name of the course		COMMUNITY PHARMACY COMMUNICATION	AND PATIENT			
2.	Code		3FMN196025				
3.	Study program		Pharmacy				
4.	Study program organizer (department, institute, branch)		Faculty of Medical Sciences, Goce Delcev University, Stip				
5.	Degree (first, second, third cyc	cle)	Integrated first and second cycle	e of studies			
6.	Academic year / semester		Fifth year / Ninth semester7.Nun ECT	nber of 4			
8.	Professor		Assoc. Prof. Dr.sc. Biljana Laza	rova			
9.	Pre-conditions for course registration		Enrolled in ninth semester of stu	ıdies			
	Aims of the study program (compet	ences):				
	Acquiring knowledge in the	field of	pharmacy as a health service the	hat includes selection,			
10.	procurement, preparation, stor	age, coi	npounding, dispensing of drugs a	nd medical devices, as			
	well as advising patients and health professionals on the safe, efficient and effective use of						
drugs.							
	L agal regulation in ph	n (appi	and standards for good	l nharmaou prostioo:			
11	- Legal regulation in ph	armacy	operations and standards for good	i pharmacy practice,			
	 – rharmacy management; – Pharmacoinformatics in pharmacy practice; 						
11.	 Communication skills of the pharmacist; 						
	 Advising patients whe 	or the p n makin	and decisions about their therapy.				
	 Pharmaceutical care in pharmacy practice. 						
	Study methods:	- p					
10	Lectures with large groups of s	students	, individual assignments, group d	iscussions, homework,			
12.	home study and student semin	ars.					
	Theoretical and practical exerc	cises wi	th small groups of students, practi	cal exams.			
13.	Total amount of time available	e	4 ECTS x 30 hours = 120 hours	(1+2)			
14.	Distribution of tasks		15+30+15+30+30				
1.5	Types of learning/teaching	15.1.	Lectures – theory	15 hours			
15.	activities	15.2.	Tutorials (laboratory,	30 hours			
		16.1	auditory), seminars, teamwork	15 h anna			
16	Other types of activities	16.1.	Projects Individual tasks	15 hours			
10.	Other types of activities	16.2.	Home study tasks	30 hours			
	Evaluation / assessment metho	 ds	Home study – tasks	50 110013			
	17.1 Tests	/u 5		40 points			
17.	17.2. Individual tasks / proje	ect (pres	sentation: written and oral)	10 points			
	17.3. Activity and participat	tion	, , , , , , , , , , , , , , , , , , , ,	20 points			
	17.4. Final exam			30 points			
			Up to 50 points	5 (five) (F)			
			51 – 60 points	6 (six) (E)			
18.	A		61 – 70 points	7 (seven) (D)			
	Assessment criteria (points / g	rade)	71 – 80 points	8 (eight) (C)			
			81 – 90 points	9 (nine) (B)			
			91 – 100 points	10 (ten) (A)			
	Eligibility for signature and ta	king	60% realization of pre-exam act	ivities, i.e., 42 points			
19.	the final exam		from two tests, seminary or prac	tical work, and			
<u> </u>			regular participation to the organ	nized activities.			
20.	Language of the study program	n	English				

21.	Quality assurance methods of the			Self-evaluation			
	teachin	g proces	S				
	Literati	ıre					
		Manda	atory literature	<u> </u>			
		No.	Author	Title	Publisher	Year	
		1.	Beardsley, R. S., Kimberlin, C. L., Tindall, W. N.	Communication Skills in Pharmacy Practice: A Practical Guide for Students and Practitioners	Lippincott Williams & Wilkins	2012	
22.	22.1.	2.	WHO Team: Essential Medicines (EML), Health Product Policy and Standards (HPS), Medicines Selection, IP and Affordability (MIA), WHO Headquarters (HQ)	WHO Model List of Essentials Medicines (23 rd list)	World Health Organization	2023	
		3.	International Pharmaceutical Federation, World Health Organization	Joint FIP/WHO Guidelines on Good Pharmacy Practice: Standards for quality of pharmacy	International Pharmaceutical Federation	2023	
		Additi	onal literature				
		No.	Author	Title	Publisher	Year	
	22.2.		Pharmaceutical	Pharmacy 2030: A	Pharmaceutical		
		1.	Group of European	Vision for Community	Group of	2023	
			Union	Pharmacy in Europe	European Union		

	Appendix 3 No. 43		Study program for integrated first and second cycle of studies					
1.	Name of the course		DRUG INFORMAT	TION	MANAGEM	ENT		
2.	Code		3FMN196125					
3.	Study program		Pharmacy					
4	Study program organizer		Faculty of Medical So	cience	es,			
4.	(department, institute, branch)		Goce Delcev Univers	sity, St	tip			
5.	Degree (first, second, third cyc	cle)	Integrated first and se	econd	cycle of studi	es		
6.	Academic year / semester		Fifth year / Ninth semester7.Number of ECTS4					
8.	Professor		Assoc. Prof. Dr.sc. B	iljana	Lazarova			
9.	Pre-conditions for course		Enrolled in ninth sem	ester (of studies			
	Aims of the study program (comnet	ences):					
10.	pharmacists, as well as information about medicines as the most fundamental obligation of pharmacists, as well as information about drugs that may be patient-specific or developed for a specific patient population. Such information is therapeutic guidelines, national quality initiatives, coordination of an adverse drug event reporting and analysis program, publication of an electronic newsletter or website update. The pharmacist can serve as a source of answers to questions related to the cost-effective choice of drugs and their use, drug policy decisions (drug benefits), selection of drug information resources or issues related to pharmaceutical practice. Increasing opportunities for drug information to evolve and expand with changes in the health care environment and with national efforts to expand access to care while reducing health care costs, with the rise of the self-care movement and the integration of new health information technologies. Increasing opportunities for drug information to grow in several different areas within the healthcare environment, such as healthcare management organizations, the pharmaceutical industry, medical and specialty healthcare clinics, scientific							
11.	 Content of the study program (applies both for theoretical and practical part): Drug information management focuses on the use and integration of data, information, knowledge, and technology involved in drug use processes to improve pharmacotherapy outcomes; The use of informatics in improving pharmaceutical care in primary and secondary healthcare; Drug information management as part of pharmaceutical practice for the delivery of drug therapy and reengineering of the drug use process; The two broad categories of information used in Drug information management and other domains of clinical informatics are patient-specific information and knowledge-based information; The importance of Drug information centers at the local and national level: 							
	Study methods:	-u uppi	saon to answering the t	140511				
12.	Lectures with large group of st home study and student semin students, practical exam.	tudents, ars. The	individual assignments coretical and practical e	s, grou exercis	up discussions ses with small	s, homework, groups of		
13.	. Total amount of time available 4 ECTS x 30 hours = 120 hours (1+2)							
14.	Distribution of tasks	-	15+30+15+30+30					
	Types of learning/teaching	15.1.	Lectures – theory		15 hou	rs		
15.	activities	15.2.	Tutorials (laboratory, auditory), seminars, t	eamw	ork 30 hour	rs		
		16.1.	Projects		15 hou	rs		
16.	Other types of activities	16.2.	Individual tasks		30 hou	rs		
	16.3.		Home study – tasks		30 hou	rs		

	Evaluation / assessment methods							
	17.1.	Tests				40 points		
17.	17.2.	Individ	ual tasks / project (pres	sentation: written and oral)	10 points		
	17.3.	Activit	y and participation			20 points		
	17.4.	Final e	xam		30 points			
				Up to 50 points		5 (five) (F)		
				51 – 60 points		6 (six) (E)		
10		, .		61 – 70 points		7 (seven) (D)	
18.	Assess	ment cri	teria (points / grade)	71 – 80 points		8 (eight) (C	$\overline{C)}$	
				81 – 90 points		9 (nine) (B	<u>,</u>)	
				91 – 100 points	91 - 100 points 1		.)	
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam acti	vities, i.e., 4	2 points	
19.	the fina	al exam		from two tests, seminary or practical work, and				
				regular participation to the organized activities.				
20.	Langua	age of th	e study program	English				
21.	Quality teachin	/ assurar	nce methods of the	Self-evaluation				
	Literat	ure						
		Manda	atory literature					
	22.1.	No.	Author	Title	Pul	olisher	Year	
		1.	Malone, P. M., Witt, B. A., Malone, M. J. Peterson, D. M.	Drug Information: A Guide for Pharmacists (7 th Edition)	McGra	w Hill	2018	
22.		2.	Neoh, C. F., Zainal, I. N. A., Hameed, M. Ab., Khan, T. M., Ming, L. C.	Development and Progress of Pharmacoinformatics in Pharmaceutical and Health Sciences	Journal Pharma	l of Young acists	2015	
		3.	Kier, K. L., Goldwire, M.	Drug Information Resources and Literature Review	Americ College Clinica Pharma	can e of ll acy	2018	
	22.2	Addıtı	onal literature	T'4		11.1	V	
	22.2.	NO.	Author	l itle	Pu	olisher	Year	
1		1.	1		1		1	

