IMPLEMENTATION PLAN

2022./2023.

POSTGRADUATE DOCTORAL STUDY
"AGRICULTURAL SCIENCES"

Josip Juraj Strossmayer University of Osijek

Faculty of Agrobiotechnical Sciences Osijek

Postgraduate doctoral study in AGRICULTURAL SCIENCES, major in AGROECONOMICS

Head of studies: prof. dr. sc. Krunoslav Zmaic

Secretary of studies: prof. dr. sc. Tihana Sudarić

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. Ph.D. sc Zdravko Tolušić	Methods and sources of economic and production theories	M	6	60	Lectures	15	Prof. dr. sc. Zdravko Tolušić
						10	Prof. dr. sc. Ruzica Lončarić
						5	Prof. dr. sc. Igor Kralik
					Seminars	10	Prof. dr. sc. Zdravko Tolušić
						5	Prof. dr. sc. Ruzica Lončarić
						15	Prof. dr. sc. Igor Kralik
					Exercises	-	
Prof. dr. sc. Krunoslav Zmaic	Instruments and policy of agricultural and rural development	M	6	60	Lectures	15	Prof. dr. sc. Krunoslav Zmaic
						10	Prof. dr. sc. Krunoslav Zmaic
					Seminars	25	Prof. dr. sc. Krunoslav Zmaic
						10	Prof. dr. sc. Krunoslav Zmaic
					Exercises	-	
Assoc. prof. dr. sc. Nenad Šuvak	Mathematical-statistical models in agro-economics	O	4	40	Lectures	20	Assoc. prof. dr. sc. Nenad Šuvak
					Seminars	-	
					Exercises	20	Assoc. prof. dr. sc. Nenad Šuvak
Prof. dr. sc. Antun Šundalić	History of agriculture and rural sociology	O	4	40	Lectures	20	Prof. dr. sc. Antun Šundalić
					Seminars	20	Prof. dr. sc. Antun Šundalić
					Exercises	-	
Prof. dr. sc. Krunoslav Zmaic	Economics of agro-complex	O	4	40	Lectures	10	Prof. dr. sc. Krunoslav Zmaic

						5	Prof. dr. sc. Tihana Sudarić
						5	Assoc. prof. dr. sc. Snjezana Tolić
					Seminars	10	Prof. dr. sc. Krunoslav Zmaic
						5	Prof. dr. sc. Tihana Sudarić
						5	Assoc. prof. dr. sc. Snjezana Tolić
					Exercises	-	
Prof. dr. sc. Jadranka Deže	Farm management	0	4	40	Lectures	20	Prof. dr. sc. Jadranka Deže
					Seminars	10	Prof. dr. sc. Ljubica Ranogajec
					Exercises	10	Prof. dr. sc. Jadranka Deže
Prof. dr. sc. Jadranka Deže	Entrepreneurship in agriculture	0	4	40	Lectures	10	Prof. dr. sc. Jadranka Deže
						5	Prof. dr. sc. Jadranka Deže
					Seminars	15	Prof. dr. sc. Jadranka Deže
						10	Prof. dr. sc. Jadranka Deže
					Exercises	-	
Prof. dr. sc. Zdravko Tolušić	Market of agricultural products	0	4	40	Lectures	10	Prof. dr. sc. Zdravko Tolušić
						10	Prof. dr. sc. Ruzica Lončarić
					Seminars	10	Prof. dr. sc. Zdravko Tolušić
						10	Prof. dr. sc. Ruzica Lončarić
					Exercises	-	
Prof. dr. sc. Ivan Štefanić	Financial management in agriculture	0	4	40	Lectures	20	Prof. dr. sc. Ivan Štefanić
					Seminars	20	Prof. dr. sc. Ivan Štefanić
					Exercises	-	
Prof. dr. sc. Ljubica Ranogajec	Entrepreneurial Accounting	0	4	40	Lectures	15	Prof. dr. sc. Ljubica Ranogajec
					Seminars	15	Prof. dr. sc. Ljubica Ranogajec
					Exercises	10	Prof. dr. sc. Ljubica Ranogajec
Prof. dr. sc. Mirna Leko Šimić	Food Marketing	0	4	40	Lectures	20	Prof. dr. sc. Mirna Leko Šimić
					Seminars	20	Prof. dr. sc. Mirna Leko Šimić
					Exercises	-	
Prof. dr. sc. Tihana Sudarić	Economics of national resources	0	4	40	Lectures	10	Prof. dr. sc. Tihana Sudarić
						10	Prof. dr. sc. Krunoslav Zmaic
					Seminars	20	Prof. dr. sc. Tihana Sudarić
					Exercises	-	

