DEPARTMENT OF PLANT PRODUCTION
Study programme: Biotechnology, plant breeding and seed production
DIPLOMA: MASTER OF AGRICULTURAL SCIENCES – Biotechnology, plant breeding and seed production

CODE	I SEMESTER – FIRST YEAR			
	Compulsory course	**Credits**	**Classes**	**Total**
2ZF230112	Methods in scientific research work	8	3+2+2	216
2ZF211412	Genetics	8	3+2+2	216
2ZF230212	Biostatistics	6	2+2+1	156
	Faculty elective course	4	2+1+1	120
	Faculty elective course	4	2+1+1	120
	Total:	30	12+8+7	828

CODE	II SEMESTER – FIRST YEAR			
	Compulsory course	**Credits**	**Classes**	**Total**
2ZF211512	Plant physiology	8	3+2+2	216
2ZF211612	Plant breeding	8	3+2+2	216
2ZF201712	Phytopatology	6	2+2+1	156
	Faculty elective course	4	2+1+1	120
	Faculty elective course	4	2+1+1	120
	Total:	30	12+8+7	828

CODE	III SEMESTER – SECOND YEAR			
	Compulsory course	**Credits**	**Classes**	**Total**
2ZF211712	Seed production	8	3+2+2	216
2ZF211812	Plant biotechnology	8	3+2+2	216
2ZF205212	Methods in biochemical and physiological investigations	8	2+2+1	156
	University elective course	6	2+2+1	156
	Total:	30	11+8+7	804

CODE	IV SEMESTER – SECOND YEAR			
	Compulsory course	**Credits**	**Classes**	**Total**
	Master's thesis	30	0+0+26	818
	Total:	30	0+0+26	818

CODE	***Faculty elective course I semester***			
2ZF211912	Cytogenetic	4	2+1+1	120
2ZF212012	Plant tissue culture	4	2+1+1	120
2ZF201912	Basics of phytopharmacy	4	2+1+1	120
2ZF212112	Eco physiology	4	2+1+1	120
	Faculty elective course II semester			
2ZF212212	Breeding of field crops	4	2+1+1	120
2ZF212312	Vine breeding	4	2+1+1	120
2ZF212412	Plant breeding in vegetable growing	4	2+1+1	120
2ZF212512	Special plant breeding	4	2+1+1	120

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	**METHODS IN SCIENTIFIC RESEARCH WORK**			
2.	**Course code**	**2ZF230112**			
3.	**Study programme**	Biotechnology, plant breeding and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	"Goce Delcev"University - Stip, Faculty of Agriculture, Stip, Department for plant and environmental protection			
5.	**Level (first, second, third cycle)**	Second cycle			
6.	**Academic year / semester**	First year / I semester	7.	Number of ECTS credits	8
8.	**Professor**	**Prof. Ilija Karov, PhD**			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme:** Introduction to the basic rules and principles in science, the scientific research methods and characteristics that should possess the scientific worker.				
11.	**Content of the course programme:** **Content of lectures:** 1. Importance of scientific research 2. Selection of topic for scientific work 3. Methodology of research 4. Literature and working hypothesis 5. Planning of experiment 6. Conducting the experiment 7. Methodology and experimental technique of field experiment 8. An overview of important procedures in the experimental technique 9. Methodology and technique of conducting experiments in containers 10. Processing and displaying the results 11. Technique of writing master's, specialist and scientific papers and citing the literature 12. Preparation of a scientific paper for printing. **Content of exercises**: 1. Introduction 2. Setting the hypothesis 3. Studying the literature 4. Performing of experiment 5. Field trials 6. Laboratory experiments 7. Experiment in containers 8. Processing of the experimental results 9. Displaying obtained results 10. Literature citation, 11. Writing a scientific paper 12. Presenting a scientific paper.				
12.	**Methods of study:** lectures, theoretical and practical exercises, consultations, independent paper work, home learning, preparatory classes for exams and mid-term tests, consultations.				
13.	**Total amount of available time**	216 hours			
14.	**Distribution of the available time**	3+2+2			
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	3	
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2	
16.	**Other forms of activities**	16.1.	Team projects	1	
		16.2.	Individual projects	1	
		16.3.	Individual study		
17.	**Forms of assessment**				
	17.1.	Exams (midterm exams, exam, electronic testing)	30		
	17.2.	Project activities (oral and written presentation)	50		
	17.3.	Other forms of studying activities	20		
18.	**Criteria for assessment (points / grade)**	to 50 points	5 (five) (F)		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		

		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	**Condition for getting a signature and taking the final exam**	60% of term activities, project activities and attending to lectures and discussions	
20.	**Language in which classes are conducted**	Macedonian	
21.	**Method of monitoring the quality of instruction**	Self-evaluation	

22. **Literature**

Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
1.	Проф. д-р. Илија Каров, Асс. Билјана Ковачевиќ	Методи на научно истражувачката работа (скрипта)	УГД-Штип	2010
2.	Ketryn L. Allen	Study skills. A student survival guide. (translation of the Macedonian language)	Goce Delcev University, Stip	2010

Additional literature

Ordinal No.	Author	Title	Publisher	Year
1.	Dr. Slavko Borojevic	Metodologija eksperimentalnog naucnog rada	Radnicki Univerzitet “Radivoj Cirpanov“	1974

Appendix No.3	**Syllabus for the first, second and third cycle of study**			
1.	**Course title**	**Genetics**		
2.	**Course code**	2ZF211412		
3.	**Study programme**	Biotechnology, selection and seed production		
4.	**Organizer of the study programme (faculty, institute, group)**	Faculty of Agriculture, University “Goce Delcev”-Stip, Department of Plant production		
5.	**Level (first, second, third cycle)**	Second cycle		
6.	**Academic year / semester**	First year/ first semester	7.	Number of ECTS credits 8
8.	**Professor**	Prof. Verica Ilieva, PhD		
9.	**Preconditions for course enrollment**	No		
10.	**Goals of the course programme**: The main objective of the course is to introduce students with the basic principles and laws of inheritance and their application in plant breeding.			
11.	**Content of the course programme**: ***Lectures***: INHERITANCE AND VARIABILITY IN PLANTS (Meaning of inheritance. Categories, groups and forms of inheritance. Cell as a place of inherited changes. Chemical structure of genetic material. The role of DNA and RNA in the process of			

	inheritance and protein synthesis. Synthesis of RNA. Structure and function of genes. Mode of action of genes and term cistron. The relationship between genes and cistrons. Chromosomes. Number of chromosomes in important crops. Behavior of chromosomes during cell divisions. Essence of variability. Types of variability. The impact of external environment of inheritance and variability among living organisms). INTERSPECIES HYBRIDIZATION (genes and alleles, their distribution and segregation in F_1, F_2 and subsequent generations at dominant-recessive and intermediate inheritance. Codominance). DISTANT (INTERSPECIES and INTERGENUS) HYBRIDIZATION (Meaning of distinct hybridization in plants. Development and properties of the F_1 generation. Hybrid sterility between species. Overcome sterility in distinct hybrids. Polyploidy rows). INHERITANCE OF QUANTITATIVE PROPERTIES (Phenotypic variability. Median value of population. The average effect of genes. Additive activity of genes). PLANTS MUTATIONS (Types of mutations. Methods for detecting mutations and their frequency. Chance of applying mutations in plant selection). EXTRANUCLEAR INHERITANCE (Native effect in inheritance. Role of plastids and mitochondrial DNA in extranuclear inheritance). GENETIC POPULATION (Population in autogamous organisms. Genetic equilibrium in populations. Change of genetic equilibrium. Mutation pressure). INBRIDING AND HETEROZIS; BASIC PRINCIPLES OF GENETIC ENGINEERING; TRANSGENIC PLANTS. ***Practices***: Structure of the genetic material; Mendel's principle of genetics; Linked traits, Numerical and structural changes in chromosome; Interspecies hybridization; Frequency of genes and genotypes in populations; Laws of large populations; Equilibrium, Gene frequency change in populations; Components of phenotypic variability; Gene systems in inheritance of quantitative traits; Heritability; Combinative ability.			
12.	**Methods of study**: Lectures, theoretical and laboratory exercises, consultations, e-learning, individual and team projects, prepare lecture for exams.			
13.	**Total amount of available time**		216 hours	
14.	**Distribution of the available time**		3+2+2	
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	3
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2
16.	**Other forms of activities**	16.1.	Team projects	/
		16.2.	Individual projects	1
		16.3.	Individual study	1
17.	**Forms of assessment**			
	17.1.	Exams (midterm exams, exam, electronic testing)		30
	17.2.	Project activities (oral and written presentation)		50
	17.3.	Other forms of studying activities		20
18.	**Criteria for assessment (points / grade)**		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