Image: Instruction of the course PROFESSIONAL CLAUCE - HOSPITAL AND CLINICAL PHARMACY 2. Code 3FMN196225 3. Study program organizer Faculty of Medical Sciences, (department, institute, branch) Goce Delece University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Academic year / semester Enrolled in ninth semester of studies Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. 10. Execution of stratization procedures and aseptic techniques, as well as preparation of ex tempore magistral formulations intended for hospital treatment. Content of the study program: — The role of the hospital pharmacist: providing advice od medication administration, familiarization with types of medical materials dispensed in hospital settings and the essential medicines ist for hospital pharmaci		Appendix 3 No. 44		Study program for integrated first and second					
1. Name of the course HOSPITAL AND CLINICAL PHARMACY 2. Code 3FMN196225 3. Study program Pharmacy 4. Study program organizer Faculty of Medical Sciences, Goce Deleev University, Stip 10 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Acausition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital settings, their pharmacothrapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines its for hospital pharmacy; 2. Study methods: - Performing sterilization procedures, aspecite work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - Familiarization with types of medical materials dispensed in hospital settings a				PROFESSIONAL PRACTICE –					
2. Code 3FMN196225 3. Study program organizer Faculty of Medical Sciences, (department, institute, branch) Goce Deleev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Adins of the study program (competences): Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-kceping. 10. Execution of strilization procedures and aseptic techniques, as well as preparation of <i>ex</i> <i>tempore</i> magistral formulations intended for hospital treatment. Content of the study program: – – 11. – The role of the hospital pharmacist: providing advice od medication administration, familiarization with types of medications, contraindications, and potential interactions; 12. Familiarization procedures, aseptic work in the hospita	1.	Name of the course		HOSPITAL AND CLINICA	L PHARMACY				
3. Study program organizer (department, institute, branch) Pharmacy Goce Delev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - The role of the hospital pharmacist: providing advice of medication administration, familiarization with weekser of medications, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital reatment; - Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. 13. Total amount of ti	2.	Code		3FMN196225					
4. Study program organizer (department, institute, branch) Faculty of Medical Sciences, Goce Deleev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex</i> <i>tempore</i> magistral formulations intended for hospital treatment. Content of the study program: - - The role of the hospital pharmacist: providing advice of medication administration, familiarization with medications used in hospital settings, their pharmacy, and preparing magistral formulations intended for hospital treatment; 11. - Familiarization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital pharmacy. 12. <td>3.</td> <td>Study program</td> <td></td> <td colspan="5">Pharmacy</td>	3.	Study program		Pharmacy					
** (department, institute, branch) Goce Delece University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Number of Number of Second cycle of studies 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Acquisition of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital pharmacy, and preparing magistral formulations intended for hospital reatment; 2. Study methods: - - - - - - - <td co<="" td=""><td>1</td><td>Study program organizer</td><td></td><td>Faculty of Medical Sciences,</td><td></td></td>	<td>1</td> <td>Study program organizer</td> <td></td> <td>Faculty of Medical Sciences,</td> <td></td>	1	Study program organizer		Faculty of Medical Sciences,				
5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 10 8. Professor Assigned practice coordinator from the receiving institution 10 9. Pre-conditions for course registration Enrolled in ninth semester of studies Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications, and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex</i> <i>tempore</i> magistral formulations intended for hospital treatment. Content of the study program: — — The role of the hospital pharmacist: providing advice of medication administration, familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; . Familiarization with types of medical materials dispensed in hospital pharmacy, and preparing magistral formulations intended for hospital treatment; . Familiarization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital pharmacy. 11.	4.	(department, institute, branch)		Goce Delcev University, Stip					
6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 10 8. Professor Assigned practice coordinator from the receiving institution 9. Pre-conditions for course registration Enrolled in ninth semester of studies 9. Pre-condition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with organization of work in a hospital pharmacy and administrative tasks, familiarization with specific categories of medications, the procedures for dispensing medications to clinical departments, and record-kceping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital ptarmacy. 11. — The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, and potential interactions; 11. — The role of the hospital pharmacist: providing advice od medication administration, familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacy, and apterparing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; 12. Study methods: 13. Total amount of time available 10 ECTS x 30 hours = 300 hours (15 wecks) 14. Distribution of tasks 30+30+42	5.	Degree (first, second, third cyc	ele)	Integrated first and second cyc	ele of studies				
8. Professor Assigned practice coordinator from the receiving institution 9. Pre-conditions for course registration Enrolled in ninth semester of studies Acquisition of the study program (competences): Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-kceping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. Content of the study program: – The role of the hospital pharmacist: providing advice of medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. – Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; 12. Performing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; 13. Total amount of time available 10 ECTS x 30 hours = 300 hours (15 weeks) 14. Distribution of tasks 30+30+0+240+0 15. Types of learning/teaching activitics 15.1. Co	6.	Academic year / semester		Fifth year / Ninth semester7.Number of ECTS10					
9. Pre-conditions for course registration Enrolled in ninth semester of studies adims of the study program (competences): Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. 10. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. 11. Content of the study program: - The role of the hospital pharmacist: providing advice of medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; - Performing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-direce	8.	Professor		Assigned practice coordinator institution	from the receiving				
Aims of the study program (competences): Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex</i> <i>tempore</i> magistral formulations intended for hospital treatment. Content of the study program: - The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; - Performing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. 13. Total amount of time available activities 15.1. 15. Types of learning/teaching activities 15.1. 16. Other types of activities 15.1. 17. Evaluation / assessment methods 240 hours 16. Individual tasks 240 hours 17.	9.	Pre-conditions for course registration		Enrolled in ninth semester of s	studies				
Acquisition of practical knowledge and skills in the domain of hospital pharmacy practice: organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. Content of the study program: The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; Familiarization with types of medical materials dispensed in hospital pharmacy, and preparing magistral formulations intended for hospital treatment; Administrative management of a hospital pharmacy. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. Total amount of time available 10 ECTS x 30 hours = 300 hours (15 weeks) 15 weeks (75 days) x 20 hours = 300 hours 16. Other types of activities 16.1. Projects 0 hours 16.2. Individual tasks 240 hours 16.3. Home study – tasks 0 hours 17.1. Evaluation criteria Up to 50 points 5 (f		Aims of the study program (compet	ences):					
organization of work in a hospital pharmacy and administrative tasks, familiarization with groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. Content of the study program: - The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacy. 21. Study methods: - - 12. Study methods: 13. Total amount of time available 14. Distribution of tasks 15. Types of learning/teaching activities 16. Other types of activities 16. Other types of activities 17. Evaluation criteria 17. Evaluation criteria		Acquisition of practical know	ledge a	nd skills in the domain of hos	pital pharmacy practice:				
10. groups of medications and medical supplies used in hospital settings, storage conditions for specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. Content of the study program: - The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; 12. - Performing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - - Administrative management of a hospital pharmacy. 12. Study methods: 10 ECTS x 30 hours = 300 hours (15 weeks) 15 weeks (75 days) x 20 hours = 300 hours 13. Total amount of time available 15.1. Lectures – theory auditory, seminars, teamwork 30 hours 14. Distribution of tasks 30+30+0+240+0 16.2. Individual tasks 24		organization of work in a host	spital p	harmacy and administrative ta	sks, familiarization with				
specific categories of medications, the procedures for dispensing medications to clinical departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of <i>ex tempore</i> magistral formulations intended for hospital treatment. Content of the study program: – The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. – Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; – Performing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; – Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. 13. Total amount of time available 14. Distribution of tasks 30+30+0+240+0 15. Types of learning/teaching activities 15.1. 16.2. Individual tasks 240 hours 16.3. Home study - tasks 0 hours 16.4. Projects 0 hours 17. Evaluation / assessment methods	10.	groups of medications and me	edical s	upplies used in hospital setting	s, storage conditions for				
departments, and record-keeping. Execution of sterilization procedures and aseptic techniques, as well as preparation of ex tempore magistral formulations intended for hospital treatment.Content of the study program:-The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions;11Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; -12.Familiarization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - - - Administrative management of a hospital pharmacy.13.Total amount of time available10 ECTS x 30 hours = 300 hours (15 weeks) 15 weeks (75 days) x 20 hours = 300 hours14.Distribution of tasks activities30+30+0+240+015.Types of learning/teaching activities15.1.16.Other types of activities16.1.17.Evaluation / assessment methods16.1.17.Evaluation / assessment methods17.17.1.Evaluation criteria17.Up to 50 points 5 (five) (F)17.Up to 50 points 5 (five) (F)17.Up to 50 points 5 (five) (F)		specific categories of medica	ations,	the procedures for dispensing	medications to clinical				
Execution of sterilization procedures and aseptic techniques, as well as preparation of extempore magistral formulations intended for hospital treatment. Content of the study program: - The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; 11. - Familiarization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. 13. Total amount of time available 10 ECTS x 30 hours = 300 hours (15 weeks) 14. Distribution of tasks 30+30+0+240+0 15. Tutorials (laboratory, auditory), seminars, teamwork 30 hours 16. Prejects 0 hours 16.1. Projects		departments, and record-keeping.							
Tempore magistral formulations include for hospital relation? Content of the study program: - The role of the hospital pharmacist: providing advice od medication administration, familiarization with medications used in hospital settings, their pharmacotherapeutic classification, and researching their indications, contraindications, and potential interactions; 11. - Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; 11. - Familiarization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. 13. Total amount of time available 10 ECTS x 30 hours = 300 hours (15 weeks) 14. Distribution of tasks 30+30+0+240+0 15. Types of learning/teaching activities 15.1. Lectures - theory 30 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.1. Projects 0 hours 17. Itsuation / assessment methods 16.3. Home		<i>tempore</i> magistral formulations intended for hospital treatment.							
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11. classification, and researching their indications, contraindications, and potential interactions; 11. Familiarization with types of medical materials dispensed in hospital settings and the essential medicines list for hospital pharmacies; - Performing sterilization procedures, aseptic work in the hospital pharmacy, and preparing magistral formulations intended for hospital treatment; - Administrative management of a hospital pharmacy. 12. Study methods: Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy. 13. Total amount of time available 14. Distribution of tasks Types of learning/teaching activities 15.1. 15. Lectures - theory 30 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.2. Individual tasks 240 hours 17. Evaluation / assessment methods 16.3. Home study – tasks 0 hours 17. Evaluation criteria Up to 50 points 5 (five) (F) 51 – 60 points 6 (six) (E)		familiarization with medications used in hospital settings, their pharmacotherapeutic							
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$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		essential medicines list for hospital pharmacies;							
$\frac{\text{preparing magistral formulations intended for hospital treatment;}}{- Administrative management of a hospital pharmacy.}$ $\frac{12.}{\text{Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy.}}{13.}$ $\frac{12.}{\text{Total amount of time available}} \qquad 10 \text{ ECTS x 30 hours = 300 hours (15 weeks)} \\ 15 \text{ weeks (75 days) x 20 hours = 300 hours} \\ 16 where were were were were were were wer$		 Performing sterilization procedures, aseptic work in the hospital pharmacy, and 							
$\frac{- \text{ Administrative management of a hospital pharmacy.}}{\text{Study methods:}}$ $\frac{12.}{\text{Theoretical, practical, and self-directed approaches tailored to the field of hospital pharmacy.}}{13.}$ $\frac{13.}{\text{Total amount of time available}} \qquad 10 \text{ ECTS x 30 hours} = 300 \text{ hours} (15 \text{ weeks}) \\ 15 \text{ weeks} (75 \text{ days}) \text{ x 20 hours} = 300 \text{ hours}}{15 \text{ weeks}} \\ \frac{16.}{15 \text{ weeks}} \text{ of learning/teaching} \\ \text{activities}} \qquad \frac{15.1}{15.2.} \text{Lectures - theory} \qquad 30 \text{ hours}}{130 \text{ hours}} \\ \frac{15.2.}{15.2.} \frac{15.1.}{10 \text{ Lectures - theory}} \\ \frac{16.1.}{15.2.} \text{Projects} \qquad 0 \text{ hours}}{16.3.} \\ \frac{16.2.}{16.3.} \text{Home study - tasks} \qquad 0 \text{ hours}}{16.3.} \\ \frac{17.}{17.1.} \text{Evaluation / assessment methods}} \\ \frac{17.}{17.1.} \frac{17.1.}{17.1.} \text{Evaluation criteria} \qquad \frac{10 \text{ Evaluation criteria}}{15.1 \text{ completed}} \\ \frac{17.}{17.000000000000000000000000000000000000$		preparing magistral formulations intended for hospital treatment;							
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14. Distribution of tasks $30+30+0+240+0$ 15. Types of learning/teaching activities 15.1. Lectures – theory 30 hours 15. Types of learning/teaching activities 15.2. Tutorials (laboratory, auditory), seminars, teamwork 30 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.2. Individual tasks 240 hours 17. Evaluation / assessment methods 16.3. Home study – tasks 0 hours 17. I7.1. Evaluation criteria Completed Not completed 17. I7.1. Evaluation criteria Up to 50 points 5 (five) (F) 51 – 60 points 6 (six) (E) 51 – 60 points 6 (six) (E)	13.	Total amount of time available	2	15 weeks (75 days) x 20 hours	s = 300 hours				
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15. Types of learning/teaching activities 15.2. Tutorials (laboratory, auditory), seminars, teamwork 30 hours 16. Other types of activities 16.1. Projects 0 hours 16. Other types of activities 16.2. Individual tasks 240 hours 17. Evaluation / assessment methods 16.3. Home study – tasks 0 hours 17. 17.1. Evaluation criteria Completed Not completed 17. 0.1. Up to 50 points 5 (five) (F) 51 – 60 points 6 (six) (E) 0 hours			15.1.	Lectures – theory	30 hours				
16. 15.2 : auditory), seminars, teamwork 50 flours 16. Other types of activities 16.1 . Projects 0 hours 16. Other types of activities 16.2 . Individual tasks 240 hours 17. Evaluation / assessment methods 16.3 . Home study – tasks 0 hours 17. Individual tasks 240 hours 0 hours 17. Evaluation / assessment methods $Completed$ 17.1. Evaluation criteria Up to 50 points 5 (five) (F) $51-60$ points 6 (six) (E) $51-60$ points 6 (six) (E)	15.	activities	15.2	Tutorials (laboratory,	30 hours				
16. Other types of activities 16.1. Projects 0 hours 16. Individual tasks 240 hours 16.1. Individual tasks 240 hours 16.2. Individual tasks 0 hours 16.3. Home study – tasks 0 hours 17. Evaluation / assessment methods Completed 17. Individual tasks Individual tasks 17. Evaluation criteria Completed 17. Up to 50 points 5 (five) (F) 51 – 60 points 6 (six) (E)			13.2.	auditory), seminars, teamwork					
16. Other types of activities 16.2. Individual tasks 240 hours 16.3. Home study – tasks 0 hours Evaluation / assessment methods 17. Individual tasks Completed 17.1. Evaluation criteria Completed Vp to 50 points 5 (five) (F) 51 – 60 points 6 (six) (E)			16.1.	Projects	0 hours				
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Evaluation / assessment methods 17. 17.1. Evaluation criteria Completed Up to 50 points 5 (five) (F) 51 - 60 points 6 (six) (E)			16.3.	Home study – tasks	0 hours				
17. 17.1. Evaluation criteria Completed Not completed Up to 50 points 5 (five) (F) 51 - 60 points 6 (six) (E)		Evaluation / assessment metho	ods						
Up to 50 points5 (five) (F) $51 - 60$ points 6 (six) (E)	17.	17.1. Evaluation criteria			Completed				
Up to 50 points5 (five) (F) $51 - 60$ points 6 (six) (E) $61 - 60$ points 6 (six) (E)					Not completed				
51 - 60 points 6 (SIX) (E)				Up to 50 points	(1100) (F)				
161 70 maints $17 (across) (D)$	18.			51 - 60 points	$\frac{0(\text{SIX})(\text{E})}{7(\text{seven})(\text{D})}$				
18. Assessment criteria (points / grade) $\frac{01 - 70 \text{ points}}{71 - 80 \text{ points}}$ / (seven) (D)		Assessment criteria (points / g	rade)	71 = 70 points	$\frac{1}{8} (\text{seven}) (D)$				
$\begin{array}{c c} 71 - 00 \text{ points} & 0 \text{ (cigit)} (C) \\ \hline 81 - 00 \text{ points} & 0 \text{ (nine)} (B) \end{array}$				81 - 90 points	9 (nine) (R)				
91 - 100 points 10 (ten) (A)				91 – 100 points	10 (ten) (A)				

19.	Eligibility for signature and taking the final exam		ignature and taking	Completed 300 hours and a confirmed practice booklet is mandatory to complete this course. No final exam needed.						
20.	Langua	ige of th	e study program	English						
21.	Quality teachin	assurar g proces	ice methods of the	Self-evaluation						
	Literatu	ıre								
		Manda	atory literature							
		No.	Author	Title	Publisher	Year				
		1.	Malone, P. M., Witt, B. A., Malone, M. J., Peterson, D. M.	Drug Information: A Guide for Pharmacists (7 th Edition)	McGraw Hill	2018				
	22.1.	2.	Embrey, M. (Editor)	Managing Access to Medicines and Health Technologies (Chapter 45. Hospital Pharmacy Management)	Management Sciences for Health	2012				
		3.	https://www.ema.eu	ropa.eu/en/medicines						
		4.	https://lekovi.zdravs	tvo.gov.mk/drugregister/d	overview					
		5.	https://malmed.gov.	https://malmed.gov.mk/						
22.		6.	https://eahp.eu/hosp hospital-pharmacy/	<u>nttps://eahp.eu/hospital-pharmacy-practice/european-statements-</u> nospital-pharmacy/						
		Additional literature								
		No.	Author	Title	Publisher	Year				
	22.2.	1.	Whalley, B., Fletcher, K. E., Weston, S., Howard, R. L., Rawlinson, C. F. (Editors)	Foundation in Pharmacy Practice	Pharmaceutical Press	2008				
		2.	Beardsley, R. S., Skrabal, M. Z., Tindall, W. N.	Communication Skills in Pharmacy Practice: A Practical Guide for Students and Practitioners (7 th Edition)	Lippincott Williams & Wilkins	2012				