Postgraduate doctoral study in AGRICULTURAL SCIENCES, AGROCHEMISTRY

Head of studies: prof. dr. sc. Gabriella Kanizai Saric

Secretary of studies: prof. dr. sc. Brigita Popović

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. dr. sc. Vesna Vukadinović	Land resources	M	6	60	Lectures	15	Prof. dr. sc. Vesna Vukadinović
						15	Prof. dr. sc. Irena Jug
						15	Prof. dr. sc. Zdenko Lončarić
					Seminars	5	Prof. dr. sc. Vesna Vukadinović
						5	Prof. dr. sc. Irena Jug
						5	Prof. dr. sc. Zdenko Lončarić
					Exercises	-	
Prof. dr. sc. Gabriella Kanizai Saric	Soil biology	M	6	60	Lectures	40	Prof. dr. sc. Gabriella Kanizai Saric
						10	Prof. dr. sc. Gabriella Kanizai Saric
					Seminars	10	Prof. dr. sc. Gabriella Kanizai Saric
					Exercises	-	
Prof. dr. sc. Zdenko Lončarić	Fertilizers and fertilization	M	6	60	Lectures	20	Assoc. prof. dr. sc. Boris Đurđević
						10	Assoc. prof. dr. sc. Brigita Popović
						20	Prof. dr. sc. Zdenko Lončarić
					Seminars	10	Prof. dr. sc. Brigita Popović
					Exercises	-	
Prof. dr. sc. Tihana Teklić	Plant Physiology	M	6	60	Lectures	15	Prof. dr. sc. Tihana Teklić
						15	Assoc. prof. dr. sc. Miroslav Lisjak

						15	Prof. dr. sc. Tihana Teklić
					Seminars	15	Assoc. prof. dr. sc. Miroslav Lisjak
					Exercises	-	
Prof. dr. sc. Domagoj Rasti	Field soil research	0	3	30	Lectures	10	Prof. dr. sc. Domagoj Rasti
					Seminars	10	Prof. dr. sc. Domagoj Rasti
					Exercises	10	Asst. Ph.D. sc. Vladimir Zebec
Prof. dr. sc. Zdenko Lončarić	Modelling of Agroecosystems	0	3	30	Lectures	15	Prof. dr. sc. Zdenko Lončarić
					Seminars	10	Prof. dr. sc. Zdenko Lončarić
					Exercises	5	
Prof. dr. sc. Brigita Popović	Fertilization in organic production	0	3	30	Lectures	20	Prof. dr. sc. Brigita Popović
					Seminars	10	Prof. dr. sc. Brigita Popović
					Exercises	-	
Prof. dr. sc. Lepomir Coga	Nutrition of woody crops	0	3	30	Lectures	15	Prof. dr. sc. Lepomir Coga
						15	Assoc. prof. dr. sc. Boris Đurđević
					Seminars	-	
					Exercises	-	
Assoc. prof. dr. sc. Boris Đurđević	Determining Fertilizer Needs	0	3	30	Lectures	20	Assoc. prof. dr. sc. Boris Đurđević
						10	Prof. dr. sc. Irena Jug
					Seminars	-	
					Exercises	-	
Assoc. prof. dr. sc. Tomislav Vinković	Fertilization in Greenhouses	0	3	30	Lectures	10	Assoc. prof. dr. sc. Tomislav Vinković
					Seminars	10	Assoc. prof. dr. sc. Tomislav Vinković
					Exercises	10	Assoc. prof. dr. sc. Tomislav Vinković
Assoc. prof. dr. sc. Drago Bešlo	The Quality of Plant Products	0	3	30	Lectures	10	Assoc. prof. dr. sc. Drago Bešlo
						7	Prof. dr. sc. Gordana Bukvić
						6	Assoc. prof. dr. sc. Drago Bešlo
					Seminars	7	Prof. dr. sc. Tihana Teklić
					Exercises	-	

Postgraduate doctoral study in AGRICULTURAL SCIENCES, majoring in ANIMAL FEEDING AND FEED TECHNOLOGY