19.	**Condition for getting a signature and taking the final exam**	60% success level on all pre-exam activities
20.	**Language in which classes are conducted**	Macedonian
21.	**Method of monitoring the quality of instruction**	Self-evaluation, Periodic tests for students, Survey

22. **Literature**

Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
22.1. 1.	Cane Stojkovski, Sonja Ivanovska	Genetics	University “Ss. Cyril and Methodius, Skopje, Faculty of agriculture science and food	2002
2.	Petrovska Dobrinka	Genetics	University “Ss. Cyril and Methodius, Skopje, Faculty of agriculture science and food	1993
3.	Aleksandar Đokić	Plant genetic	Partenon, Beograd	2000

Additional literature

Ordinal No.	Author	Title	Publisher	Year
22.2. 1.	Sonja Ivanovska, Ljupco Jankuloski, Mirjana Jankulovska	Collection tasks of genetics	University “Ss. Cyril and Methodius, Skopje, Faculty of agriculture science and food	2011
2.	Šurlan – Momirović, G., Rakonjac, V., Prodanović, S., Živanović, T.	Genetics and plant breeding (script)	University of Beograd, Faculty of Agriculture, Beograd	2007
3.	Borojević Slavko, Borojević Katarina	Genetics	University of Novi Sad, Faculty of Agriculture,	1976
4.	Ayala F., Kiger J.A.	Modern genetics	The Benjamin/Cummings Publishing Company, Inc. Menlo Park, California	1984

		5.	Borojević Katarina	Genes and populations	Forum, Novi Sad	1986
		6.	Dimitrijević M., Petrović Sofija	Genetic modified organisms Questions and dilemmas	Novi Sad	2004
		7.	Dimitrijević M., Petrović Sofija	Genetics populations Adaptability and genotype stability	Faculty of agriculture, Novi Sad, Institute for crop field	2005
		8.	Marinković M., Tucić N., Kekić V.	Genetics	Science book, Beograd	1982

Appendix No.3	**Syllabus for the first, second and third cycle of study**					
1.	**Course title**	**BIOSTATISTICS**				
2.	**Course code**	**2ZF230212**				
3.	**Study programme:**	**Field crops**				
4.	**Organizer of the study programme (faculty, institute, group)**	Department for plant and environmental protection Faculty of Agriculture University “Goce Delcev”- Stip.				
5.	**Level (first, second, third cycle)**	Second cycle				
6.	**Academic year / semester**	Second year/ first semester	7.	**Number of ECTS credits**	6	
8.	**Instructor**	**Prof. Tatjana Atanasova Pacemska, PhD**				
9.	**Preconditions for course enrollment**					
10.	**Goals of the course programme**: Getting more detailed knowledge for the use of statistical methods in agricultural practice					
11.	**Content of the course programme**: **Content of lectures:** 1. Introduction to statistics (mathematics and statistics science) 2. Basic statistical techniques 3. Types of statistical methods 4. Data processing 5. Statistics, variability and distribution 6. Discrete equal distribution. 7. Elements of statistical conclusion. 8. T test and F test 9. Analysis of variance (ANOVA) 10. Factorial experiment, two factorial experiment 11. Linear regression and correlation 12. Experimental Design - practical application of methods in agricultural research. **Content of exercises:** 1. Mathematics and statistics science 2. The use of basic statistical techniques 3. Types of statistical methods 4. Practical ways of data processing 5. Statistics, variability and distribution 6. Discrete equal distribution. 7. Elements of statistical conclusion. 8. T test and F test 9. Analysis of variance (ANOVA) 10. Factorial experiment, two factorial experiment 11. Linear regression and correlation 12. Experimental Design - practical application of methods in agricultural research.					
12.	**Methods of study**: Lectures, theoretical and practice exercises, consultations; individual work; home learning; preparatory classes for exams and mid-term tests: consultation;					
13.	**Total amount of available time**	156 hours				
14.	**Distribution of the available time**	2+2+1				
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	2		
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2		
16.	**Other forms of activities**	16.1.	Team projects	1		
		16.2.	Individual projects	-		
		16.3.	Individual study	-		
17.	**Forms of assessment**					
	17.1.	Exams (midterm exams, exam, electronic testing)	30			
	17.2.	Project activities (oral and written presentation)	50			
	17.3.	Other forms of studying activities	20			
18.	**Criteria for assessment (points / grade)**	to 50 points	5 (five) (F)			
		from 51 to 60 points	6 (six) (E)			

		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	**Condition for getting a signature and taking the final exam**	60% of term activities	
20.	**Language in which classes are conducted**	Macedonian	
21.	**Method of monitoring the quality of instruction**	Self-evaluation	

22. **Literature**

Compulsory literature

	Ordinal No.	Author	Title	Publisher	Year
22.1.	1.	Graham Currell, Antony Dowman	Essential mathematics and statistics for science		2009
	2.	Nelmut van Emden	Statistics for terrified biologists		2008
	3.	Calvin Dytham	Choosing and Using Statistics		2003

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	Course title	**Plant physiology**			
2.	Course code	2ZF211512			
3.	Study programme	Biotechnology, genetics and plant selection			
4.	Organizer of the study programme (faculty, institute, group)	University “Goce Delcev”- Stip, Faculty of Agriculture, Stip, Plant Production			
5.	Level (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First / II	7.	Number of ECTS credits	8
8.	Professor	Prof. Liljana Koleva-Gudeva, PhD			
9.	Preconditions for course enrollment	No			
10.	Goals of the course programme: The course aims to acquaint students with life processes at the plant in its entire life cycle. Physiological processes occurring in the plant create organic matter and energy, which is energy on the survival of animal and plant life on earth.				
11.	Content of the course programme: Content of the lectures**:** Historical development of plant physiology. Phylogenetic tree of living organisms. Chemical composition of plants. Water balance: transpiration. Gutcion. Receive transport and function of mineral salts. Mechanism of Photosynthesis: Calvin cycle, C-3, C-4 and CAM photosynthesis. Photorespiration. Respiration: glycolysis, Krebs cycle, pentose phosphate path, ß oxidation Glyoksilae cycle. Physiology of seeds and fruits. Physiology of stress. Phytohormones and growth regulators. Biosynthesis and catabolism of auxsyne, giberelyne, cytokinine, ABA and ethylene. Jasmonates. Brasinosteroides. Oligosaccharides. Polyamines.Secondary metabolism: phenols, alkaloids and therpene. Culture of plant cells and tissues in vitro.				