	Appendix 3 No. 45		Study program for integrated first and second						
1	Name of the course		PROFESSIONAL PRACTICE –						
1.			COMMUNITY PHARMA	CY					
2.	Code		3FMN196325						
3.	Study program		Pharmacy						
4.	(department institute branch)		Case Deleasy University. Stin						
5	Degree (first second third cyc	.le)	Integrated first and second cy	vele of studies					
5.	Degree (first, second, tilld eye		Fifth year /	Jumber of					
6.	Academic year / semester		Tinki year7.Tumber of ECTS20						
8.	Professor		Assigned practice coordinato institution	r from the receiving					
9.	Pre-conditions for course registration		Enrolled in tenth semester of studies						
	Aims of the study program (compet	ences):						
	Acquisition of practical know	vledge	and skills in the field of pha	rmacy practice: keeping					
10	selection, procurement (order	ng and	receipt), handling shortages,	storage and preservation					
10.	dispensing prescriptions, patient counseling, prescription processing, maintaining records for								
	controlled substances, preparation of <i>ex tempore</i> magistral formulations, monitoring adverse								
	orug reactions, detecting potential interactions in polypnarmacy, and the pharmacist's advisory role in the domains of cosmetics, dietary products, and supplements								
	Content of the study program	n:							
	- Familiarization with the administrative operation of a pharmacy, maintaining								
	mandatory documentation, understanding the legal regulations related to pharmacy								
	practice, and using the information system for administrative work with the Health								
	Insurance Fund;								
	- Familiarization with pharmacotherapeutic drug groups and the use of professional								
	literature databases for pharmacotherapy, indications, contraindications, and								
	interactions;								
11.	 Understanding the essential medicines list for community pharmacies; 								
	 Introduction to the pharmacovigilance system; 								
	- Familiarization with categories of medicines and medical devices, cosmetic products,								
	procedures:	dietary products, and supplements, including their reception, storage, and dispensing							
	 Understanding the pro 	cesses f	for dispensing prescription and	non-prescription (OTC)					
	drugs;		or dispensing presemption and	non presenption (010)					
	 Preparation of <i>ex tempore</i> magistral medicines: 								
	 Developing communication skills for patient interactions and providing professional 								
	advice.								
	Study methods:								
12.	Theoretical, practical, and self	-directe	d approaches tailored to the fie	ld of community					
	pharmacy.								
13.	Total amount of time available	;	20 ECTS x 30 hours = 600 hours	burs (15 weeks) $a = 600 \text{ haves}$					
14	Distribution of tasks		$15 \text{ weeks} (75 \text{ days}) \times 40 \text{ hour}$	s = 600 nours					
14.	Distribution of tasks		Lectures – theory	30 hours					
15.	Types of learning/teaching	1.5.1.	Tutorials (laboratory	50 110415					
	activities	15.2.	auditory), seminars, teamwor	k 270 hours					
		16.1.	Projects	0 hours					
16.	Other types of activities	16.2.	Individual tasks	300 hours					
		16.3.	Home study – tasks	0 hours					
17.	Evaluation / assessment metho	ds		·					

	171	Evoluo	tion oritorio			Completed		
	17.1.	Lvalua				Not compl	eted	
				Up to 50 points		5 (five) (F))	
				51 – 60 points		6 (six) (E)		
18	Access	mont ori	taria (nainta / grada)	61 – 70 points		7 (seven) (D)	
10.	A35035		iena (ponits / grade)	71 – 80 points		8 (eight) (0	C)	
				81 – 90 points		9 (nine) (B	5)	
				91 – 100 points		10 (ten) (A	L)	
	Fligibi	lity for s	ionature and taking	Completed 600 hours an	Completed 600 hours and a confirmed practice			
19.	the fina	al exam	ignature and taking	booklet is mandatory to complete this course.				
		ar exam		No final exam needed.				
20.	Language of the study program English							
21.	Quality teachin	Quality assurance methods of the teaching process Self-evaluation						
	Literat	ure						
		Manda	tory literature					
	22.1.	No.	Author	Title	Pu	blisher	Year	
		1.	Beardsley, R. S., Skrabal, M. Z., Tindall, W. N.	Communication Skills in Pharmacy Practice: A Practical Guide for Students and Practitioners (7 th Edition)	Lippin Willia Wilkir	cott ms & ıs	2012	
22.		2.	Malone, P. M., Witt, B. A., Malone, M. J., Peterson, D. M.	Drug Information: A Guide for Pharmacists (7 th Edition)	McGraw Hill		2018	
		3.	Dua, K., Pabreja, K., Sharma, V. K.	Community Pharmacy: Basic Principles and Concepts	Pharm Press	aMed	2015	
		4.	https://www.ema.eu	ropa.eu/en/medicines				
		5.	https://lekovi.zdravs	tvo.gov.mk/drugregister/	overviev	V		
		6.	https://malmed.gov.	mk/				
		Additi	onal literature					
		No.	Author	Title	Pu	blisher	Year	
	22.2.	1.	Calomo, J. M.	Teaching Management in a Community Pharmacy	Ameri Journa Pharm Educa	can l of aceutical tion	2006	

		Appendix 3 No. 46		Study program for integrated first and second cycle of studies					
1.	Name of	the course		GRADUATION TH	IESIS				
2.	Code			3FMN196425					
3.	Study pr	ogram		Pharmacy					
	Study pr	ogram organizer		Faculty of Medical Second	cience	es.			
4.	(departm	ent, institute, branch)		Goce Delcev Univers	sitv. S	tip			
5.	Degree (first, second, third cyc	ele)	Integrated first and second cycle of studies					
6.	Academ	ic year / semester	,	Fifth year / Tenth semester7.Number of ECTS10					
8.	Professo	r		Selected by the stude	nt from	m the teac	ning	professors	
9.	Pre-cond registrati	litions for course		Enrolled in tenth sem	ester	of studies		•	
	Aims of	the study program (compet	ences):					
	- 1	Independent execution	of scie	ntific research work ur	nder tl	ne supervis	ion	of a selected	
	 Development of competencies for scientific research, including formulating an 								
10.	- Conducting literature searches from relevant sources:								
	 Conducting literature searches from relevant sources; Critically exploration alteria disputation. 								
	 Critically evaluating obtained results; Writing are face involved intific research in the second secon								
	-	Writing professional/s	cientifie	c research papers;					
	- I	Presenting research fir	idings e	effectively.					
	Complet	Completion of all phases of scientific research work, from the preliminary literature review and							
	formulation of a research hypothesis (research objective) to the implementation of research								
	(experim	ent) analysis of the o	btained	results and presentation	on of	the finding	s in	the form of a	
	written f	hesis and a thesis defe	ense	results, and presentativ		the mang	5 111	the form of a	
	After conducting the research, the student prepares a thesis containing the following chapters:								
11.	Introduction, Research Objective, Materials and Methods, Results and Discussion, Conclusion,								
	and References. Once the thesis is completed and approved by the mentor, a public defense is								
	scheduled. The public defense is conducted in front of committee composed of a chairperson,								
	a first member, and a second member, who also serves as the mentor of the thesis.								
	During t	he defense, the studen	t preser	nts the main aspects of	the th	esis in a co	onci	se format and	
	then resp	oonds to questions pos	ed by th	ne committee members.	. After	r the defen	se, t	he committee	
	deliberat	tes and decides whethe	er the th	esis is accepted, assign	ning ai	n appropria	ate g	grade.	
	Study m	nethods:		.					
12.	Working	g with a mentor, condu	cting li	terature searches, self-l	learnii	ng, practic	al w	ork,	
10	scientific	c writing, and presenti	ng the r	research in the form of	a pres	sentation.			
13.	Total am	iount of time available	•	10 ECTS x 30 hours	= 300	hours			
14.	Distribut	tion of tasks	1.5 1	30+30+0+200+40		201			
15	Types of	f learning/teaching	15.1.	Lectures – theory		301	iour	'S	
15.	activities	5	15.2.	I utorials (laboratory,		30 l	nour	S	
			16.1	Draioata	eaniw				
16	Other tw	nes of activities	16.1.	Individual tasks		200	hor	120	
10.	Other ty	pes of activities	16.2.	Home study tasks		401		115 'S	
	Evaluati	on / assessment metho	 ds	110mc study – tasks		401	ioul	3	
	17.1	Tests	40			/			
17	17.2	Individual tasks / proje	ect (nres	sentation: written and o	oral)	100	noi	nts	
1/.	17.3	Activity and participat	ion	sentation. written and o		/	101		
	17.4	Final exam			/				
				Up to 50 points		5 (f	ive)	(F)	
18.	Assessm	ent criteria (points / g	51 - 60 points		6 (s	ix) (E)		
				61 70 maints	7 (201100) (D)			
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				01 - 70 points	/ (seven) (D)			
				71 – 80 points	8 (eight) (0	C)			
				81 – 90 points	9 (nine) (B	3)			
				91 – 100 points	10 (ten) (A	()			
	Eligibi	lity for s	ignature and taking	Completed 300 hours of graduation work, completion					
19.	the fina	al exam		of all necessary activities related to the study program					
				and plagiarism check of the written paper.					
20.	Langua	ige of th	e study program	English					
21	Quality assurance methods of the			Calf and heating					
21.	teachin	g proces	SS	Self-evaluation					
	Literat	ure							
		Manda	atory literature						
	22.1.	No.	Author	Title I	Publisher	Year			
22.		1.	Literature selection a	ccording to the research topic.					
		Additi	onal literature						
	22.2.	No.	Author	Title I	Publisher	Year			
		1.							

		Appendix 3 No. 47		Study program for integrat cycle of stud	ted first and second dies	
1.	Name	of the course		MACEDONIAN LANGUAGI STUDENTS	E FOR FOREIGN	
2.	Code			4FF161125		
3.	Study	program		Pharmacy		
4.	Study (depart	program organizer tment, institute, branch)		Faculty of Medical Sciences, Goce Delcev University, Stip		
5.	Degree	e (first, second, third cyc	cle)	Integrated first and second cycle	e of studies	
6.	Acade	mic year / semester		First year / First semester7.Num EC	mber of 4	
8.	Profes	sor		Ass. Prof. Dr.sc. Marija Grkova	-Beader	
9.	Pre-co registra	nditions for course ation		Enrolled in first semester of stud	dies	
	Aims	of the study program (compet	ences):		
10.	with the phonological-phonetic and morphological structure of the language. They are also introduced to the basic ways of word formation, proficiency in the Macedonian language in oral and written form. Students are introduced to basic vocabulary related to colors, physical appearance, hour weather, seasons, parts of the world, food, institutions, and so on. Students are introduced to the alphabet, present and future tense, the verb 'am', nouns, adjectives, their grammatical categories and more.					
11.	Content of the study program (applies both for theoretical and practical part): Alphabet – sounds and graphemes, numbers, present and future tense (affirmative, negative and interrogative), nouns – grammatical categories, adjectives, pronouns, short and long pronoun forms – imperative, prepositions. Introduction, flags, countries, nationalities, transport, household, days, months, hours, seasons, parts of the world, food, institutions, activities, clothes, music, sports, animals, avanuable landmarks, etc.					
12.	Study Interactechnic electro	methods: ctive, group work, home ques, individual assign nic learning in teaching	work, in ments, and exe	ndividual work, lecture, discussio independent study, making indercises.	n, cooperative learning lividual work, use of	
13.	Total a	amount of time available	e	4 ECTS x 30 hours = 120 hours	(2+1)	
14.	Distrib	oution of tasks		30+15+15+30+30		
15.	Types activiti	of learning/teaching ies	15.1. 15.2.	Lectures – theory Tutorials (laboratory, auditory), seminars, teamwork	30 hours 15 hours	
			16.1.	Projects	15 hours	
16.	Other	types of activities	16.2.	Individual tasks	30 hours	
			16.3.	Home study – tasks	30 hours	
	Evalua	tion / assessment metho	ods			
	17.1.	Tests			40 points	
17.	17.2.	Individual tasks / proje	ect (pres	sentation: written and oral)	10 points	
	17.3. Activity and participation				20 points	
	17.4.	Final exam			30 points	
				Up to 50 points	5 (five) (F)	
				51-60 points	6 (six) (E)	
10		, •, • <i>/</i> •	1 \	61 - 70 points	7 (seven) (D)	
18.	Assess	ement criteria (points / g	rade)	71-80 points	8 (eight) (C)	
				81-90 points	9 (nine) (B)	
				91 – 100 points	10 (ten) (A)	

	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam activities, i.e.,	42 points			
19.	the fina	al exam		from two tests, seminary	from two tests, seminary or practical work, and				
				regular participation to t	regular participation to the organized activities.				
20.	Langua	ige of th	e study program	Macedonian and English					
21	Quality	v assurar	nce methods of the	Salf avaluation					
21.	teachin	g proces	SS	Sell-evaluation					
	Literat	ure							
		Manda	Iandatory literature						
		No.	Author	Title	Publisher	Year			
		1.	Kusevska, M., Mitkovska, L.	Do you speak Macedonian? – Textbook	Prosvetno delo	2017			
22.	22.1.	2.	Kusevska, M., Mitkovska, L.	Do you speak Macedonian? – Workbook	Prosvetno delo	2017			
		3.	Gochkova- Stojanovski, T., Panovska- Dimkova, I.	Bozhilak	Kultura	2015			
		Additi	onal literature						
	22.2.	No.	Author	Title	Publisher	Year			
	·	1.							

		Appendix 3 No. 48		Study program for cyc	r inte cle of	grate stud	ed first a ies	nd second
1.	Name	of the course		ENGLISH FOR PHA	ARM	ACIS	STS	
2.	Code			4FF161225				
3.	Study	program		Pharmacy				
4	Study	program organizer		Faculty of Medical Sci	ience	s,		
4.	(depar	tment, institute, branch)		Goce Delcev Universit	ty, St	ip		
5.	Degre	e (first, second, third cy	cle)	Integrated first and sec	cond	cycle	of studie	es
6.	Acade	mic year / semester		First year / First semester	7.	Nun ECT	ber of S	4
8.	Profes	sor		Senior Lecturer Draga	ın Do	nev		
9.	Pre-co registr	nditions for course ation		Enrolled in first semes	ster of	f stud	ies	
	Aims	of the study program (compet	ences):				
10	The ai	m of the course is to enal	ole stude	ents to supplement and ex	xpan	d their	r languag	ge knowledge,
10.	as wel	l as to apply it in verba	l situati	ons in the field of pharm	macy	throu	igh the i	ntegral use of
	approp	oriate language.						
	Conte	nt of the study program	m (appl	ies both for theoretical	land	prac	tical par	rt):
1.1	The H	uman Body; Review of	Previou	is Lesson Material; The	Loco	omoto	ory Syste	m; Review of
11.	Previo	us Lesson Material; If	ne Senso	bry System; Review of	Prev	10US	Lesson I	Material; The
Nervous System; Review of Previous Lesson Material; The Respirator						ry Syster	n; Review of	
	Study methods:							
12	2 Seminars discussion cooperative learning techniques independent learning making							
individual work, use of electronic learning in teaching and exercises						king		
13.	Total a	amount of time available	2	4 ECTS x 30 hours = 1	120 h	ours	(2+1)	
14.	Distri	oution of tasks		30+15+15+30+30				
	Types of learning/teaching		15.1.	Lectures – theory			30 hour	s
15.			15.2	Tutorials (laboratory,			15 hour	10
	activit	105	13.2.	auditory), seminars, te	amw	ork	15 noui	.8
			16.1.	Projects			15 hour	S
16.	Other	types of activities	16.2.	Individual tasks			30 hour	·S
	- 1		16.3.	Home study – tasks			30 hour	S
	Evalua	ation / assessment metho	ods				40 :	
17	17.1.		. (1)		40 poin	ts
1/.	17.2.	A stivity and nortiging	ect (pres	sentation: written and or	ai)		10 poin	ts
	17.3.	Final avem	lion				20 poin	ts
	17.4.	I'llial Cxalli		Up to 50 points			$\frac{50 \text{ point}}{5 \text{ (five)}}$	$\frac{15}{(F)}$
				51 - 60 points			$\frac{5(\text{inve})}{6(\text{six})}$	(F)
				61 - 70 points			$\frac{0}{5}$ (sever	(D)
18.	Assess	sment criteria (points / g	rade)	71 - 80 points			8 (eight	(C)
				81 - 90 points			9 (nine)) (B)
				91 – 100 points			10 (ten)) (A)
	Eligib	ility for signature and ta	king	60% realization of pre-	e-exar	n acti	vities, i.e	e., 42 points
19.	the fin	al exam	C	from two tests, semina	ary or	pract	tical wor	k, and
				regular participation to	o the	organ	ized acti	vities.
20.	Langu	age of the study program	n	English				
21.	Qualit teachin	y assurance methods of ng process	the	Self-evaluation				
22	Literat	ture						
22.	22.1.	Mandatory literature						

		No.	Author	Title	Publisher	Year		
		1.	Evans, V., Dooley, J.	<i>Upstream Elementary</i> <i>A2</i>	Express Publishing	2013		
		Additional literature						
	22.2.	No.	Author	Title	Publisher	Year		
		1.						