Head of studies: prof. dr. sc. Matija Domaćinović

Secretary of studies: prof. dr. sc. Zvonimir Steiner

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. dr. sc. Marcela Šperanda	Physiology	M	3	30	Lectures	20	Prof. dr. sc. Marcela Šperanda
					Seminars	5	Prof. dr. sc. Marcela Šperanda
					Exercises	5	Prof. dr. sc. Marcela Šperanda
Assoc. prof. dr. sc. Drago Bešlo	Selected Topics in Biochemistry	M	3	30	Lectures	30	Assoc. prof. dr. sc. Drago Bešlo
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Pero Mijić	Introduction to scientific work	M	3	30	Lectures	30	Prof. dr. sc. Pero Mijić
					Seminars	-	
					Exercises	-	
Assoc. prof. dr. sc. Andrijana Rebekić	Biometrics in Zootechnics	M	3	30	Lectures	20	Assoc. prof. dr. sc. Andrijana Rebekić
					Seminars	-	
					Exercises	10	Assoc. prof. dr. sc. Andrijana Rebekić
Prof. dr. sc. Matija Domačinović	General Feeding	M	6	60	Lectures	30	Prof. dr. sc. Matija Domaćinović
						10	Prof. dr. sc. Zvonko Antunović
					Seminars	5	Assoc. prof. dr. sc. Ivana Prakatur
					Exercises	15	Assoc. prof. dr. sc. Ivana Prakatur
Prof. dr. sc. Gordana Bukvić	Forage Crops	O	4	40	Lectures	30	Prof. dr. sc. Gordana Bukvić
					Seminars	-	

					Exercises	10	Assoc. prof. dr. sc. Ranko Gantner
Prof. dr. sc. Zvonimir Steiner	Special nutrition I - herbivores	0	4	40	Lectures	20	Prof. dr. sc. Zvonimir Steiner
						5	Prof. dr. sc. Zvonko Antunović
					Seminars	-	
					Exercises	10	Prof. dr. sc. Zvonimir Steiner
						5	Prof. dr. sc. Zvonko Antunović
Prof. dr. sc. Matija Domačinović	Special nutrition II - omnivores	0	4	40	Lectures	20	Prof. dr. sc. Matija Domaćinović
						8	Prof. dr. sc. Anđelko Opačak
						4	Asst. Ph.D. sc. Danijela Samac
					Seminars	-	
					Exercises	8	Prof. dr. sc. Zvonimir Steiner
Prof. dr. sc. Krunoslav Zmaic	Economics in livestock production	0	4	40	Lectures	30	Prof. dr. sc. Krunoslav Zmaic
					Seminars	10	Prof. dr. sc. Jadranka Deže
					Exercises	-	
Assoc. prof. dr. sc. Mislav Đidara	Feeding Pathology	0	4	40	Lectures	20	Assoc. prof. dr. sc. Mislav Đidara
					Seminars	10	Assoc. prof. dr. sc. Mislav Đidara
					Exercises	10	Assoc. prof. dr. sc. Mislav Đidara
Prof. dr. sc. Matija Domačinović	Technology of Feed Mixtures Production	0	4	40	Lectures	30	Prof. dr. sc. Matija Domaćinović
					Seminars	5	Assoc. prof. dr. sc. Ivana Prakatur
					Exercises	5	Assoc. prof. dr. sc. Ivana Prakatur
Prof. dr. sc. Davor Kralik	Facilities and equipment in animal husbandry	0	4	40	Lectures	10	Prof. dr. sc. Davor Kralik
						10	Prof. dr. sc. Davor Kralik
					Seminars	-	
					Exercises	20	Prof. dr. sc. Davor Kralik
Prof. dr. sc. Marcela Šperanda	Micropopulation in Digestive System of the Domestic Animals	0	4	40	Lectures	30	Prof. dr. sc. Marcela Šperanda
					Seminars	-	
					Exercises	10	Prof. dr. sc. Suzana Kristek

Post-graduate doctoral study in AGRICULTURAL SCIENCES, major in HUNTING AND CINELOGY