	Content of exercises (**practical** and laboratory**):** Quantitative analysis of the basic components in plants. Free, hygroscopic and total water. Dry solids. Total minerals. Total organic matter. Quantitative analysis of nitrogen in plants. Protein. Cellulose. Starch. Oils. Photosynthesis: Isolation of chloroplasts. Quantitative analysis of photosynthetic pigments. Proving Phytohormones. Vegetative propagation of plants. Micro propagation in vitro.				
12.	Methods of study: Lectures, Theoretical exercises, Laboratory exercises, E-learning, individual and team projects, consultations about the final exam, Final exam.				
13.	Total amount of available time		216 hours		
14.	Distribution of the available time		3 + 2 + 2		
15.	Forms of teaching activities	15.1.	Lectures - theoretical training		3
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork		2
16.	Other forms of activities	16.1.	Team projects		
		16.2.	Individual projects		2
		16.3.	Individual study		
17.	Forms of assessment				
	17.1.	Exams (midterm exams, exam, electronic testing)			30
	17.2.	Project activities (oral and written presentation)			50
	17.3.	Other forms of studying activities			20
18.	Criteria for assessment (points / grade)		to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
19.	Condition for getting a signature and taking the final exam		60% of term activities, project activities and attending to lectures and discussions		
20.	Language in which classes are conducted		Macedonian		
21.	Method of monitoring the quality of instruction		Self-evaluation		

22.	Literature					
	22.1.	Compulsory literature				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Liljana Koleva Gudeva	Plant Physiology	UGD - Stip	2010
		2.	Mirko Spasenoski Sonja Gadzovska	Plant Physiology	UKIM - Skopje	2009
	22.2.	Additional literature				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Taiz L., Zeiger E.	Plant Physiology	Sunderland, Massachusetts, USA	2006
		2.	Ljubinka Culafic	Plant Physiology	NNK International	2003

Appendix No.3		**Syllabus for the first, second and third cycle of study**			
1.	**Course title**	**Plant breeding**			
2.	**Course code**	2ZF211612			
3.	**Study programme**	Biotechnology, selection and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	Faculty of Agriculture, University “Goce Delcev”- Stip, Department of Plant production			
5.	**Level (first, second, third cycle)**	Second cycle			
6.	**Academic year / semester**	First year/ second semester	7.	Number of ECTS credits	8
8.	**Professor**	Prof. Verica Ilieva, PhD Ass. prof. Dragica Spasova, PhD			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme**: The main objective of the course is to introduce the students with the ways and methods of plant breeding, their genetic basis, and the organization of plant breeding process, the procedure for application, approval and registration of newly created varieties.				
11.	**Content of the course programme**: ***Lectures***: INTRODUCTION, IMPORTANCE, SELECTIONS TASK AND GOALS; SELECTION AND OTHER SCIENTIFIC DISCIPLINES; PLANT GENETIC RESOURCES (Concept and meaning, Sources of germplasm for plant breeding - initial material in selection, Concept for gene pool in cultural species, The concept of genetic vulnerability and hazard loss of plant genetic resources, Procedures for conserving and maintain the plant genetic resources, Variability of plant genetic resources); GENETIC BASIS OF SELF-POLINATION AND NON SELF - POLINATION SPECIES; PROPRETY, GENOTYPE, PHENOTYPE, ABOUT THE VARIETY IN SELECTION (Definition and importance of variety, types of varieties and their genetic composition, adaptability of the variety); METHODS IN PLANT BREEDING (Genetic basis and theory, methods for creating genetic variability - hybridization, mutations, polyploidy, the application of biotechnology in plant breeding, methods of selection in plant breeding), SELECTION OF CERTAIN PROPERTIES AND GENETIC PROFITS FROM PLANT BREEDING (Selection for yield, Selection for resistance to disease and insects, Selection for resistance to high temperatures and drought, Selection for resistance to low temperatures, Loading resistance, Selection for length of vegetation period, Selection of quality); INBRIDING AND UTILIZATION OF HETEROZIS. ORGANIZATION OF PLANT BREEDING PROCESS (Scheme for plant breeding process, Methods of field trials), REGISTRATION, APPROVAL AND REGISTRATION OF NEW VARIETIES; SELECTION FOR ORGANIC PRODUCTION (Methods in organic plant breeding). ***Practices***: Methods for setting trials fields; Statistical analysis of the results; Inheritance of quantitative traits; Heritability and components of the genetic variances; Combinative abilities.				
12.	**Methods of study**: Lectures, theoretical and laboratory exercises, consultations, e-learning, individual and team projects, e-learning, prepare lecture for exams.				
13.	**Total amount of available time**	216 hours			
14.	**Distribution of the available time**	3+2+2			

15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	3
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2
16.	**Other forms of activities**	16.1.	Team projects	/
		16.2.	Individual projects	1
		16.3.	Individual study	1
17.	**Forms of assessment**			
	17.1.	Exams (midterm exams, exam, electronic testing)		30
	17.2.	Project activities (oral and written presentation)		50
	17.3.	Other forms of studying activities		20
18.	**Criteria for assessment (points / grade)**		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
19.	**Condition for getting a signature and taking the final exam**		60% success level on all pre-exam activities	
20.	**Language in which classes are conducted**		Macedonian	
21.	**Method of monitoring the quality of instruction**		Self-evaluation, Periodic tests for students, Survey	

22. **Literature**

22.1. ***Compulsory literature***

Ordinal No.	Author	Title	Publisher	Year
1.	Verica Ilieva	Plant breeding (general part), textbook	University “Goce Delčev”- Štip, Faculty of Agriculture	2012
2.	Dragica Spasova	Selection and seed production - (no reviewed script)	University “Goce Delčev”- Štip, Faculty of Agriculture	2011

		3.	Cvetanka Najcevska	Selection and seed production (practicum)	University “Ss. Cyril and Methodius, Skopje, Faculty of agriculture science and food	1997
		4	Beljo, J.	Plant breading	Faculty of agriculture – Mostar	2006
	22.2.	***Additional literature***				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Martinčić, J., Kozumplik, V.	Plant breading	Faculty of agriculture – Mostar	1996
		2.	Murphy, D.	Plant breeding and biotechnology:	Societal Context and the Future of Agriculture. Cambridge University. New York	2007
		3.	Lammerts van Bueren, E. T., Myers, J.R..	Organic Crop Breeding	Wiley-Blackwell.	2012
		4		Principles of plant breeding	John Wiley	1999
		5	Borojević S.	Principles and Methods for plant breeding	Scientific Book, Belgrade	1992

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	**PHYTOPATHOLOGY**			
2.	**Course code**	**2ZF201712**			
3.	**Study programme**	**Biotechnology, selection and seed production**			
4.	**Organizer of the study programme (faculty, institute, group)**	“Goce Delcev”University - Stip, Faculty of Agriculture, Stip, Department for plant production			
5.	**Level (first, second, third cycle)**	Second cycle			
6.	**Academic year / semester**	First / II semester	7.	Number of ECTS credits	4
8.	**Professor**	**Prof. Sasa Mitrev, PhD**			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme:** Introducing to the most significant causes of plant diseases, symptoms and implementation of appropriate measures for protection.				
11.	**Content of the course programme:** **Content of lectures:**				

	1. Concept and development of phytopathology; Concept of plant disease, Economic importance of plant diseases 2. Plant diseases and their causes: Parasitic diseases, fungal pathogens 3. Prokariotes as causes of plant diseases: bacteria and molikuts 4. Actinomycetes: rickettsia, molikuts, fitoplazmas, spiroplazmas 5. Pathogen viruses; Parasitic flowering plants 7. Symptomatology 8. Parasites and parasitism in plant life, 9. Pathological changes in sick plant 10. Pathogenesis 11. Changes in the intensity of the disease 12. Plant resistance to pathogens; **Content of exercises:** 1. Description of symptoms caused by pathogen microorganisms 2. Isolation of fungal pathogens 3. Determination of pathogenicity of fungi 4. Identification of fungi based on its morphological characteristics; 5. Bacteria isolation 6. Determination of pathogenicity of bacteria; 7. Identification of the type of bacteria based on their biochemical characteristics; 8. Breeding characteristics of phytopathogen viruses 9. Determination of the virus type using ELISA test, 10. Modern methods of identification: Polimerase chain reaction; 11. Methods for evaluating the intensity of the disease 12. Genetic basis of host - parasite interactions;				
12.	**Methods of study:** lectures, theoretical and practical exercises, consultations, making independent paper work, home teaching, consultancy.				
13.	**Total amount of available time**		156 hours		
14.	**Distribution of the available time**		2+2+1		
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	2	
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2	
16.	**Other forms of activities**	16.1.	Team projects	-	
		16.2.	Individual projects	1	
		16.3.	Individual study		
17.	**Forms of assessment**				
	17.1.	Exams (midterm exams, exam, electronic testing)	30		
	17.2.	Project activities (oral and written presentation)	50		
	17.3.	Other forms of studying activities	20		
18.	**Criteria for assessment (points / grade)**		to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
19.	**Condition for getting a signature and taking the final exam**		60% of term activities, project activities and attending to lectures and discussions		
20.	**Language in which classes are conducted**		Macedonian		
21.	**Method of monitoring the quality of instruction**		Self-evaluation		
22.	**Literature**				