		Appendix 3 No. 49		Study program for integrated first and second cycle of studies				nd second
1.	Name	of the course		GERMAN LANGUA	AGE	LEVEL	A1.1	
2.	Code			4FF161325				
3.	Study	program		Pharmacy				
4	Study	program organizer		Faculty of Medical So	cience	es,		
4.	(depar	tment, institute, branch)		Goce Delcev Univers	ity, St	tip		
5.	Degree	e (first, second, third cyc	ele)	Integrated first and se	cond	cycle of	studie	es
6.	Acade	mic year / semester		First year / First semester	7.	Numbe ECTS	er of	4
8.	Profes	sor		Senior Lecturer Maria	ca Tas	sevska		
9.	Pre-co registr	nditions for course ation		Enrolled in first seme	ster o	of studies	5	
10.	Aims of Studen everyd countr opinio etc.	of the study program (hts to be able to conduct lay topics, to find an unk ies, to shop in Germany ns, to get acquainted wit	compet short d nown c y, to ma h the cu	ences): ialogues when meeting ity, to communicate wi ake recommendations, alture and civilization in	, gree th peo to de n the (eting, to ople fror escribe a German	expres n Gerr nd exj -speak	s opinions on nan-speaking press specific ing countries,
11.	 Content of the study program (applies both for theoretical and practical part): <i>Grammar</i>: verbs and conjugation of verbs (haben, sein, kommen, sprechen, fahren, schlafen, sehen), question words (wer, wo, woher, wie), personal pronouns (accusative and dative), possessive pronouns (nominative and accusative), definite / indefinite article, separable verbs, adverbs in time (accusative and dative), question sentences, modal verbs (mögen, können, wollen, dürfen, sollen, müssen), perfect (past tense), imperative (ordering, adverbs of place, modality 'könnten, würden + infinitiv'), comparative and conjugative adjectives (viel, gern, gut), verbs with dative, conjunctions for independent sentences (und, oder, aber, denn), ordinal numbers. <i>Vocabulary</i>: words from the field: greeting, presentation, eating and drinking, weight measures, furniture, household appliances, numbers, colors, activities and leisure, weather, professions, human body parts, diagnosis and recommendations, landmarks of the city, transportation, fashion and clothing, more important holidays in the German-speaking countries, etc. <i>Speaking</i>: dialogues when meeting, first meeting, description of person, dialogues in the market, restaurant, description of an apartment or particular room, description of activities we undertake in our free time, description of a profession, description of a city that you visited and country, scheduling, rescheduling or cancellation of an appointment, description of a particular location, answering machine message, dialogues in shopping center, fashion magazine image description of sharing specialty opinions. 							
12.	Study Interact cooper activiti	methods: ctive method: group wor cative studying technique ies, individual studying.	k, repoi es, indiv	rts, homework, seminar vidual tasks, simulation	pape of ex	rs, discu tra-curr	ission, icular	debate, educational
13.	Total a	amount of time available	,	4 ECTS x 30 hours =	120 h	nours (2-	+1)	
14.	Distrib	oution of tasks		30+15+15+30+30				
15.	Types	of learning/teaching	15.1.	Lectures – theory Tutorials (laboratory,		3	0 hour 5 hour	S
	activit		13.2.	auditory), seminars, to	eamw	vork 1		0
1.			16.1.	Projects		1	$\frac{5 \text{ hour}}{2}$	S
16.	Other	types of activities	16.2.	Individual tasks		3	$\frac{0 \text{ hour}}{0}$	S
		16.3.		Home study – tasks		3	0 hour	S
17.	Evalua	ation / assessment metho	ds				<u>.</u>	
	17.1.	Tests				4	0 poin	ts

	17.2.	Individ	ual tasks / project (pres	sentation: written and oral	l)	10 points	
	17.3.	Activit	y and participation			20 points	
	17.4.	Final e	xam			30 points	
				Up to 50 points		5 (five) (F)
				51 – 60 points		6 (six) (E)	
10	1	mont out	tonia (nainta / anada)	61 – 70 points		7 (seven)	(D)
10.	Assess	ment cri	teria (points / grade)	71 – 80 points		8 (eight) (C)
				81 – 90 points		9 (nine) (H	3)
				91 – 100 points		10 (ten) (A	A)
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	exam act	ivities, i.e.,	42 points
19.	the fina	al exam		from two tests, seminar	y or prac	tical work,	and
				regular participation to the organized activities.			
20.	Langua	age of th	e study program	German and English			
21.	Quality teaching	/ assurar	nce methods of the ss	Self-evaluation			
	Literat	ure					
		Manda	atory literature				
		No.	Author	Title	Pu	blisher	Year
			Kerner, M., Hilpert,	Schritte International			2 005
		1.	S., Reimann, M.,	1: Kursbuch und	Huebe	r Verlag	2006
			Tomaszewski, A.	Arbeitsbuch			
	22.1.	2.		Grammatik aktiv:	Cornelsen		2010
			J1n, F., Voß, U.	Uben, Hören,			2018
				Sprechen			
				Large Macedonian-	Magor		
		3.	Grcheva, R., Rau,	German dictionary,			2006
			Р.	German-Macedonian			
22.		A J J ; 4:		aictionary			
		No	Author	Titla	Du	blichor	Voor
		INO.	Autioi	Title	Notion		Tear
					Ination	$a \propto \frac{1}{2}$	
		1	Gacoy D	Gorman grammar	Librar	v St	1005
		1.	Gaeov, D.	German grummar	Cleme	nt of	1775
	22.2				Ohrid	111 01	
	22.2.		Evans S. Pude A.		omia		
		2.	Sprecht, F.	Menschen A1.2	Huebe	r Verlag	2012
			· · ·	Grammatik &			
		2	Smallana O	Konversation 1:	Trees		2012
		3.	Swerlowa, O.	Arbeitsblätter für den	Lange	nscheidt	2013
				Deutschunterricht			

	Appendix 3 No. 50		Study program for integ cycle of	rated first aı tudies	nd second				
1.	Name of the course		INDUSTRIAL PHARMA	ĊY					
2.	Code		3FMN196825						
3.	Study program		Pharmacy						
4	Study program organizer		Faculty of Medical Sciences						
4.	(department, institute, branch)		Goce Delcev University, Sti)					
5.	Degree (first, second, third cyc	ele)	Integrated first and second c	cle of studie	s				
6.	Academic year / semester		Fourth year / Eighth semester7.	Number of ECTS	2				
8.	Professor		Assoc. Prof. Dr.sc. Aleksand	ar Cvetkovsk	i				
9.	Pre-conditions for course registration		Enrolled in eighth semester	of studies					
	Aims of the study program (compet	ences):						
	Acquiring a knowledge in the	quality	assurance systems in the pro-	uction and d	istribution of				
10.	medicines, the basic principle	es for fo	ormulation and development	of pharmaceu	itical dosage				
	forms (PDF), the methodologi	es of tra	insferring the procedure for the	e production	of PDF from				
	the laboratory to the production	ion leve	el, the methodology of valid	tion of the t	echnological				
	Content of the study program:								
	— Concept of developme	II. Intofnk	armaceutical formulations an	l transfer of t	echnologies				
	from the laboratory to	the pr o	duction industrial facilities:		echnologies				
	 Formulation and reformulation of PDFs: 								
	 Formulation and development of conventional PDFs; 								
	 Formulation and development of modern PDFs; 								
	– Incompatibilities in the formulation, stability, stabilization;								
1.1	 Transferring the proce 	dure to	produce PDFs from the labor	tory to the in	dustrial				
11.	level;								
	- Pharmaceutical-technological operations in the pharmaceutical industry: crushing,								
	Steving;								
	 Pharmaceutical-technological operations in the pharmaceutical industry: mixing, home conjustion and devices for mixing and home conjustion. 								
	homogenization and devices for mixing and homogenization;								
	 – Thrations and Intration – Compression and com 	nression	a devices in the pharmaceutic	l industry.					
	 Filling packaging sto 	rage an	d distribution of medicines	i industry,					
	Study methods:	ruge un							
12.	Lectures, seminars, individual	assignn	nents, collaborative lectures, r	nethods of gro	oup				
	discussion.	U	,	U	1				
13.	Total amount of time available	;	2 ECTS x 30 hours = 60 hours	rs (2+0)					
14.	Distribution of tasks		30+0+10+10+10						
	Types of learning/teaching	15.1.	Lectures – theory	30 hours	5				
15.	activities	15.2	Tutorials (laboratory,	0 hours					
		13.2.	auditory), seminars, teamwo	k o nours					
		16.1.	Projects	10 hours	5				
16.	Other types of activities	16.2.	Individual tasks	10 hours	5				
		16.3.	Home study – tasks	10 hours	5				
	Evaluation / assessment metho	ods							
17	1/.1. Tests	4 (······································	40 point	40 points				
1/.	17.2. Individual tasks / proje	ect (pres	sentation: written and oral)	10 point	S				
	17.4 Final aver	ion		20 point	<u>s</u>				
10	Aggggment oritoria (points / a	rada)	Up to 50 points	50 point	<u>s</u> (E)				
10.	Assessment criteria (points / gi	iauej	op to so points	J (nve)	(II)				

				51 – 60 points		6 (six) (E)			
				61 – 70 points		7 (seven) (D)		
				71 – 80 points		8 (eight) (0	C)		
				81 – 90 points		9 (nine) (B	8)		
				91 – 100 points		10 (ten) (A	()		
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam act	ivities, i.e., 4	42 points		
19.	the fina	al exam		from two tests, seminary	or prac	tical work, a	and		
				regular participation to t	he orgar	nized activiti	ies.		
20.	Langua	ige of th	e study program	English					
21.	Quality teachin	assurar	nce methods of the	Self-evaluation					
	Literature								
		Manda	atory literature						
	22.1.	No.	Author	Title	Pu	blisher	Year		
		1.	Khar, R. K., Vyas, S. P.	Lachman/Lieberman's The Theory and Practice of Industrial Pharmacy (4 th Edition)	CBS P & Dist Pvt Lte	Publishers tributors d	2015		
		2.	Levin, M. (Editor)	Pharmaceutical Process Scale-Up (3 rd Edition)	CRC F	Press	2011		
22.		Additi	onal literature				-		
		No.	Author	Title	Pu	blisher	Year		
	22.2.	1.	Sinko, P. J. (Editor)	Martin's Physical Pharmacy and Pharmaceutical Sciences (6 th Edition)	Lippin Willia Wilkir	acott ms & 15	2008		
		2.	Allen, L., McPherson, T. B.	Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems (12 th Edition)	Lippin Willia Wilkir	cott ms & 1s	2021		

		Appendix 3 No. 51		Study program fo cy	or into cle of	egrated first : f studies	and second			
1.	Name	of the course		COSMETOLOGY						
2.	Code			3FMN196925						
3.	Study	program		Pharmacy						
4	Study	program organizer		Faculty of Medical Sc	cience	es,				
4.	(depart	tment, institute, branch)		Goce Delcev Universit	ity, S	tip				
5.	Degree	e (first, second, third cyc	cle)	Integrated first and se	cond	cycle of studi	es			
6.	Acade	mic year / semester		Fourth year / Eighth semester	7.	Number of ECTS	2			
8.	Profess	sor		Assoc. Prof. Dr.sc. El	lena [Drakalska Sers	semova			
9.	Pre-co registra	nditions for course ation		Enrolled in eighth sen	nester	r of studies				
	Aims o	of the study program (compet	ences):						
	The ol	ojective of the course	Cosmet	ology within the Phar	macy	program is	to familiarize			
	students with composition, effects, preparation, and production of cosmetic products. The									
10.	course includes fundamentals of skin anatomy and physiology, the medical aspects of the									
10.	effects and potential side effects of cosmetic agents, characterization of cosmetic products, and									
	both active substances and excipients used in cosmetic production concerning their properties,									
	ingred	ients, manufacturing tec	nnology	and applications. Additionally, the course addresses the uality standards they are required to meet						
	Content of the study program:									
	Conte	Regulation of cosmet	n. Jogy:							
		 Anatomy and physiology of the skin; 								
	 Raw materials for cosmetics; 									
	- Formulation and evaluation of cosmetic preparations;									
	 Physical and chemical quality control of cosmetic products; 									
11.	- Characterization of dermato-cosmetic preparations;									
	 Application of nanotechnology in cosmetic formulation; 									
	 Specialized cosmetic products; 									
	 Adverse effects of cosmetic preparations; 									
	_	Cosmetovigilance;	1	1						
	_	Organic cosmetics;								
	_	Marketing of cosmetic	e prepar	ations.						
12	Study	methods:								
12.	Lectur	es, interactive teaching	and rese	earch work.						
13.	Total a	mount of time available	2	2 ECTS x 30 hours =	60 ho	ours (2+0)				
14.	Distrib	ution of tasks		30+0+15+15+0						
1.7	Types	of learning/teaching	15.1.	Lectures – theory		30 hou	rs			
15.	activiti	les	15.2.	Tutorials (laboratory,		, 0 hours	5			
			161	auditory), seminars, to	eamw	vork				
10	01	6 1 1 1 1	16.1.	Projects		15 hou	rs			
16.	Other	types of activities	16.2.	Individual tasks		15 nou	rs			
	Evolue	tion / aggaggement mathe	10.3.	Home study – tasks		0 hours	6			
	Evalua	Tests	<i>u</i> s			40 poir	nte			
17	17.1.	Individual tasks / proje	ect (pres	sentation: written and o	ral)	10 poir	nts			
17.	17.2.	Activity and participat	ion	sentation, written and 0.	141)	20 poir	nts			
	17.3.	Final exam	1011			30 poir	nts			
	1/.T.			Up to 50 points		5 (five)) (F)			
18.	Assess	ment criteria (points / g	rade)	51-60 points		6 (six)	(E)			
		u - 6	,	61 – 70 points		7 (seve	en) (D)			

				71 – 80 points		8 (eight) (0	C)		
				81 – 90 points		9 (nine) (B	5)		
				91 – 100 points		10 (ten) (A	L)		
19.	Eligibil the fina	lity for s al exam	ignature and taking	60% realization of pre-exam activities, i.e., 42 points from two tests, seminary or practical work, and regular participation to the organized activities.					
20.	Langua	ige of th	e study program	English					
21.	Quality teachin	assurar g proces	ace methods of the	Self-evaluation					
	Literatu	ure							
		Manda	Aandatory literature						
		No.	Author	Title	Pu	blisher	Year		
	22.1.	1.	SCCS (Scientific Committee on Consumer Safety)	Guidance on the safety assessment of nanomaterials in cosmetics	Europo Comm	ean iission	2023		
		2.	Cajkovac, M.	Cosmetology	Zagreb)	2004		
22.		3.	Vasiljevic, D., Savic, S., Djordjevic, Lj., Krajisnik, D.	Handbook of Cosmetology	Nauka	, Belgrade	2009		
		Additi	onal literature						
		No.	Author	Title	Pu	blisher	Year		
	22.2.	1.	Rieger, M. M.	Harry's Cosmetology (8 th Edition)	Chemi Publis	cal hing	2000		
		2.	Mohiuddin, A. K.	Cosmetics in use – A Pharmacological Review	Journa Derma Cosme	l of itology & etology	2019		

	Appendix 3 No. 52		Study program for integrated first and second cycle of studies				
1.	Name of the course		NUTRACEUTICAI	LS			
2.	Code		3FMN197025				
3.	Study program		Pharmacy				
	Study program organizer		Faculty of Medical Se	cience	S.		
4.	(department, institute, branch)		Goce Delcev Univers	sitv. St	tip		
5.	Degree (first, second, third cyc	le)	Integrated first and se	econd	cycle of studie	es	
6.	Academic year / semester	7	Fourth year / Eighth semester	7.	Number of ECTS	2	
8.	Professor		Assoc. Prof. Dr.sc. K	atarin	a Smilkov		
9.	Pre-conditions for course registration		Enrolled in eighth ser	mester	of studies		
	Aims of the study program (compet	ences):				
10.	 Acquiring a comprehensive understanding of nutraceuticals, focusing on bioactive components derived from food and their roles in human health; Gaining knowledge of the most commonly utilized bioactive compounds from food and their significance in maintaining and promoting human health; Developing an understanding of the toxicological potential of bioactive compounds from food and their safety profiles. 						
11.	 Content of the study program: Classification of Nutraceuticals: comprehensive classification of nutraceuticals based on their origin, chemical composition, and mechanisms of action; Bioactive components in food: an overview of bioactive food components, including carbohydrates, lipids, bioactive peptides, amino-acids, polyphenols, carotenoids, and other compounds with confirmed health-promoting effects; Applications of nutraceuticals in health promotion: overview of nutraceuticals used to enhance the functions of various organs and organ systems, including the skeletal-muscular, cardiovascular, nervous, respiratory, and reproductive systems. Exploring nutraceuticals with a role in cancer prevention, weight management, skin and oral health, and improvement of sports performance with an emphasis on their overall bioactive properties and therapeutic potential; Toxicological considerations of bioactive food components: evaluation of the toxicological potential of bioactive components in food, assessing their safety, possible adverse effects, and dose-related toxicological risks. 						
12.	additional preparation for exan	s and t	rests.	eli-ba	sed learning, s	eminars,	
13.	Total amount of time available		2 ECTS x 30 hours =	60 hc	ours (2+0)		
14.	Distribution of tasks		30+0+10+0+20		T		
15.	Types of learning/teaching activities	<u>15.1.</u> 15.2.	Lectures – theory Tutorials (laboratory, auditory), seminars, t	eamw	30 hour ork 0 hours	'S	
		16.1.	Projects		10 hour	S	
16.	Other types of activities	16.2.	Individual tasks		0 hours		
L		16.3.	Home study – tasks		20 hour	S	
	Evaluation / assessment metho	ds	• • •				
	17.1. Tests				40 poin	ts	
17.	17.2. Individual tasks / proje	ct (pres	sentation: written and o	oral)	10 poin	ts	
	17.3. Activity and participat	ion			20 poin	ts	
	17.4. Final exam				30 poin	ts	
18.	Assessment criteria (points / gr	rade)	Up to 50 points 51 – 60 points		5 (five) 6 (six) ((F) (E)	

				61 – 70 points		7 (seven) (D)
				71 – 80 points		8 (eight) (C)	
				81 – 90 points		9 (nine) (B)	
				91 – 100 points		10 (ten) (A	()
	Eligibi	lity for s	signature and taking	60% realization of pre-e	xam act	ivities, i.e., 4	42 points
19.	the fina	al exam		from two tests, seminary	or prac	tical work, a	ind
				regular participation to t	he orgar	nized activiti	ies.
20.	Langua	age of th	e study program	English			
21.	Quality teachin	assurat	nce methods of the	Self-evaluation			
	Literati	ure	55				
	Enterati	Manda	atory literature				
		No	Author	Title	P11	blisher	Year
		110.	a 111 IV		Goce l	Delcev	1 cui
		1.	Smilkov, K.	Authorized lectures	Univer	University, Stip $\begin{bmatrix} 202^2 \end{bmatrix}$	
				Handbook of			
	22.1.	2.	Cicero, A. F. G.,	Nutraceuticals for	Spring	er	2018
			Colletti, A.	Clinical Use			
		3	Aluko R F	Functional foods and	Spring	er	2012
		5.	Aluko, K. L.	nutraceuticals	Spring	,CI	
		4.	Lockwood, B.	Nutraceuticals	Pharm	aceutical	2007
22.		A 11.	11:		Press		
		Additi	onal literature	T1	n		X 7
		No.	Author	Title	Pu	blisher	Year
			Belitz, H. D.,	Food Chemistry (4 th			2000
		1.	Grosch, W.,	Edition, revised and	Spring	ger	2009
			Schieberle, P.	extended)			
	22.2.			Methods of Analysis			
		2.	Hurst, W. J.	Jor Functional Foods	CRC F	Press	2008
			(Editor)	ana Nuiraceuticais (2			
			Mahan K I	Krause's Food & the			
		3	Raymond I I	Nulle Sroou & the	Floor	or	2017
		3.	(Editors)	$(14^{th} Edition)$	Elsevier		2017

		Appendix 3 No. 53		Study program for integrated first and second cycle of studies		
1.	Name	of the course		PHARMACOECONOMI PHARMACEUTICAL M	CS AND A PKETINC	
2	Code			3FMN197125		
3	Study	nrooram		Pharmacy		
	Study	program organizer		Faculty of Medical Science	8	
4.	(depar	tment. institute. branch)		Goce Delcey University. St	in	
5.	Degree	e (first, second, third cy	cle)	Integrated first and second	cycle of studies	
6.	Acade	mic year / semester		Fourth year / 7.	Number of 2	
8	Profes	sor		Adi Ass Prof. Dr.sc. Zorat	n Nakov	
	Pre-co	nditions for course				
9.	registr	ation		Enrolled in eighth semester	of studies	
	Aims	of the study program (compet	ences):		
10	_	Gaining knowledge at	out the	basic principles of pharmacc	economic analysis;	
10.	_	Gaining knowledge at	out pha	rmacoeconomics and health	care systems;	
	_	Gaining capability for	health	echnology assessment.	•	
	Conte	nt of the study program	n:	<u>_</u>		
	_	Methods of pharmaco	econom	ic analysis;		
	_	Principles of pharmac	oeconor	nic analysis;		
11.	 Pharmacoeconomics and health politics; 					
	 Basic principles of drug pricing models and reimbursement process; 					
	_	Health Technology As	ssessme	nts;		
	- Sales skills in pharmaceutical industry.					
10	Study methods:					
12.	Lectur	es, seminars and case st	udies.			
13.	Total a	amount of time available	2	2 ECTS x 30 hours = 60 ho	urs (2+0)	
14.	Distrib	oution of tasks		30+0+0+15+15		
	Tupos	Types of loaming/tapphing 15.1		Lectures – theory	30 hours	
15.	activit	ies	15.2	Tutorials (laboratory,	0 hours	
	activit		13.2.	auditory), seminars, teamw	ork	
			16.1.	Projects	0 hours	
16.	Other	types of activities	16.2.	Individual tasks	15 hours	
			16.3.	Home study – tasks	15 hours	
	Evalua	tion / assessment metho	ods			
	17.1.	Tests			40 points	
17.	17.2.	Individual tasks / proje	ect (pres	sentation: written and oral)	10 points	
	17.3.	Activity and participat	10n		20 points	
	17.4.	Final exam			30 points	
				Up to 50 points	5 (five) (F)	
				51 - 60 points	<u>6 (six) (E)</u>	
18.	Assess	ment criteria (points / g	rade)	61 - 70 points	/ (seven) (D)	
		u C		71 - 80 points	8 (eight) (C)	
				81 – 90 points	9 (nine) (B)	
	T 11 11	1. 0 1. 1.		91 - 100 points	10 (ten) (A)	
10	Eligibi	lity for signature and ta	kıng	60% realization of pre-exar	n activities, i.e., 42 points	
19.	the fin	al exam		trom two tests, seminary or	practical work, and	
20	τ			regular participation to the	organized activities.	
20.		age of the study program	n 41	English		
21.	Qualit	y assurance methods of	tne	Self-evaluation		
22	teachi	ig process				
$\angle \angle$.	Luerat	uie				

		Manda	atory literature							
		No.	Author	Title	Publisher	Year				
	22.1	1.	Arnold, R. J. G.	Pharmacoeconomics: From Theory to Practice (2 nd Edition)	CRC Press	2021				
	22.1.	2.	Zgarrick, D. P., Desselle, S. P., Moczygemba, L. R., Alston, G.	Pharmacy Management: Essentials for All Practice Settings (5 th Edition)	McGraw Hill	2020				
		Additi	onal literature							
		No.	Author	Title	Publisher	Year				
	22.2.	1.	Garrido, M. V., Kristensen, F. B., Nielsen, C. P., Busse, R. (Editors)	Health technology assessment and health policy-making in Europe: current status, challenges and potential	World Health Organization on behalf of the European Observatory on Health Systems and Policies	2008				

	Appendix 3 No. 54		Study program for integrated first and second cycle of studies						
1.	Name of the course		ENZYMES AND EN	NZYN	AE INHIBIT	ORS			
2.	Code		3FMN197225						
3.	Study program		Pharmacy						
4	Study program organizer		Faculty of Medical Se	cience	es,				
4.	(department, institute, branch)		Goce Delcev Univers	sity, S	tip				
5.	Degree (first, second, third cyc	ele)	Integrated first and se	econd	cycle of studi	es			
6.	Academic year / semester		Fourth year / Eighth semester	7.	Number of ECTS	2			
8.	Professor		Ass. Prof. Dr.sc. Mar	ija Ar	ev				
9.	Pre-conditions for course		Enrolled in eighth ser	mester	of studies				
	registration								
	Aims of the study program (compet	ences):	4	1	6			
	This curriculum provides a c	lear int	roduction to the struc	a how	and properties	of enzymes,			
	targets for many drugs influ	logical p	their activity in ord	s now	treat various	diseases By			
	understanding how enzymes fi	inction	students can better an	nrecia	te their signif	icance in both			
	normal cellular operations and	in ther	apeutic interventions.	preeia	the then signif				
10.	The curriculum will also examine how certain drugs act as enzyme inhibitors blocking enzyme								
	activity through different mechanisms such as competitive, non-competitive, and allosteric								
	inhibition. These mechanisms are crucial in drug design, as inhibiting specific enzymes can								
	help manage or cure diseases. Several examples of enzyme-inhibiting drugs will be highlighted,								
	showcasing how this approach	showcasing how this approach is applied in clinical settings to provide effective treatments for							
	conditions such as hypertensio	n, infec	tions, and cancer.						
	Content of the study program	n:		. .		2			
	1. Proteins: structure and biological importance, classification and properties of some								
	important proteins; 2 Engunasi definition nomenalature general momenties and structure of engunasis								
	 Enzymes: definition, nomenclature, general properties, and structure of enzymes; Mechanisms of catalytical activity of enzymes and elegatification; 								
	 5. Internations of catalytical activity of enzymes and classification; 4. Enzyme specificity: 								
	 4. Enzyme specificity; 5. Cofactors and coenzymes: 								
11.	6. Enzyme kinetics:	1103,							
	7. Factors affecting enzy	me acti	vity, denaturation;						
	8. Enzyme activators and	l inhibit	cors;						
	9. Diagnostic enzymes;		,						
	10. Pharmacological significance of enzymes; enzymes as drug target;								
	11. Various types of drug enzyme inhibition;								
	12. Pharmacological exam	ples an	d mechanisms of action	n of e	nzyme inhibit	ors.			
10	Study methods:	1				4 1. 4. 1. 1			
12.	Lectures, exercises, theoretical	and pr	actical exercises, semir	hars, c	onsultation ar	id individual			
12	Total amount of time evoilable		2 ECTS = 20 hours =	60 hc	(2 ± 0)				
13.	Distribution of tasks	,	$2 \pm 0 \pm 15 \times 50 \text{ Hours} =$ 30+0+0+15+15	00 110	Juis (2 FU)				
17.		15.1	Lectures – theory		30 hour	rs			
15	Types of learning/teaching	13.1.	Tutorials (laboratory		50 1100	15			
10.	activities	15.2.	auditory), seminars, t	eamw	ork 0 hours	•			
		16.1.	Projects		0 hours				
16.	Other types of activities	16.2.	Individual tasks		15 hour	rs			
		16.3.	Home study – tasks		15 hou	rs			
	Evaluation / assessment metho	ds							
17.	17.1. Tests				40 poir	nts			
	17.2. Individual tasks / proje	ect (pres	sentation: written and o	oral)	10 poir	nts			