22.1.	**Compulsory literature**				
	Ordinal No.	Author	Title	Publisher	Year
	1.	Проф. д-р. Филип Пејчиновски и Проф.	Земјоделска Фитопатологија Општ дел	УГД-Штип	2007

			Д-р. Саша Митрев			
		2.	Проф. д-р. Филип Пејчиновски и Проф. Д-р. Саша Митрев	Земјоделска Фитопатологија Специјален дел	УГД-Штип	2009
		3.	Митрев Саша, Емилија Костадиновска	Практикум по фитопатологија	УГД-Штип	2010
	22.2.	**Additional literature**				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Babovic M.	Osnovi patologije biljaka	Poljoprivredni fakultet, Univerzitet u Beogradu	2003
		2.	Lucas John Alexander	Plant pathology and plant pathogens	Oxford; Malden, Mass.	1998

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	**Seed production**			
2.	**Course code**	2ZF211712			
3.	**Study programme**	Biotechnology, selection and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	Faculty of Agriculture, University “Goce Delcev”-Stip, Department of Plant production			
5.	**Level (first, second, third cycle)**	Second cycle			
6.	**Academic year / semester**	Second year/ third semester	7.	Number of ECTS credits	8
8.	**Professor**	Ass. prof. Dragica Spasova, PhD, Prof. Verica Ilieva, PhD			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme**: The aim of the course is to introduce students with the general principles in seed production, control over the seed production, marketing, distribution, sales and general methods of testing seed quality.				
11.	**Content of the course programme**: ***Lectures***: 1. Introduction, definition and task of seed production; 2. Morphology of seed; 3. Chemical composition of seed; 4. Physiology of seed; 5. Ecology of seed; 6. Agro-technical measures affecting to seed production; 7. Agro-technical measures affecting to seed production; 8. Choice of variety and categories of seed; 9. Seed quality; 10. Finishing and storage of seed; 11. Laboratory tests of seed quality; 12. Marketing in seed production. ***Practices***: 1. Technique of plowing; 2. Introduce with legislation in the seed production; 3. Methods of sampling for seed quality; 4. Packing seed; 5. Laboratory evaluation of seed quality; 6. Testing the purity and type of the variety; 7. Testing the absolute and hectoliter mass of grain; 8. Introduce and practice work on field ground;				

	9.Introduction to the centers for finishing seed production; 10. Categories of seed variety;11. Control of seed crops; 12. Control of seed crops.			
12.	**Methods of study**: Lectures, theoretical and laboratory exercises, consultations, e-learning, individual and team projects, e-learning, prepare lecture for exams.			
13.	**Total amount of available time**		216 hours	
14.	**Distribution of the available time**		3+2+2	
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	3
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2
16.	**Other forms of activities**	16.1.	Team projects	1
		16.2.	Individual projects	1
		16.3.	Individual study	/

17.	**Forms of assessment**		
	17.1.	Exams (midterm exams, exam, electronic testing)	30
	17.2.	Project activities (oral and written presentation)	50
	17.3.	Other forms of studying activities	20

18.	**Criteria for assessment (points / grade)**	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	**Condition for getting a signature and taking the final exam**	60% success level on all pre-exam activities	
20.	**Language in which classes are conducted**	Macedonian	
21.	**Method of monitoring the quality of instruction**	Self-evaluation, Periodic tests for students, Survey	

22. **Literature**

Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
22.1. 1.	Miodrag M. Marić	Seed production	Publisher DRAGANIC, Beograd	2005
22.1. 2.	Milošević M., Ćirović M., Mihaljev I., Dokić P.	General seed production	Institute for field crop, Novi Sad	1996
22.1. 3.	Gatarić Đ.	Seed production	Faculty of agriculture Banja Luka	1999
4	Mladenovski, T.	Seed production	Skopje	2004

22.2. ***Additional literature***

		Ordinal No.	Author	Title	Publisher	Year
		1.	Mladenovski, T.	Seed biology	Skopje	1996
		2.				
		3.			.	

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	Course title	**Plant byotechnology**			
2.	Course code	2ZF211812			
3.	Study programme	Biotechnology, genetics and plant selection			
4.	Organizer of the study programme (faculty, institute, group)	University “Goce Delcev”- Stip, Faculty of Agriculture, Stip, Plant Production			
5.	Level (first, second, third cycle)	Second cycle			
6.	Academic year / semester	Second / III	7.	Number of ECTS credits	8
8.	Professor	Prof. Liljana Koleva-Gudeva, PhD			
9.	Preconditions for course enrollment	No			
10.	Goals of the course programme: Learning the basic skills and knowledge of plant biotechnology and genetic engineering as drivers of modern refining plant and enrichment of plant genetic resources.				
11.	Content of the course programme: Content of the lectures**:** 1. Introduction. Meaning and objectives of plant biotechnology. 2 Nucleic acids. 3 Morphogenesis in vitro. 4 Micro propagation. 5 Somatic embryogenesis. 6 Therein protoplast: isolation and purification, somatic hybridization. 7 Genetic transformation: recombinant DNA. 8 Genetic transformation*: Agrobacterium tumefaciens*. 9 TI plasmid: structure and transfer. 10 Transgenic plants. 11 Viral DNA. 12 Genetic vectors. Content of exercises (**practical** and laboratory**):** 1. Laboratory of Plant Biotechnology equipment and space. 2 Sterilization of equipment for work and plant material. 3 Preparation of nutrient solutions and growth regulators. 4 Preparation of nutrient medium. 5 In vitro cultures. 6 Culture of plant tissues. 7 Obtaining therein protoplast. 8 Methods for obtaining haploids and dihaploids. 9 Isolation of DNA. 10 Quantification of the DNA. 11 Digestion of the DNA. 12 Acclimatization of regenerated plants.				
12.	Methods of study: Lectures, Theoretical exercises, Laboratory exercises, E-learning, individual and team projects, consultations for the final exam, Final exam.				
13.	Total amount of available time	216 hours			
14.	Distribution of the available time	3 + 2 + 2			
15.	Forms of teaching activities	15.1.	Lectures - theoretical training		3
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork		2
16.	Other forms of activities	16.1.	Team projects		
		16.2.	Individual projects		2
		16.3.	Individual study		
17.	Forms of assessment				
	17.1.	Exams (midterm exams, exam, electronic testing)			30
	17.2.	Project activities (oral and written presentation)			50

	17.3.	Other forms of studying activities		20
18.	Criteria for assessment (points / grade)		to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
19.	Condition for getting a signature and taking the final exam		60% of term activities, project activities and attending to lectures and discussions	
20.	Language in which classes are conducted		Macedonian	
21.	Method of monitoring the quality of instruction		Self-evaluation	

22. Literature

22.1. Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
1.	Liljana Koleva Gudeva	Plant Physiology	UGD - Stip	2010
2.	George E.F.	Plant Propagation by tissue culture	Edingtin Wilts, England	1996

22.2. Additional literature

Ordinal No.	Author	Title	Publisher	Year
1.	Bruss Alberst, at all.	Molecular Biology of the cell	Garland Science, NY USA	2002

Appendix No.3	**Syllabus for the first, second and third cycle of study**			
1.	**Course title**	**Methods in biochemical and physiological investigations**		
2.	**Course code**	2ZF205212		
3.	**Study programme**	Biotechnology, selection and seed production		
4.	**Organizer of the study programme (faculty, institute, group)**	Department of plant production Faculty of Agriculture, University “Goce Delcev”- Stip		
5.	**Level (first, second, third cycle)**	Second cycle		
6.	**Academic year / semester**	First year/ third semester	7. Number of ECTS credits	8
8.	**Professor**	Prof. Rubin Gulaboski, prof. Liljana Koleva-Gudeva		
9.	**Preconditions for course enrollment**	No		
10.	**Goals of the course programme**: Students are introduced to the basics of analytical methods for analysis, their function and their application in biochemical and physiological analysis			
11.	**Content of the course programme**:			

	Lectures: 1. Introduction to instrumental techniques; 2. Precision, accuracy, reproducibility; 3. Quantum theory for the atom structure 4. Atomic absorption spectroscopy; 5. ICP MS; 6. Methods based on light absorption; 7. UV-VIS; 8. Theory of chromatography; 9. Liquid chromatography; 10. Gas chromatography; 11. Electrochemical techniques; 12. Potentiommetry and voltammetry. ***Practices***: 1. Introduction; 2. Determination of heavy metals with AAS; 3. Determination of heavy metals in plants with ICP MS; 4. Determination of heavy metals in water with UV VIS; 5. Determination of total phenolic content with UV VIS; 6. Methods for lipids extraction; 8. Electrophoresis-protein detection; 9. Determination of lipids extracted from plants with HPLC: 10. Determination of proteins with liquid chromatography; 11. Voltammetric determination of heavy metals in plants; 12. Electrochemical determination of total antioxidative potential of plant extracts.				
12.	**Methods of study**: Lectures, Laboratory exercises, e-learning, individual and team projects, consultations.				
13.	**Total amount of available time**		216 hours		
14.	**Distribution of the available time**		3+2+2		
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	3 classes weekly	
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	2 classes weekly	
16.	**Other forms of activities**	16.1.	Team projects	1 class weekly	
		16.2.	Individual projects	1 class weekly	
		16.3.	Individual study		

17.	**Forms of assessment**		
	17.1.	Exams (midterm exams, exam, electronic testing)	30
	17.2.	Project activities (oral and written presentation)	50
	17.3.	Other forms of studying activities	20

18.	**Criteria for assessment (points / grade)**	up to 50 points	5(five) (F)
		from 51 to 60 points	6(six) (E)
		from 61 to 70 points	7(seven) (D)
		from 71 to 80 points	8(eight) (C)
		from 81 to 90 points	9(nine) (B)
		from 91 to 100 points	10(ten) (A)
19.	**Condition for getting a signature and taking the final exam**	60% of term activities, project activities and attending to lectures and discussions	
20.	**Language in which classes are conducted**	Macedonian	
21.	**Method of monitoring the quality of instruction**	Self-evaluation, anonym polls	

22.	**Literature**					
	22.1.	***Compulsory literature***				
		Ordinal No.	Author	Title	Publisher	Year

		1.	Rubin Gulaboski	Instrumental methods, internal stuff available on www.rubingulaboski.synthasite.com	UGD-Stip	2010
		2.	Semih Otles	Handbook of Food Analysis Instruments, Taylor & Francis, Semih Otles (ed.) 2008. http://www.chipsbooks.com/hbfdinst.htm	Taylor & Francis	2008
		3.				
	22.2.	***Additional literature***				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Rubin Gulaboski	Authorized lectures in ppt format, available in free format on www.rubingulaboski.synthasite.com	UGD	2010
		2.				
		3.				

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	**Cytogenetics**			
2.	**Course code**	2ZF211912			
3.	**Study programme**	Biotechnology, selection and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	Faculty of Agriculture, University “Goce Delcev”-Stip, Department of Plant production			
5.	**Level (first, second, third cycle)**	Second cycle			
6.	**Academic year / semester**	First year/ first semester	7.	Number of ECTS credits	4
8.	**Professor**	Prof. Verica Ilieva, PhD			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme**: The main objective of the course is to expand the knowledge for structure of chromosomes and the changes that may occur in the structure and number of chromosomes.				
11.	**Content of the course programme**: ***Lectures***: Cellular distribution and inheritance (Gene distribution through cell divisions. Mitosis and genetic constancy); Cellular distribution and inheritance (Meiosis and genetic variability); Cellular ddistribution and inheritance (Genetic effects by changing the normal processes of mitosis and meiosis); Cellular distribution and inheritance (Reproductive cycle of some prokaryote and eukaryotes); Cellular distribution and inheritance (Eukaryotic cells in culture); Chromosome basis of inheritance (Poly and unifibrilar organization of chromosomes); Hemizam of chromosomes. Morphology of chromosomes; Karyotyping. Polytene chromosomes; Molecular structure of chromosomes (Nucleosomal organization of chromosomes. Replication of chromosomes); Molecular structure of chromosomes (Replication in eukaryotes and viruses); Changes in the number of chromosomes; Changes in the structure of chromosomes.				

	Practices: Important methods for cytogenetic analysis; Making karyotype and karyogramme; Marking chromosomes through mitosis and meiosis; Changes in the number of chromosomes; Changes in the structure of chromosomes; Detection chromosomes with chromosomal aberrations.			
12.	**Methods of study**: Lectures, theoretical and laboratory exercises, consultations, e-learning, individual and team projects, e-learning, prepare lecture for exams.			
13.	**Total amount of available time**		120 hours	
14.	**Distribution of the available time**		2+1+1	
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	2
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	1
16.	**Other forms of activities**	16.1.	Team projects	/
		16.2.	Individual projects	0.5
		16.3.	Individual study	0.5

17.	**Forms of assessment**		
	17.1.	Exams (midterm exams, exam, electronic testing)	30
	17.2.	Project activities (oral and written presentation)	50
	17.3.	Other forms of studying activities	20

18.	**Criteria for assessment (points / grade)**	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	**Condition for getting a signature and taking the final exam**	60% success level for all pre-exam activities	
20.	**Language in which classes are conducted**	Macedonian	
21.	**Method of monitoring the quality of instruction**	Self-evaluation, Periodic tests for students, Survey	

22. **Literature**

Compulsory literature (22.1.)

Ordinal No.	Author	Title	Publisher	Year
1.	Stevan Petrovic, Mirjana Vucenovic	Cytogenetics	Faculty of agriculture, Novi Sad, Institute for Field Crop	1992
2.	Vladimir Spasojevic	Citogenetics	Scientific Book, Beograd	1978
3.	Borojević Slavko, Borojević Katarina	Genetics	University of Novi Sad, Faculty of agriculture	1976

Additional literature (22.2.)

Ordinal	Author	Title	Publisher	Year

		No.				
		1.	Ayala F., Kiger J.A.	Modern genetics	The Benjamin/Cummings Publishing Company, Inc. Menlo Park, California	1984
		2.	Borojević Katarina	Genes and populations	Forum, Novi Sad	1986
		3.	Dimitrijević M., Petrović Sofija	Genetics population. Adaptability and genotype stability	Faculty of agriculture, Novi Sad, Institute for Field Crop	2005
		4	Marinković M., Tucić N., Kekić V.	Genetics	Scientific Book, Beograd	1982

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	Course title	**Plant tissue culture**			
2.	Course code	2ZF212012			
3.	Study programme	Biotechnology, genetics and plant selection			
4.	Organizer of the study programme (faculty, institute, group)	University “Goce Delcev”- Stip, Faculty of Agriculture, Stip, Plant Production			
5.	Level (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First / I	7.	Number of ECTS credits	4
8.	Professor	Prof. Liljana Koleva-Gudeva, PhD			
9.	Preconditions for course enrollment	No			
10.	Goals of the course programme: The rapid development of biotechnology and plant genetic engineering have enabled widespread use of methods of plant tissue culture under conditions in vitro. The course aims to introduce a theoretical and practical methods for students with culitvation of plant cells and tissues in conditions in vitro.				
11.	Content of the course programme: Content of the lectures**:** 1. Introduction. Meaning and objectives of plant tissue culture under conditions in vitro. Second Physiology of development. 3. Organogenesis - concept and significance. 4 Direct and indirect organogenesis. 5 Somatic organogenesis. 6 Definition, meaning and stages of micro propagation. 7 Free of viruses plant material. 8 Methods for obtaining haploids and dihaploids. 9 Therein protoplast. 10 Genetic transformations. 11 Viral DNA. 12 Gene banks. Content of exercises (**practical** and laboratory**):** 1. Laboratory culture of plant tissues equipment and space. 2 Sterilization of equipment for work and plant material. 3 Preparation of nutrient solutions and growth regulators. 4 Preparation of nutrient medium. 5 Set up the seed for basal medium. 6. Isolation the initial explants. 7. Culture of meristems. 8. Micro propagation. 9-12. In vitro cultures of plant tissues and organs.				
12.	Methods of study: Lectures, Theoretical exercises, Laboratory exercises, E-learning, individual and team projects, consultations for the final exam, Final exam.				