-								
	17.3.	Activit	y and participation			20 points		
	17.4.	Final e	xam			30 points		
				Up to 50 points		5 (five) (F))	
				51 – 60 points		6 (six) (E)		
10			t	61 – 70 points		7 (seven) (D)		
18.	Assess	ment cri	teria (points / grade)	71 – 80 points		8 (eight) (0	<u>C)</u>	
				81 – 90 points		9 (nine) (B	3)	
				91 – 100 points		10 (ten) (A	<u>()</u>	
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam acti	vities, i.e., 4	42 points	
19.	the fina	al exam		from two tests, seminary	or pract	ical work, a	ind	
				regular participation to t	he organ	ized activiti	es.	
20.	Langua	ige of th	e study program	English				
21	Quality	assurar	nce methods of the	Calf analyzation				
21.	teachin	g proces	58	Self-evaluation				
	Literat	ure						
		Manda	atory literature					
		No.	Author	Title	Pul	blisher	Year	
		1	Zollner H	Handbook of Enzyme	Wilow		2008	
		1.	Zonner, m.	Inhibitors (3 rd Edition)	wney		2008	
				Evolution of Enzyme				
			Copeland, R. A.	Inhibitors in Drug				
	22.1.	2.		Discovery: A Guide for	Wiley		2013	
				Medical Chemists and	whey		2015	
				Pharmacologists (1 st				
				Edition)				
			~	Enzymes and Their	CRC Press 200			
		3.	Smith, H. J., Simons, C.	Inhibitors: Drug			2004	
22.				Development (1 st				
		A 1 1.	1.1.	Edition)				
		Additi	onal literature	T'4		1.1.1	V	
		No.	Author	little	Pu	blisher	Year	
		1		Fundamentals of	CD C D		1002	
		1.	Matthews, J. C.	Receptor, Enzyme and	CRC P	ress	1993	
			A 1'1 D	Transport Kinetics				
	22.2.	2	Aebisher, D.,	The Biochemical	W/1		2022	
		2.	Bartusik-Aebisner,	Guide to Enzymes	wiley		2022	
			D.	Engrand Engrand				
				Luzymes und Enzyme	Novo	aionaa		
		3.	Lashinski, E. M.	Riology and Clinical	Dub	ocience	2013	
				Significance	1 40			
	i	•	1		1		1	

	Appendix 3		Study program for integrated first and second				
	No. 55		CONTEMPORARY ASPECTS OF HERRAL				
1.	Name of the course		CONTEMPORARY ASPECT	S OF HERBAL			
2	Code		3FMN107325				
2.	Study program		Dharmaoy				
5.	Study program organizer		Faculty of Medical Sciences				
4.	(department institute branch)		Goce Delcey University Stin				
5	Degree (first second third cyc	cle)	Integrated first and second cycle	e of studies			
5.		(10)	Fourth year / Nur	nber of			
6.	Academic year / semester		Fourth year7.Eighth semester7.EC1	TS 2			
8.	Professor		Assoc. Prof. Dr.sc. Viktorija Ma Ass. Prof. Dr.sc. Milkica Arsova	aksimova a			
9.	Pre-conditions for course registration		Enrolled in eighth semester of st	tudies			
	Aims of the study program (compet	ences):				
	Through this course, students	should b	become familiar with contemporation	ry aspects of the use of			
	herbal medicines. In doing so,	by defin	ning the concepts of herbal substa	nce, herbal processing,			
	and herbal medicine, they will additionally learn about: the methodology for the development						
10.	of new herbal medicines from raw material to finished product; methods for obtaining extracts						
	and incorporating them into herbal medicine or traditional herbal medicine; procedures for						
	registering herbal medicine/traditional herbal medicine and their regulation in the country vs.						
abroad; critical points in quality control of herbal preparations; legal regulations							
	cultivation of medical cannabi	s and its	s medical use.				
	Content of the study program:						
	- The importance of nerval medicines as OTC (over the counter) preparations in modern phytotherapy:						
	The concent and types of herbol medicines:						
	- The concept and types of herbal medicines;						
	 Formulation, production, and commercialization of herbal medicines; 						
11.	- Pre-production and production processes in obtaining herbal medicine;						
	- GMP principles in the production of herbal medicines;						
	- Regulation and registration of herbal medicines;						
	 Critical points in quality control of herbal medicines and validation of analytical 						
	Medical use of commo	i uns pr	ocess,	tion of modical			
	- Medical use of califiat	of conne	big propagations with or without '				
	Study mothods:		abis preparations with or without	Inc.			
12.	Lectures, consultations, group	and ind	ividual work (project tasks with c	oral presentation).			
13.	Total amount of time available	;	2 ECTS x 30 hours = 60 hours (2+0)			
14.	Distribution of tasks		30+0+10+10+10	,			
		15.1.	Lectures – theory	30 hours			
15.	Types of learning/teaching	15.0	Tutorials (laboratory,	0.1			
	activities	15.2.	auditory), seminars, teamwork	0 hours			
		16.1.	Projects	10 hours			
16.	Other types of activities	16.2.	Individual tasks	10 hours			
		16.3.	Home study – tasks	10 hours			
	Evaluation / assessment method	ods					
	17.1. Tests			40 points			
17.	17.2. Individual tasks / proje	ect (pres	sentation: written and oral)	10 points			
	17.3. Activity and participat	ion		20 points			
	17.4. Final exam			30 points			
10	Assagement anitania (mainta / -	rada	Up to 50 points	5 (five) (F)			
10.	Assessment criteria (points / g	raue)	51 – 60 points	6 (six) (E)			

				61 – 70 points		7 (seven) ((D)	
				71 – 80 points		8 (eight) (0	C)	
				81 – 90 points		9 (nine) (B)		
				91 – 100 points		10 (ten) (A)		
	Eligibi	lity for s	signature and taking	60% realization of pre-e	xam acti	ivities, i.e., 4	42 points	
19.	the fina	al exam		from two tests, seminary	or prac	tical work, a	and	
				regular participation to t	he organ	nized activit	ies.	
20.	Langua	ige of th	e study program	English				
21.	Quality assurance methods of the teaching process			Self-evaluation				
	Literatu	ure						
		Manda	atory literature					
	22.1.	No.	Author	Title	Pu	blisher	Year	
		1.	Khan, M. S. A., Ahmad, H., Chattopadhyay, D.	New Look to Phytomedicine: Advancements in Herbal Products as Novel Drug Leads	Elsevi	er	2018	
		2.	Haensel, R., Sticher, O.	Pharmakognosie – Phytopharmazie	Spring	er	2007	
22.		3.	Maksimova, V.	Contemporary Aspects of the Use of Herbal Medicines	Goce I Univer	Delcev sity, Stip	2023	
		Additi	onal literature					
		No.	Author	Title	Pu	blisher	Year	
	22.2.	1.	World Health Organization	<i>Quality Control</i> <i>Methods for Medicinal</i> <i>Plant Materials</i>	World Organi	Health ization	1999	
		2.	European Pharmacopoeia Commission	European Pharmacopoeia (Ph. Eur.)	Counc Europe	il of	Current issue	

	Appendix 3 No. 56	Study program for integrated first and second cycle of studies			
1.	Name of the course	RADIOPHARMACY			
2.	Code	3FMN197425			
3.	Study program	Pharmacy			
Δ	Study program organizer	Faculty of Medical Sciences,			
4.	(department, institute, branch)	Goce Delcev University, Stip			
5.	Degree (first, second, third cycle)	Integrated first and second cycle of studies			
6.	Academic year / semester	Fifth year / Ninth semester7.Number of ECTS2			
8.	Professor	Full Prof. Dr.sc. Emilija Janevik-Ivanovska			
9.	Pre-conditions for course registration	Enrolled in ninth semester of studies			
10.	 Aims of the study program (competent The goal of the Radiopharmacy courss The fundamental knowledge in types, preparation, and applich medicine; The basic concepts of radiation (alpha, beta, gamma), radiation radioactive decay, half-life, and the edge of the radioactive indices of the radioactive indices of the radioactive decay, half-life, and the edge of the radioactive decay, half-life, and the edge of the radioactive decay, half-life, and the edge of the radioactive indices of the radio and the receives of the radioactive indices of the radioactive indices of the radioactive indices of the radio pharmaceutical practices of the radioactive indices of the radioactive	ences): ences): e is to introduce the students with: in Radiopharmacy, including understanding of the ations od radiopharmaceuticals used in nuclear on physics, including knowledge of radiation types on detection, safety protocols, and the principles of nd the interactions of radiation with matter; ty; ribution studies of radiopharmaceuticals; on of radioactive isotopes and radiopharmaceutical uclides – understanding the chemical behavior of ey bind to biomolecules, and the radiolabeling Synthesis using various radionuclides (e.g., Tc-99m, F- radionuclide generators, cyclotrons, and other techniques; ficiency in performing quality control tests for (e.g., radiochemical purity, sterility, endotoxin levels); pharmaceuticals – Imagining Techniques (knowledge es that use radiopharmaceuticals, such as PET, SPECT pharmaceuticals for targeted therapy – radionuclide r thyroid cancer treatment); I Manufacturing Practices (GMP) and Good ts (GRPP); n Radiopharmacy – Innovative Radiopharmaceuticals tudies. with the necessary theoretical knowledge and practical the field of Radiopharmacy, contributing to d radiopharmaceutical development.			
11.	 Content of the study program: Introduction to Radiopharmac characteristics of nuclear radii Interactions of matter with ion detection instruments; Biological effects of ionizing Obtaining radionuclides used 	cy – basics of ionization radiation, nuclear decay, ation; nizing radiation, ionizing radiation detection systems, radiation – dosimetry and radiation protection; in medicine and pharmacy;			

	_	Mecha	nism of action of	of radio	pharmaceuticals containin	g radior	uclides for l	human
		use:			P	8		
	_	Radion	harmaceutical r	oreparat	tions of iodine isotopes:			
	_	- Technetium-99m radiopharmaceuticals:						
	_	Radion	harmaceutical 1	oreparat	tions of other gamma emit	ters for	diagnostics:	
	_	Basics	of positron emi	ssion to	mography (PET), product	tion and	synthesis of	FPET
		radiopl	narmaceuticals;		8		- ,	
	_	PET ra	diopharmaceuti	cals – v	vith fluorine-18, carbon-1	1. nitrog	en-13, oxve	en-16.
		galliun	1-68, copper-64	, zirnoc	nium-89;	, 2	, -, ,,	, -,
	_	Radiop	harmaceutical p	oreparat	tions of beta and alpha em	itters for	r therapy	
		(Thera	nostics);		Ĩ		12	
	_	Quality	control of radi	opharm	aceuticals;			
	_	Legisla	tion, Radiopha	rmaceut	tical Laboratory Design, H	Iospital	Radiopharm	acy,
		Central	lized Laborator	y;		-	-	-
	—	Implen	nentation of Go	od Man	ufacturing Practices in Ra	diophar	macy.	
12	Study	method	s:					
12.	Lecture	es, labor	atory exercises,	consul	tations, seminars.			
13.	Total a	mount o	f time available	•	2 ECTS x 30 hours = 60	hours (2	2+0)	
14.	Distrib	ution of	tasks	1	30+0+0+0+30		1	
	Types (of learni	ng/teaching	15.1.	Lectures – theory		30 hours	
15.	15. activities		15.2.	Tutorials (laboratory,		0 hours		
			16.1	auditory), seminars, tean	nwork	0 10 10		
16	Other types of activities 16.2		16.1.	Projects		0 hours		
16.	Other t	ypes of a	activities	16.2.	Individual tasks		0 hours	
	16.3				Home study – tasks		30 hours	
	Evalua	Tests	sessment metho	us			10 points	
17	17.1. Itolo 17.2 Individual tasks / project (pre				centation: written and oral)	10 points	
17.	17.2.	Activit	v and participat	ion	sentation. written and orar)	20 points	
	17.5.	Final	y and participat	1011			30 points	
	17.11	T mar e			Up to 50 points		5 (five) (F))
					51 - 60 points	6 (six) (E)		/
1.0					61 - 70 points		7 (seven) (D)	
18.	Assessi	ment cri	teria (points / gi	rade)	71 - 80 points		$\frac{1}{8}$ (seven) (D)	
					81 – 90 points		9 (nine) (B	5)
					91 – 100 points		10 (ten) (A	x)
	Eligibil	ity for s	ignature and tal	king	60% realization of pre-ex	xam act	ivities, i.e., 4	42 points
19.	the fina	l exam	-	-	from two tests, seminary	or prac	tical work, a	und
					regular participation to the	he orgar	nized activiti	ies.
20.	Langua	ige of th	e study progran	n	English			
21	Quality	assurar	ice methods of $\overline{\mathbf{f}}$	the	Self-evaluation			
21.	teachin	g proces	5S		Sen-evaluation			
	Literatu	ıre						
		Manda	atory literature			1		
		No.	Author		Title	Pu	blisher	Year
					Handbook of			
22.	aa 1		Kilbourn. M.	R.,	Radiopharmaceuticals			2021
	22.1.	1.	Scott, P. J. H.	,	– Methodology and	Wiley		2021
					Application (2^{m})			
					Ealtion)			
		2.	Saha, G. B.		Fundamentals of	Spring	er	2010
					Ivuclear Pharmacy	. 0		