13.	Total amount of available time		120 hours	
14.	Distribution of the available time		2 + 1 + 1	
15.	Forms of teaching activities	15.1.	Lectures - theoretical training	2
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	1
16.	Other forms of activities	16.1.	Team projects	
		16.2.	Individual projects	1
		16.3.	Individual study	

17.	Forms of assessment		
	17.1.	Exams (midterm exams, exam, electronic testing)	30
	17.2.	Project activities (oral and written presentation)	50
	17.3.	Other forms of studying activities	20

18.	Criteria for assessment (points / grade)	to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Condition for getting a signature and taking the final exam	60% of term activities, project activities and attending to lectures and discussions	
20.	Language in which classes are conducted	Macedonian	
21.	Method of monitoring the quality of instruction	Self-evaluation	

22. Literature

22.1. Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
1.	Liljana Koleva Gudeva	Plant Physiology	UGD - Stip	2010
2.	George E.F.	Plant Propagation by tissue culture	Edingtin Wilts, England	1996

22.2. Additional literature

Ordinal No.	Author	Title	Publisher	Year
1.	Bruss Alberst, at all.	Molecular Biology of the cell	Garland Science, NY USA	2002

Appendix No.3	**Syllabus for the first, second and third cycle of study**	
1.	**Course title**	**BASICS OF PHYTOPHARMACY**
2.	**Course code**	2ZF201912
3.	**Study programme**	Biotechnology, selection and seed production
4.	**Organizer of the study programme (faculty, institute, group)**	“Goce Delcev”University - Stip, Faculty of Agriculture, Stip, Department for plant production
5.	**Level (first, second, third cycle)**	Second cycle

6.	**Academic year / semester**	First / I semester	7.	Number of ECTS credits	4
8.	**Professor**	**Prof. Ilija Karov, PhD**			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme:** Introduction to the fundamentals, principles and rules of phytopharmacy, divisions of pesticides, introduction to biochemical properties of pesticides, method of action, toxicity and opportunities for application.				
11.	**Content of the course programme:** **Contents of lectures:** 1.Introduction and historical development of pesticides; 2. Classification of pesticides; 3. Forms of production of pesticides; 4. Toxicity of pesticides to man and animals; 5. Toxicity: parameters of toxicity, carenza, tolerance and phytotoxicity; 6. Resistance; 7. Fate of pesticides in the environment; 8. Movement of pesticides in plants; 9. Fungicides; 10. Insecticides; 11. Herbicides; 12. Antibiotics, rodenthicides, limacides, korvicides and acaricides; **Content of exercises:** 1. Pesticide formulation; 2. Physico-chemical properties of pesticides; 3. Legislation 4. Determination of maximum permitted concentration 5. Application of pesticides 6. Methods for determination of pesticide residues 7. Taking a sample for testing of pesticide residues in different samples, 8. Calibration of the apparatus work (GC / MS / MS); 9. Preparation of test sample: liquid-liquid extraction of pesticides from different samples, 10. Determination of pesticide residues in plant sample with GC; 11. Determination of pesticide residues in plant sample with GC / MS / MS; 12. Protecting people and the environment from harmful effects of pesticides;				
12.	**Methods of study:** lectures, theoretical and practical exercises, consultations, making independent paper work, home teaching, consultancy.				
13.	**Total amount of available time**	120 hours			
14.	**Distribution of the available time**	2+1+1			
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training		2
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork		1
16.	**Other forms of activities**	16.1.	Team projects		0,5
		16.2.	Individual projects		0,5
		16.3.	Individual study		
17.	**Forms of assessment**				
	17.1.	Exams (midterm exams, exam, electronic testing)		30	
	17.2.	Project activities (oral and written presentation)		50	
	17.3.	Other forms of studying activities		20	
18.	**Criteria for assessment (points / grade)**	to 50 points		5 (five) (F)	
		from 51 to 60 points		6 (six) (E)	
		from 61 to 70 points		7 (seven) (D)	
		from 71 to 80 points		8 (eight) (C)	
		from 81 to 90 points		9 (nine) (B)	
		from 91 to 100 points		10 (ten) (A)	
19.	**Condition for getting a signature and taking the final exam**	60% of term activities, project activities and attending to lectures and discussions			
20.	**Language in which classes are conducted**	Macedonian			

21.	**Method of monitoring the quality of instruction**		Self-evaluation		
22.	**Literature**				
		Compulsory literature			
	22.1.	Ordinal No.	Author	Title	Publisher	Year
		1.	Проф д-р. Бранко Балтовски	Фитофармација	Наша книга, Скопје	1981
		2.	Проф. д-р. Филип Пејчиновски и Проф. Д-р. Саша Митрев	Општа Фитопатологија	УГД-Штип	2007
		3.	Milan Maceljski	Fitofarmacija (opći dio)	Sveučilište u Zagrebu	1967
			Radmila Šovljanski, Zlata Klokočar Šmit, Sanja Lazić	Praktikum iz Opšte Fitofarmacije	Poljoprivredni fakultet, Novi Sad	2002
		Additional literature				
	22.2.	Ordinal No.	Author	Title	Publisher	Year
		1.	Milan Maceljski, Bogdan Cvjetkovic, Jasminka I. Barcic, Zvonimir Ostojic	Prirucnik iz zastite bilja	Tiskara MDZagreb	1997

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	Course title	**Eco physiology of plants**			
2.	Course code	2ZF212112			
3.	Study programme	Biotechnology, genetics and plant selection			
4.	Organizer of the study programme (faculty, institute, group)	University “Goce Delcev”- Stip, Faculty of Agriculture, Stip, Plant Production			
5.	Level (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First / I	7.	Number of ECTS credits	4
8.	Professor	Prof. Liljana Koleva-Gudeva, PhD			
9.	Preconditions for course enrollment	No			
10.	Goals of the course programme: The course aims to acquaint students with life processes and throughout the life cycle of plants depending on environmental conditions. Research in the field of eco physiology connects the living conditions and the ability of plants depending on environmental conditions, through positive and negative impacts.				
11.	Content of the course programme: Content of the lectures**:** Introduction. Life processes in plants. Plant environment. Carbon balance in plants. Contents of minerals. Water balance. Plant development and the environment. Plants exposed to stress. Physiology of resistance. Content of exercises (**practical** and laboratory**):**				

	Quantitative analysis of the basic components in plants. Free, hygroscopic and total water. Pumping water. Dry solids. Total minerals. Chloral fluorescence. Assimilation transport. Increasing the CO2 content in the atmosphere from environmental point of view. Stress from the strong light. Surviving the cold. Mechanism of evolutionary adaptation of soils with heavy metals.			
12.	Methods of study: Lectures, Theoretical exercises, Laboratory exercises, E-learning, individual and team projects, consultations for the final exam, Final exam.			
13.	Total amount of available time		120 hours	
14.	Distribution of the available time		2 + 1 + 1	
15.	Forms of teaching activities	15.1.	Lectures - theoretical training	2
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	1
16.	Other forms of activities	16.1.	Team projects	
		16.2.	Individual projects	1
		16.3.	Individual study	

17.	Forms of assessment		
	17.1.	Exams (midterm exams, exam, electronic testing)	30
	17.2.	Project activities (oral and written presentation)	50
	17.3.	Other forms of studying activities	20

18.	Criteria for assessment (points / grade)	to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Condition for getting a signature and taking the final exam	60% of term activities, project activities and attending to lectures and discussions	
20.	Language in which classes are conducted	Macedonian	
21.	Method of monitoring the quality of instruction	Self-evaluation	

22. Literature

22.1. Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
1.	Liljana Koleva Gudeva	Plant Physiology	UGD - Stip	2010
2.	Volter Larcer	Plant Eco Physiology	Government Project – translation of 500 scientific books	2009

22.2. Additional literature

Ordinal No.	Author	Title	Publisher	Year
1.	Taiz L., Zeiger E.	Plant Physiology	Sunderland, Massachusetts, USA	2006

		2.	Ljubinka Culafic	Plant Physiology	NNK International	2003

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	**Breeding of field crops**			
2.	**Course code**	2ZF212212			
3.	**Study programme**	Biotechnology, selection and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	Faculty of Agriculture, University “Goce Delcev”-Stip, Department of Plant production			
5.	**Level (first, second, third cycle)**	Second cycle			
6.	**Academic year / semester**	First year/ second semester	7.	Number of ECTS credits	4
8.	**Professor**	Prof. Verica Ilieva, PhD			
9.	**Preconditions for course enrollment**	No			
10.	**Goals of the course programme**: The aim of course is to apply the acquired general knowledge of genetics and plant breeding in order to create new varieties and improving and maintaining of existing varieties of different field crops.				
11.	**Content of the course programme**: ***Lectures***: Selection of wheat, barley, oats, rye, rice, corn, soybeans, sunflower, poppy, alfalfa (meaning, origin, botanical origin and system of pollination; initial material for selection and usage, methods of selection, methods of selection and an examination of plant breeding, selection to improve individual properties, seed production). ***Practices***: Selection of wheat, barley, oats, rye, rice, corn, soybean, sunflower, poppy, alfalfa (laboratory methods for assessment of selected material, polish methods of assessment selected material).				
12.	**Methods of study**: Lectures, theoretical and laboratory exercises, consultations, e-learning, individual and team projects, e-learning, prepare lecture for exams.				
13.	**Total amount of available time**	120 hours			
14.	**Distribution of the available time**	2+1+1			
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training	2	
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	1	
16.	**Other forms of activities**	16.1.	Team projects	/	
		16.2.	Individual projects	0.5	
		16.3.	Individual study	0.5	
17.	**Forms of assessment**				
	17.1.	Exams (midterm exams, exam, electronic testing)	30		
	17.2.	Project activities (oral and written presentation)	50		
	17.3.	Other forms of studying activities	20		
18.	**Criteria for assessment (points / grade)**	up to 50 points	5 (five) (F)		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		

		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	**Condition for getting a signature and taking the final exam**	60% success level on all pre-exam activities	
20.	**Language in which classes are conducted**	Macedonian	
21.	**Method of monitoring the quality of instruction**	Self-evaluation, Periodic tests for students, Survey	

22. **Literature**

Compulsory literature

Ordinal No.	Author	Title	Publisher	Year
1.	Verica Ilieva Natalija Markova	Plant breeding and seed production - (no reviewed script)	University "Goce Delčev"- Štip, Faculty of Agriculture	2012
2.	Cvetanka Najcevska	Plant breeding and seed production - (practicum)	University "Ss. Cyril and Methodius, Skopje, Faculty of agriculture science and food	1997
3.	Martinčić, J., Kozumplik, V.	Plant breeding	Faculty of agriculture Zagreb	1996
4		Breeding of field crops	Blackwell, Ames, Iowa, USA.	2006

22.1.

22.2.

Additional literature

Ordinal No.	Author	Title	Publisher	Year
1.	Mladenovski, T.	Certification of seeds from plants for fiber production, oil and sugar	Bigos, Skopje	2007
2.	Mladenovski, T.	Production seeds from plants for feeding cattle	Alpha94, Skopje	2006
3.	Mladenovski, T.	Seed production	Publisher house Draganic, Beograd	2005

Appendix No.3	**Subject programme from first cycle studies**	
1.	Course title	Vine breeding
2.	Course code	2ZF212312
3.	Study programme**:**	Biotechnology, plant breeding and seed production

4.	Organizer of the study programme (faculty, institute, group)	University “Goce Delcev”- Stip, Faculty of agriculture /Department for viticulture and fruit growing			
5.	Degree (first cycle)	First cycle			
6.	Academic year / semester	first year/second semester	7.	Number of ECTS credits	4
8.	Professor	Prof. Violeta Dimovska, Ph.D			
9.	Preconditions for course enrollment	No			
10.	Goals of the course programme: Getting knowledge for the genetics characteristic and methods in selection and their usage in creating grape vine species and base.				
11.	Content of the course programme: 1. Introduction, definition, importance of the selection, background and gathered results. 2. Systematic of the grape vine. Family, class, subspecies, gender, subtype, type, sort, variety, clone. 3. Meaning (Importance) of the starting material for selection of substrates and varieties. 4. Introduction and acclimatization. 5. Propagation of the grapevine in the selection process. 6. Species of propagation. Flowering, pollination and fertilization. 7. Genetic basis in the selection of the grapevine. Genetic variability. 8. Inheritance of quantitative and qualitative properties, change of the number of chromosomes. 9. Spontaneous and induced mutations. 10. Methods in the selection. Individual and mass selection of foundations and varieties. 11. Clone selection of substrates and varieties (sorts).Methods of creating new varieties (sorts) and foundations. 12. Hybridization, clone selection and induced mutations.				
12.	Methods of study: Lectures, Laboratory exercises, e-learning, individual and team projects, consultations				
13.	Total amount of available time	120			
14.	Distribution of the available time	2 +1 +1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical training	2	
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork	/	
16.	Other forms of activities	16.1.	Team projects	1	
		16.2.	Individual projects	1	
		16.3.	Individual study	/	
17.	Forms of assessment				
	17.1.	Exams (midterm exams, exam, electronic testing)	30		
	17.2.	Project activities (oral and written presentation)	50		
	17.3.	Other forms of studying activities	20		
18.	Criteria for assessment (points / grade)	to 50 points	5(five) (F)		
		from 51 to 60 points	6(six) (E)		
		from 61 to 70 points	7(seven) (D)		
		from 71 to 80 points	8(eight) (C)		
		from 81 to 90 points	9(nine) (B)		
		from 91 to 100 points	10(ten) (A)		

19.	Condition for getting a signature and taking the final exam		/ 60% of term activities or minimum 42 points from 2 midterm exams, project activities and attending to lectures and discussions		
20.	Language in which classes are conducted		Macedonian		
21.	Method of monitoring the quality of instruction		Self-evaluation		
22.	Literature				
	22.1.	Compulsory literature			
		Ordinal No.	Author	Title	Publisher	Year
		1.	Miladin Soskic 1980	Breeding of fruits and vine	University in Belgrade	1994
		2.	I.Pejkic	Breeding of fruits and vine	University in Belgrade	1980
		3.	Dzevat Jarebica and Mirsad Kurtovic	Breednig of fruits and vine	EDIS-Saraevo	1997
	22.2.	Additional literature				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Edi Maletic, Jasminka Kontic, Ivan Pejic	Vitis vinifera (separate chapters)	School book, Zagreb	2008