	3.	Theobald, T. (Editor)	Sampson's Textbook of Radiopharmacy (4 th Edition)	Pharmaceutical Press	2010			
	Additional literature							
	No.	Author	Title	Publisher	Year			
	1.	Group of authors	Operational Guidance on Hospital Radiopharmacy: A Safe and Effective Approach	International Atomic Energy Agency	2008			
22.2.	2.	Peller, P. J. (Editor)	PET Radiochemistry and Radiopharmacy, PET-CT and PET-MRI in Oncology, Medical Radiology. Diagnostic Imaging	Springer	2012			
	3.	Schillaci, O., Calabria, F. (Editors)	Radiopharmaceuticals: a guide to PET/CT and PET/MRI	Springer	2020			

	Appendix 3 No. 57			Study program for integrated first and second cycle of studies				
1.	Name	of the course		VALIDATION AND QUALII ANALYTICAL LABORATO	FICATION IN RIES			
2.	Code			3FMN197525				
3.	Study	program		Pharmacy				
4.	Study (depar	program organizer tment, institute, branch)		Faculty of Medical Sciences, Goce Delcev University, Stip				
5.	Degree	e (first, second, third cyc	cle)	Integrated first and second cycle	e of studies			
6.	Acade	mic year / semester		Fifth year / Ninth semester7.Number of ECTS				
8.	Profes	sor		Full Prof. Dr.sc. Zorica Arsova	Sarafinovska			
9	Pre-co	nditions for course		Enrolled in ninth semester of stu	idies			
).	registr	ation		Enroned in minth semester of su	udies			
10.	Aims of the study program (competences): The aim of the study program is to introduce students with the principles of qualification of analytical laboratory; ensuring the quality system in laboratory activities in accordance with national and international standards and regulations.							
	Conte	nt of the study program	n: tical lab	oratories				
		 Organization of analytical faboratories; Facilities and environmental conditions: 						
	 — Qualification of equipment, management of reagents and consumables: 							
	_	- Equipment calibration and metrological traceability;						
11	_	 Standard operative procedure; 						
11.	_	Method verification and	nd valid	ation;				
	 Quality management system; 							
	- Quality assessment of test results – participation in proficiency tests, inter-laboratory							
	comparisons and internal quality controls;							
	 Accreditation procedures; Standards and avidations, mating logitization logitization logitization logitization. 							
	— -	Standards and guidelin	nes – na	tional and international regulation	1.			
12	Study	methods:	oup of a	tudents with discussion and stude	ent angagament a			
12.	learnin	es (meory) in a large gr	oup of s	students with discussion and stude	ni engagement, e-			
13	Total a	mount of time available		2 FCTS x 30 hours = 60 hours (2+0)				
14.	Distrib	oution of tasks		<u>30+0+0+10+20</u>	2.0)			
	T		15.1.	Lectures – theory	30 hours			
15.	Types	of learning/teaching	15.0	Tutorials (laboratory,	0.1			
	activiti	les	15.2.	auditory), seminars, teamwork	0 nours			
			16.1.	Projects	0 hours			
16.	Other	types of activities	16.2.	Individual tasks	10 hours			
			16.3.	Home study – tasks	20 hours			
	Evalua	tion / assessment metho	ods					
17	17.1.	Tests	. (40 points			
1/.	17.2.	Individual tasks / proje	ect (pres	sentation: written and oral)	10 points			
	17.3.	Final exam	.1011		20 points			
	17.7.			Up to 50 points	5 (five) (F)			
				51 - 60 points	6 (six) (E)			
10		, •, • <i>,</i> • , ,	1 \	61 - 70 points	7 (seven) (D)			
18.	Assess	sment criteria (points / g	rade)	71 – 80 points	8 (eight) (C)			
				81 – 90 points	9 (nine) (B)			
				91 – 100 points	10 (ten) (A)			

	Eligibi	lity for s	ignature and taking	60% realization of pre-exam activities, i.e., 42 points			
19.	the fina	al exam		from two tests, seminary or practical work, and			
				regular participation to t	he organized activiti	es.	
20.	Langua	ige of th	e study program	English			
21	Quality assurance methods of the			Calf analystica			
21.	teaching process			Self-evaluation			
	Literat	ure					
		Manda	atory literature				
		No.	Author	Title	Publisher	Year	
		Funk, W.,	Quality Assurance in				
	22.1.	1.	Dammann, V.,	Pharmaceutical	Wiley	2007	
22.			Donnevert, G.	Chemistry			
		n	International standards and guidelines (ICH Guidelines; OMCL Guidelines;				
		۷.	MKC EN ISO/IEC 1	7025:2018)			
		Additi	onal literature				
	22.2.	No.	Author	Title	Publisher	Year	
		1.					

1. Name of the course ANALYSES IN CLINICAL TOXICOLOGY 2. Code 3FMN197625 3. Study program Pharmacy 4. Study program organizer (department, institute, branch) Faculty of Medical Sciences, Goce Deleev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 2 9. Pre-conditions for course registration Enrolled in ninth semester of studies 10. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses; 2.		Appendix 3 No. 58		Study program for integrated first and second cycle of studies					
2. Code 3FMN197625 3. Study program Pharmacy 4. Study program organizer Faculty of Medical Sciences, (department, institute, branch) Goce Delcev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies 10. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses;	1.	Name of the course		ANALYSES IN CLI	NICAI	L TOXICO	LOGY		
3. Study program Pharmacy 4. Study program organizer (department, institute, branch) Faculty of Medical Sciences, Goce Delcev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies 10. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses; 2. Opprovision of dispersion of toxic agents that are unservised for the study program:	2.	Code		3FMN197625					
4. Study program organizer (department, institute, branch) Faculty of Medical Sciences, Goce Delcev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies 10. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses; 2. Occurrence diameters are accurated toxicological analyses;	3.	Study program		Pharmacy					
 4. (department, institute, branch) Goce Delcev University, Stip 5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning. Forcessing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: Introduction to analytical toxicological analyses; Occurrence diagnosis processing methods for consisting processing constrained toxicological analyses; 	4	Study program organizer		Faculty of Medical Sc	iences,	1			
5. Degree (first, second, third cycle) Integrated first and second cycle of studies 6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies 4 Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning. 10. Content of the study program: 1. Introduction to analytical toxicological analyses; 2. Occurrence diagnacia, group time of dimension	4.	(department, institute, branch)		Goce Delcev Universi	ity, Stip)			
6. Academic year / semester Fifth year / Ninth semester 7. Number of ECTS 2 8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies 10. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses; 2. Oncomparison of analytical toxicological analyses;	5.	Degree (first, second, third cyc	ele)	Integrated first and see	cond cy	cle of studie	es		
8. Professor Assoc. Prof. Dr.sc. Darinka Gjorgieva Ackova 9. Pre-conditions for course registration Enrolled in ninth semester of studies 9. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses;	6.	Academic year / semester		Fifth year / Ninth semester	7. N E	Number of ECTS	2		
9. Pre-conditions for course registration Enrolled in ninth semester of studies 10. Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses;	8.	Professor		Assoc. Prof. Dr.sc. Da	arinka (Gjorgieva Ac	ekova		
 Aims of the study program (competences): The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: 1. Introduction to analytical toxicological analyses; 2. Operating diagnosis provention and treatment of preisoning. 	9.	Pre-conditions for course registration		Enrolled in ninth seme	ester of	studies			
 The course guides students into the field of clinical toxicology as a specialized subfield of toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: Introduction to analytical toxicological analyses; Operating diagnosis processing of treatment of processing 		Aims of the study program (compet	ences):					
 toxicology. They acquire knowledge about toxins and toxicants, mechanisms of toxicity, methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: Introduction to analytical toxicological analyses; Operating diagnosis prevention and treatment of prevention. 		The course guides students in	to the t	field of clinical toxicol	ogy as	a specialize	d subfield of		
 methods for detection of toxic agents that are most often found as causes of poisoning, processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: Introduction to analytical toxicological analyses; Operation of analytical toxicological analyses; 	10	toxicology. They acquire know	wledge	e about toxins and tox	icants,	mechanism	s of toxicity,		
 processing of different types of samples, as well as the approach for treatment and application of antidotes in case of poisoning. Content of the study program: Introduction to analytical toxicological analyses; Operation of antidotes in case of poisoning around the study program: 	10.	methods for detection of toxic agents that are most often found as causes of poisoning,							
Operation Operation 1. Introduction to analytical toxicological analyses; 2. Operation of the study program:		processing of different types of	f sampl	es, as well as the approa	ach for	treatment ar	nd application		
1. Introduction to analytical toxicological analyses;		of antidotes in case of poisoning.							
1. Introduction to analytical toxicological analyses;		Content of the study program	n:	1					
		1. Introduction to analytical toxicological analyses;							
2. Occurrence, diagnosis, prevention and treatment of poisoning;									
5. Clinical toxicology. Therapeutic monitoring;									
4. Fediatic toxicology, 5. Analyzes of alcohol and substances of abuse in traffic violations:									
6 Analyzes of drugs and substances of abuse in sports and doping:									
7 Forensic and post mortem analyzes:									
8 Medicinal products volatile substances natural toxins pesticides and identification									
11. of solid forms:	11.								
9. Sampling, storage, processing (extraction) and stability:		9. Sampling, storage, processing (extraction) and stability							
10. Application of chromatographic (TLC, GC, HPLC) and spectro/photo/methods									
(UV/VIS and fluorescence spectrophotometry, FTIR/Raman spectroscopy, mass									
spectrometry) for sample analysis in poisoning diagnostics;									
11. Application of immunochemical methods for sample analysis in poisoning		11. Application of immunochemical methods for sample analysis in poisoning							
diagnostics;		diagnostics;							
12. Development of a method for analysis and validation. Quality control and									
accreditation in a toxicological laboratory. Interpretation of toxicological results.		accreditation in a toxic	cologica	al laboratory. Interpretat	tion of t	tox1colog1ca	l results.		
Study methods:	10	Study methods:		. 1		6	4. 10		
12. Lectures, project assignments, case-studies, consultations, in small groups of up to 10	12.	Lectures, project assignments,	case-st	udies, consultations, in	small g	groups of up	to 10		
Students. 12 Total amount of time quailable $2 \text{ ECTS } \times 20 \text{ hours} = 60 \text{ hours} (2\pm 0)$	12	Total amount of time available		$2 \text{ ECTS } \times 20 \text{ hours} = 100000000000000000000000000000000000$	60 hour	ma (2±0)			
13. Total amount of time available $2 \text{ ECTS } \times 30 \text{ mours} = 00 \text{ mours} (2+0)$	13.	Distribution of tasks	,	2 ECTS x 50 Hours = 0	00 Hour	18 (2+0)			
$151 \text{Lectures} = \text{theory} \qquad 30 \text{ hours}$	14.		15.1	Lectures _ theory		30 hour	·c		
Types of learning/teaching Tutorials (laboratory 50 hours	15	Types of learning/teaching	13.1.	Tutorials (laboratory		50 11001	3		
activities 15.2. auditory) seminars teamwork 0 hours	15.	activities	15.2.	auditory) seminars te	eamwor	$\cdot_k = 0$ hours			
16.1. Projects 10 hours			16.1	Projects	241111101	10 hour	S		
16. Other types of activities 16.2. Individual tasks 0 hours	16.	Other types of activities	16.2.	Individual tasks		0 hours	5		
1000000000000000000000000000000000000	101		16.3.	Home study – tasks		20 hour	S		
Evaluation / assessment methods		Evaluation / assessment metho	ds	,					
17.1. Tests 40 points		17.1. Tests				40 poin	ts		
17. 17.2. Individual tasks / project (presentation: written and oral) 10 points	17.	17.2. Individual tasks / proje	ect (pres	sentation: written and or	ral)	10 poin	ts		
17.3. Activity and participation 20 points		17.3. Activity and participat	ion		/	20 poin	ts		
17.4. Final exam 30 points		17.4. Final exam				30 poin	ts		

				Up to 50 points		5 (five) (F)		
				51 – 60 points		6 (six) (E)		
10			tonia (nainta / ana da)	61 – 70 points		7 (seven) (D)		
18.	Assessi	ment cri	teria (points / grade)	71 – 80 points		8 (eight) (0	<u>C)</u>	
				81 – 90 points		9 (nine) (B	3)	
				91 – 100 points		10 (ten) (A	()	
	Eligibi	lity for s	signature and taking	60% realization of pre-e	xam act	ivities, i.e., 4	42 points	
19.	the fina	al exam		from two tests, seminary	or prac	tical work, a	und	
				regular participation to t	he orgar	nized activiti	ies.	
20.	Langua	ige of th	e study program	English				
21.	Quality	/ assurar	nce methods of the	Self-evaluation				
	teachin	g proces	38					
	Literati	ture						
		Manda	atory literature			1 1 . 1	X 7	
		No.	Author	Title	Pu	blisher	Year	
	22.1.		Mottat, A. C.,	Clarke's analysis of	Pharmaceutical Press			
		1.	Widdon B	drugs and poisons (4 th			2011	
			(Editors)	Edition)	11035			
			Jickells, S.,					
		2.	Negrusz, A.	Clarke's analytical	Pharm	aceutical	2008	
			(Editors)	Forensic toxicology	Press			
		3.	Pena-Fernandez, A Evans M D	Toxicology for the				
22.				Health and	CRC Press	2022		
			Cooke M S	Pharmaceutical	CICC FIESS		2022	
				Sciences				
		Additi	onal literature					
		No.	Author	Title	Pu	blisher	Year	
		1.	Gjorgieva Ackova,	Authorized lectures	Goce I	Delcev	2024	
	22.2	<u> </u>	D.		Univer	rsity, Stip		
	22.2.		T D I	Dreisbach's handbook				
			Irue, B-L.,	of poisoning:				
		2.	Driesbach, R.	Prevention, diagnosis	CRC Press		2001	
			(Editors)	and treatment (13 th)				
				Edition)	1			