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	Plant breeding in vegetable growing			
2.	**Course code**	2ZF212412			
3.	**Study programme:**	Biotechnology, plant breeding and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	University “GoceDelcev”- Stip, Faculty of Agriculture, Department for Plant production			
5.	**Level (first, second, third cycle)**	First cycle			
6.	**Academic year / semester**	First year/ second semester	7.	Number of ECTS credits	4
8.	**Instructor**	Prof. Dragica Spasova, PhD			
9.	**Preconditions for course enrollment**	/			
10.	**Goals of the course programme:** The course aims at applying acquired knowledge of plant genetics and selection in the selection for the creation of new varieties and hybrids in certain vegetable crops, propagation and maintenance through seed production per individual methods in separate vegetable crops.				
11.	**Content of the course programme:** **Content of the lectures:** 1.Methods for selection of natural and local populations: Autogamous, xenogamous. 2. Methods for selection of crops that have vegetative reproduction. 3. Methods for the creation of new genotypes in certain vegetables: bulbous vegetables. 4. Methods for the creation of new genotypes in cabbage vegetables. 5. Methods for the creation of new genotypes in cabbage vegetables. 6. root vegetables, fam. Apiaceae. 7. Root vegetables, fam. Brasicaceae and fam. Chenopodiaceae. 8. Fruit vegetables, fam. Solanaceae 9.Fruit vegetables, fam. Cucurbitaceae. 10. Procedure with				

	hybrid offspring. 11. Application of heterozys in certain vegetables. 12. Application of Biotechnology in the selection. **Content of the exercises**: 1. Significance of initial material for plant breeding and its collection 2. Preparation of seeds for sowing and sowing technique 3. Field selection of elite plants. 4. Laboratory analysis of selected plants. 5. Methods for plamt breeding (mass and individual plant breeding). 6. Individual plant breeding at autogamous and xenogamous crops 7. Individual plant breeding in crops with vegetative reproduction. 8. Application of methods for plant breeding at separate plants. 9. Hybridization as method for plant breeding; 10.Experimental field (technique of planning) 11. Setting of field trials 12.Statistical processing of the results.				
12.	**Methods of study**: Lectures, theoretical and practical exercises, consultations, making independent seminar work; learning home; exam preparatory classes and mid-term tests.				
13.	**Total amount of available time**		120 hours		
14.	**Distribution of the available time**		2+1+1		
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training		2
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork		1
16.	**Other forms of activities**	16.1.	Team projects		/
		16.2.	Individual projects		0,5
		16.3.	Individual study		0,5
17.	**Forms of assessment**				
	17.1.	Exams (midterm exams, exam, electronic testing)			30
		Successfully implemented lab / theoretical exercises			50
	17.2.	Project activities (oral and written presentation)			20
	17.3.	Other forms of studying activities			10
18.	**Criteria for assessment (points / grade)**		to 50 points		5(five) (F)
			from 51 to 60 points		6(six) (E)
			from 61 to 70 points		7(seven) (D)
			from 71 to 80 points		8(eight) (C)
			from 81 to 90 points		9(nine) (B)
			from 91 to 100 points		10(ten) (A)
19.	**Condition for getting a signature and taking the final exam**		/ 60% of term activities or minimum 42 points from 2 midterm exams, project activities and attending to lectures and discussions		
20.	**Language in which classes are conducted**		Macedonian		
21.	**Method of monitoring the quality of instruction**		Self-evaluation		

22.	**Literature**					
		Compulsory literature				
		Ordinal No.	Author	Title	Publisher	Year
	22.1.	1.	Verica Ilieva	Plant breeding, textbook	UGD-Stip	2012
		2.	Dragica Spasova	Plant breeding and seed production – Peer reviewed script	UGD - Stip	2012

		3.	Beljo, J.	Oplemenjivanje bilja	Agronomski fakultet – Mostar	2006
		4.	Cvetanka Naj;evska	Селекција на растенијата со семепроизводство (практикум)	УКИМ, Земјоделски факултет. Скопје	1997
	22.2.	Additional literature				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Мартинčић, J., Козумплик, В.	Оплемењивање биља, Загреб.	Poljoprivredni fakultet -Osijek, Agronomski fakultet - Zagreb	1996
		2.	Marić, M. Miodrag	Semenarstvo	Izdavačka kuća DRAGANIĆ, Beograd	2005
		3.				

Appendix No.3	**Syllabus for the first, second and third cycle of study**				
1.	**Course title**	Special plant breeding			
2.	**Course code**	2ZF212512			
3.	**Study programme:**	Biotechnology, plant breeding and seed production			
4.	**Organizer of the study programme (faculty, institute, group)**	University “GoceDelcev”- Stip, Faculty of Agriculture, Department for Plant production			
5.	**Level (first, second, third cycle)**	First cycle			
6.	**Academic year / semester**	First year/ second semester	7.	Number of ECTS credits	4
8.	**Instructor**	Prof. Dragica Spasova, PhD			
9.	**Preconditions for course enrollment**	/			
10.	**Goals of the course programme:** The course aim is to familiarize students with the principles of seed production in separate cultures: cereal crops, industrial crops, forage crops.				
11.	**Content of the course programme:** **Content of the lectures:** 1. Seed production in cereals (True cereals) 2. Seed production in cereals (millet cereals) 3. General characteristics and selection of varieties for cultivation 4. Seed production in leguminous grain species and stews (soybean, peas, beans) 5. General characteristics and selection varieties to plant 6. Seed production in industrial crops (sunflower, oilseed rape, sugar beet), 7. Characteristics and selection of varieties 8. Seed production in perennial forage crops, fam. Fabaceae (alfalfa, sainfoin) 9. Seed production in annual species of fam. Fabaceae (vetches); 10. Seed production in annual species of fam. Poaceae; 11. Seed production in the perennial species of fam. Poaceae; 12. Characteristics and selection of varieties for cultivation. **Content of the exercises**: 1. Visiting the plots with seed crops of cereals (real grains) 2. Introduction to the details of seed production of real grains 3. Visiting the plots with seed crops of cereals (millet cereals) 4. Introduction to the details of seed production of millet cereals 5. Visiting the plots with soybeans, peas and beans; 6 Introduction to the details of the seed production of stews 7. Visiting the plots with perennial forage crops 8.				

	Introduction to the details of the seed production of perennial forage crops, 9. Visiting the plots with annual forage crops 10. Introduction to the details of the seed production of annual forage crops 11. Visiting of finishing centres for certain crops, 12. Visiting finishing centres for separate cultures.				
12.	**Methods of study**: Lectures, theoretical and practical exercises, consultations, making independent seminar work; learning home; exam preparatory classes and mid-term tests.				
13.	**Total amount of available time**		120 hours		
14.	**Distribution of the available time**		2+1+1		
15.	**Forms of teaching activities**	15.1.	Lectures - theoretical training		2
		15.2.	Exercises (laboratory, auditory), workshops, outreach and teamwork		1
16.	**Other forms of activities**	16.1.	Team projects		/
		16.2.	Individual projects		0,5
		16.3.	Individual study		0,5
17.	**Forms of assessment**				
	17.1.	Exams (midterm exams, exam, electronic testing)			30
		Successfully implemented lab / theoretical exercises			50
	17.2.	Project activities (oral and written presentation)			20
	17.3.	Other forms of studying activities			
18.	**Criteria for assessment (points / grade)**		to 50 points		5(five) (F)
			from 51 to 60 points		6(six) (E)
			from 61 to 70 points		7(seven) (D)
			from 71 to 80 points		8(eight) (C)
			from 81 to 90 points		9(nine) (B)
			from 91 to 100 points		10(ten) (A)
19.	**Condition for getting a signature and taking the final exam**		/ 60% of term activities or minimum 42 points from 2 midterm exams, project activities and attending to lectures and discussions		
20.	**Language in which classes are conducted**		Macedonian		
21.	**Method of monitoring the quality of instruction**		Self-evaluation		

22.	**Literature**					
	22.1.	Compulsory literature				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Miodrag M. Marić	Semenarstvo	Izdavačka kuća DRAGANIĆ, Beograd	2005
		2.	Grupa autora	Tehnologija proizvodnje semena	Društvo selekcionara I semenara Srbije, Janus, Beograd	1996
		3.	Gatarić Đ.	Sjemenarstvo	Poljoprivredni fakultet Banja	1999

					Luka	
		4.	Lekić, S.	Zivotna sposobnost semena	Društvo selekcionara I semenara Srbije, Janus, Beograd	2003
	22.2.	Additional literature				
		Ordinal No.	Author	Title	Publisher	Year
		1.	Бабамов, Л.	Семепроизводство	Скопје	1971
		2.				
		3.				