	Appendix 3		Study program for integrated first and second				
	No. 59		cycle of stuc	lies			
			PHARMACEUTICAL LEGIS	SLATION AND			
1.	Name of the course		REGISTRATION OF MEDICINES AND				
2	Code		3FMN197725				
2.	Study program		Pharmacy				
5.	Study program organizer		Figure Fi				
4.	(department institute branch)		Gage Deleav University Stin				
5	Degree (first, second, third cvc	ele)	Integrated first and second cycle	e of studies			
		(10)	Fifth year / Nur	mber of			
6.	Academic year / semester		Ninth semester 7. EC	$\frac{100}{15}$ $\frac{2}{2}$			
8.	Professor		Assoc. Prof. Dr.sc. Marija Dark	ovska Serafimovska			
0	Pre-conditions for course			1.			
9.	registration		Enrolled in ninth semester of stu	idies			
	Aims of the study program (compet	ences):				
10.	The aim of the course is for stu	idents t	o gain knowledge about the pharm	naceutical legislation			
	and marketing authorization ar	nd regul	ation of medicines and medical d	evices.			
	Content of the study program	n:					
	Registration procedures/types	of app	plications for placing the medic	ine on the market in			
	accordance with European reg	accordance with European regulations; Organization of CTD documentation for registration					
	(marketing authorization) of the	he medi	icine; Changes in the approved n	narketing authorization			
11	for medicines (variations and	their cl	assification); Harmonization of national and European				
11.	regulations; Regulatory measured	res for p	protection against falsification of n	nedicines; Concept and			
	definition of medical devices	for use	in human medicine, conditions a	and procedure for their			
	production, a way to ensure	their qu	uality, safety and efficiency; Cla	assification of medical			
	devices; Contirmatory assessment of medical devices; Labeling, sales and advertising o						
	medical devices; Clinical trials	s of med	licinal product.				
12.	Study methods:	thodai	n dividual want				
12	Total amount of time available	thous, i	2 ECTS x 30 hours = 60 hours	2+0)			
13.	Distribution of tasks	, ,	2 + 0 + 0 + 20 + 10	2+0)			
11.		15.1.	Lectures – theory	30 hours			
15.	Types of learning/teaching		Tutorials (laboratory.				
	activities	15.2.	auditory), seminars, teamwork	0 hours			
		16.1.	Projects	0 hours			
16.	Other types of activities	16.2.	Individual tasks	20 hours			
		16.3.	Home study – tasks	10 hours			
	Evaluation / assessment metho	ds	ν Γν				
	17.1. Tests			40 points			
17.	17.2. Individual tasks / proje	ect (pres	sentation: written and oral)	10 points			
	17.3. Activity and participat	ion		20 points			
	17.4. Final exam			30 points			
			Up to 50 points	5 (five) (F)			
			51 – 60 points	6 (six) (E)			
10	A agagament anitaria (mainta / a	(a h a	61 – 70 points	7 (seven) (D)			
10.	Assessment criteria (points / gi	rade)	71 – 80 points	8 (eight) (C)			
			81 – 90 points	9 (nine) (B)			
			91 – 100 points	10 (ten) (A)			
	Eligibility for signature and tal	king	60% realization of pre-exam act	ivities, i.e., 42 points			
19.	the final exam		from two tests, seminary or prac	tical work, and			
			regular participation to the organ	nized activities.			
20.	Language of the study program	1	English				

21.	Quality teachin	assurar g proces	nce methods of the	Self-evaluation					
	Literature								
		Manda	Mandatory literature						
	22.1.	No.	Author	Title	Publisher	Year			
22.		1.	Law on Medicines an	w on Medicines and Medical Devices in North Macedonia					
		2.	EU directives			Current issue			
		3.	ICH Guidelines			Current issue			
		4.	EMA QWP Guides			Current issue			
		5.	FDA Guidelines			Current issue			
		Additi	onal literature						
	22.2.	No.	Author	Title	Publisher	Year			
		1.							

	Appendix 3 No. 60		Study program for integrated first and second cycle of studies			
1.	Name of the course		PHARMACEUTICAL CARI PHARMACOVIGILANCE	E AND		
2.	Code		3FMN197825			
3.	Study program		Pharmacy			
4.	Study program organizer (department, institute, branch)		Faculty of Medical Sciences, Goce Delcev University, Stip			
5.	Degree (first, second, third cyc	ele)	Integrated first and second cycle of studies			
6.	Academic year / semester		Fifth year / Ninth semester7.Number of ECTS2			
8.	Professor		Assoc. Prof. Dr.sc. Biljana Laz	arova		
9.	Pre-conditions for course registration		Enrolled in ninth semester of st	udies		
	Aims of the study program (compet	ences):			
10.	 Gaining knowledge to describe the definition of pharmacist-provided pharmaceutical care services, recommendations for required service components, alignment of documentation and roles and responsibilities of pharmacists providing the service; Pharmaceutical care services will support the continuity of care by health professionals from different disciplines to care for a patient both when the patient is in hospital and when the patient is discharged to home or ambulatory care; Patient-specific information and medications could be shared among healthcare professionals to help ensure patient safety across the continuum of care and empower patients to take responsibility for their own health; Students to acquire knowledge of pharmacovigilance as a "science and activities related to detecting, assessing, understanding and preventing adverse effects or any other metantial dama related metahem". 					
11.	 Pharmaceutical care focuses on patient-centered services aimed at empowering patients and/or caregivers to take responsibility for their medication needs and achieve the best health outcome; Pharmaceutical care services should complement existing patient care practices to make drug therapy more effective and safer; Who should receive pharmaceutical care and how often; How pharmaceutical care should be performed; Components for pharmaceutical care services; Improving patient care and safety related to the use of medicines and all medical and paramedical interventions; Contribution of the assessment of benefit, harm, effectiveness and risk of drug use, leading to prevention of harm and maximization of benefit; Encouraging safe, rational and more efficient (including economical) use of 					
12.	Study methods: Lectures with large groups of students, individual assignments, group discussions, homework, home study and student seminars.					
13.	Total amount of time available	;	$2 \text{ ECTS x } \overline{30 \text{ hours}} = 60 \text{ hours}$	(2+0)		
14.	Distribution of tasks	- <u></u>	30+0+10+10+10			
15.	Types of learning/teaching activities	15.1. 15.2.	Lectures – theory Tutorials (laboratory, auditory), seminars, teamwork	30 hours 0 hours		
		16.1	Projects	10 hours		
16	Other types of activities	16.2	Individual tasks	10 hours		
10.	16.2.		Home study – tasks	10 hours		

	Evaluation / assessment methods							
	17.1.	Tests			2	40 points		
17.	17.2.	Individ	ual tasks / project (pres	sentation: written and oral) 1	10 points		
	17.3.	Activit	y and participation		2	20 points		
	17.4.	Final e	xam		30 points			
				Up to 50 points	4	5 (five) (F)		
				51 – 60 points	(5(six)(E)		
10		, .		61 – 70 points	7	7 (seven) (D)	
18.	Assess	ment cri	teria (points / grade)	71 – 80 points	8	3 (eight) (C	C)	
				81 – 90 points	9	(nine) (B		
				91 – 100 points	1	10 (ten) (A	.)	
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam activi	ities, i.e., 4	2 points	
19.	the final exam			from two tests, seminary	or practic	cal work, a	ind	
				regular participation to the organized activities.			es.	
20.	Langua	age of th	e study program	English				
21.	Quality teachin	assurar	ice methods of the	Self-evaluation				
	Literati	ature						
		Mandatory literature						
		No.	Author	Title	Publisher		Year	
				Pharmaceutical Care				
			Farris, K. B.,	in Community	A	ſ		
		1.	Fernandez-Llimos,	Pharmacies: Practice	Annais C)] hothoropy	2005	
			F., Benrimoj, S. I.	and Research from	1 Harmat	опстару		
				Around the World				
			Allemann, S. S.,					
			Foppe can Mil, J.	Pharmaceutical care:	International Journal of			
		2.	W., Botermann, L.,	the PCNE definition		2014		
	22.1		Berger, K., Griese,	2013	Clinical			
22	22.1.		N., Hersberger, K.		Pharmacy			
22.			E.					
			Juda, A., Comis, I.					
		2	J., Halle-Selassie,	Dhawmacovigilanco	World H	lealth	2018	
		5.	N. Sturkenboom	Fnarmacovigliance	Organiza	ation	2018	
			M					
		-	International	IFPMA Position Paper	Internati	onal		
			Federation of	on Pharmacovioilance	Federati	on of		
		4	Pharmaceutical	Principles for	Pharmac	centical	2018	
			Manufacturers and Riotheraneutic	Manufac	cturers	2010		
			Associations	Medicines	and Asso	ociations		
		Additi	onal literature					
	22.2.	No.	Author	Title	Publ	isher	Year	
		1.						

	Appendix 3 No. 61		Study program for integrated first and second cycle of studies			
1.	Name of the course		STABILITY OF MED	DICINA	L PROD	UCTS
2.	Code		3FMN197925			
3.	Study program		Pharmacy			
4	Study program organizer		Faculty of Medical Scie	ences,		
4.	(department, institute, branch)		Goce Delcev University	y, Stip		
5.	Degree (first, second, third cyc	ele)	Integrated first and seco	ond cycle	e of studie	es
6	A andomia year / somester		Fifth year /	, Nur	nber of	r
0.	Academic year / semester		Ninth semester /	· EC	ГS	2
8.	Professor		Ass. Prof. Dr.sc. Ivana	Mitrevsk	a	
9.	Pre-conditions for course		Enrolled in ninth semes	ster of stu	ıdies	
_	registration					
10.	The study program objective for the students is to gain knowledge for a comprehensive resource on how the pharmaceutical industry can enhance their understanding of a product's stability and predict drug expiry more accurately and quickly. The students will be able to provides high level strategies for the successful implementation of APS in a pharmaceutical company. Pharmaceutical student will be able to handle responsibilities in a variety of functions relating to the drug stability, including R&D, formulation, analytical development, QA/QC, regulatory affairs and production. Gaining knowledge to scientific understanding of regulations and balances methodologies and best practices. The study program will enable to the students for better understand key concepts such as rate and order of reaction, reaction equilibrium, complex reaction mechanisms and an in-depth discussion of both aqueous and solid drug solutions and contains the latest international regulatory requirements on drug stability. This study program will give an overview of tools that a student should have in order to evaluate the impact of excursions from the storage label instructions on the disposition of distributed					
11.	 Content of the study program: Understanding ICH Guidelines Applicable to Stability Testing Global Stability Practices Post-approval Changes – Stability Requirements and Regulations Understanding and Predicting Pharmaceutical Product Shelf-Life Development of Stability Indicating Methods Impact of Solid-State Characteristics to the Physical Stability of Drug Substance and Drug Product Evaluation of Stability Data Stability Operation Practices Qualification, Calibration, and Maintenance of Stability Chambers Accelerated Predictive Stability 					
	Study methods:	JI DIOIC	igics			
12.	Lectures with large groups of s	students	, individual assignments.	, group d	iscussion	s, homework.
	home study and student semina	ars.	, 6 ,			, ,
13.	Total amount of time available	;	2 ECTS x 30 hours = 60	0 hours (2+0)	
14.	Distribution of tasks		30+0+10+10+10	``````````````````````````````````````		
	Types of learning/teaching	15.1.	Lectures – theory		30 hour	S
15.	activities	15.2	Tutorials (laboratory,		0 hours	
L		1.5.2.	auditory), seminars, tea	mwork	0 nours	
		16.1.	Projects		10 hour	S
16.	Other types of activities	16.2.	Individual tasks		10 hour	S
		16.3.	Home study – tasks		10 hour	S
17.	Evaluation / assessment metho	ds				

r							
	17.1.	Tests		40 points			
	17.2.	Individ	ual tasks / project (pre	sentation: written and oral)	10 points	
	17.3.	Activit	y and participation			20 points	
	17.4.	Final e	xam			30 points	
				Up to 50 points		5 (five) (F)	
				51 – 60 points		6 (six) (E)	
10			tania (mainta / anada)	61 – 70 points		7 (seven) (D)	
18.	Assess	ment cri	teria (points / grade)	71 – 80 points		8 (eight) (0	C)
				81 – 90 points		9 (nine) (B	<u>B)</u>
				91 – 100 points		10 (ten) (A	<u>()</u>
	Eligibi	lity for s	ignature and taking	60% realization of pre-e	xam act	ivities, i.e., 4	42 points
19.	the fina	al exam	с с	from two tests, seminary	or prac	tical work, a	and
				regular participation to t	he orgar	nized activiti	ies.
20.	Langua	age of th	e study program	English			
21	Quality	y assurar	nce methods of the	Calf and head's a			
21.	teachin	ig proces	SS	Self-evaluation			
	Literat	ure					
		No.	Author	Title	Pu	ıblisher	Year
				Stability testing of			
			ICH Guidelines	new drug substances			
				and products			
				Stability testing:			
				photostability testing			
				of new drug substances			• • • •
				and products			2003
				Stability testing for			1996
		1		new dosage forms	ICH		1996
				Bracketing and			2002
		1.	01A-01F	matrixing designs for	ICH		2003
			<u>x x.</u>	stability testing of new	esting of new 2018	2018	
		drug substances and products					
				Evaluation for stability			
22	22.1.			data			
				Stability data package			
				for registration			
				application in climatic			
				zones III and IV			
				Handbook of Stability			
				Testing in			
				Pharmaceutical			
		2.	Kim Huvnh-Ba	Development	Spring	rer	2009
				Regulations	~pe	,	2009
				Methodologies, and			
				Best Practices			
				Accelerated Predictive			
				Stability			
		3	Fenghe Qiu, Garry	Fundamentals and	Acade	mic Press	2018
			Scrivens,	Pharmaceutical	110000		
				Industry Practices			
		Additi	onal literature	1	1		1
	22.2.	No.	Author	Title	Pu	blisher	Year

	1.	Sanjay Bajaj, Saranjit Singh	Methods for Stability Testing of Pharmaceuticals (Methods in Pharmacology and Toxicology)	Humana	2018
	2.	Thorsteinn Loftsson	Drug Stability for Pharmaceutical Scientists	Academic Press	2014