Head of studies: prof. dr. sc. Tihomir Florijančić

Secretary of studies: Assoc. Prof. dr. sc. Ivica Boskovic

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. dr. sc. Tihomir Florijančić	Principles of breeding and game protection	M	6	60	Lectures	30	Prof. dr. sc. Tihomir Florijančić
					Seminars	10	Prof. dr. sc. Tihomir Florijančić
					Exercises	20	Assoc. prof. dr. sc. Ivica Boskovic
Assoc. prof. dr. sc. Ivica Boskovic	Cynological zoology	M	3	30	Lectures	15	Assoc. prof. dr. sc. Ivica Boskovic
					Seminars	5	Assoc. prof. dr. sc. Ivica Boskovic
					Exercises	10	Assoc. prof. dr. sc. Ivica Boskovic
Prof. dr. sc. Pero Mijić	Introduction to scientific work	O	3	30	Lectures	10	Prof. dr. sc. Pero Mijić
					Seminars	10	Prof. dr. sc. Pero Mijić
					Exercises	10	Prof. dr. sc. Pero Mijić
Assoc. prof. dr. sc. Andrijana Rebekić	Selected statistical mathematical models in biology	O	3	30	Lectures	15	Assoc. prof. dr. sc. Andrijana Rebekić
					Seminars	5	Assoc. prof. dr. sc. Andrijana Rebekić
					Exercises	10	Assoc. prof. dr. sc. Andrijana Rebekić
Assoc. prof. dr. sc. Drago Bešlo	Selected topics from biochemistry and physiology	O	3	30	Lectures	10	Assoc. prof. dr. sc. Drago Bešlo
						10	Prof. dr. sc. Marcela Šperanda

					Seminars	5	Assoc. prof. dr. sc. Drago Bešlo
					Exercises	5	Prof. dr. sc. Marcela Šperanda
Prof. dr. sc. Siniša Ozimec	Botany and Phytocoenology	0	3	30	Lectures	15	Prof. dr. sc. Siniša Ozimec
					Seminars	5	Prof. dr. sc. Siniša Ozimec
					Exercises	10	Prof. dr. sc. Siniša Ozimec
Assoc. prof. dr. sc. Ivica Boskovic	Breeding, diseases, and training of dogs	0	3	30	Lectures	10	Assoc. prof. dr. sc. Ivica Boskovic
						5	Assoc. prof. dr. sc. Ivica Boskovic
					Seminars	5	Prof. dr. sc. Tihomir Florijančić
					Exercises	10	Assoc. prof. dr. sc. Ivica Boskovic
Prof. dr. sc. Anđelko Opačak	Ecology of Ichthyophagous Feathered Game Animals	0	3	30	Lectures	15	Prof. dr. sc. Anđelko Opačak
					Seminars	5	Prof. dr. sc. Anđelko Opačak
					Exercises	10	Prof. dr. sc. Tihomir Florijančić
Assoc. prof. dr. sc. Ivona Djurkin Kušec	Technology of Game Meat and Meat Products	0	3	30	Lectures	20	Assoc. prof. dr. sc. Ivona Djurkin Kušec
					Seminars	5	Assoc. prof. dr. sc. Ivona Djurkin Kušec
					Exercises	5	Assoc. prof. dr. sc. Ivona Djurkin Kušec
Prof. dr. sc. Marcela Šperanda	Canine Reproduction	0	3	30	Lectures	10	Prof. dr. sc. Marcela Šperanda
						10	Assoc. prof. dr. sc. Ivica Boskovic
					Seminars	5	Prof. dr. sc. Marcela Šperanda
					Exercises	5	Assoc. prof. dr. sc. Ivica Boskovic
Assoc. prof. dr. sc. Ivica Boskovic	Dog nutrition	0	3	30	Lectures	15	Assoc. prof. dr. sc. Ivica Boskovic
					Seminars	10	Assoc. prof. dr. sc. Ivica Boskovic
					Exercises	5	Assoc. prof. dr. sc. Ivica Boskovic
Prof. dr. sc. Sonja Petrović	Cytogenetics	0	2	20	Lectures	10	Prof. dr. sc. Sonja Petrović
					Seminars	5	Prof. dr. sc. Sonja Petrović
					Exercises	5	Prof. dr. sc. Sonja Petrović
Prof. dr. sc. Tihomir Florijančić	Diseases of Game Animals	0	3	30	Lectures	10	Prof. dr. sc. Tihomir Florijančić
						10	Assoc. prof. dr. sc. Mislav Đidara
					Seminars	5	Prof. dr. sc. Tihomir Florijančić
					Exercises	5	Prof. dr. sc. Tihomir Florijančić

Prof. Ph.D. Tihomir Florijančić	Management in hunting	0	3	30	Lectures	15	Prof. Ph.D. Tihomir Florijančić
					Seminars	5	Assoc. Prof. Ph.D. Ivica Boskovic
					Exercises	10	Assoc. Prof. Ph.D. Ivica Boskovic
Prof. Ph.D. Mladen Jurišić	Inventory and arrangement of hunting grounds	0	3	30	Lectures	5	Prof. Ph.D. Mladen Jurišić
					Lectures	5	Assoc. Prof. Ph.D. Ivan Plaščak
					Seminars	5	Prof. dr. sc. Mladen Jurišić
					Seminars	5	Assoc. prof. dr. sc. Ivan Plaščak
					Exercises	5	Prof. dr. sc. Mladen Jurišić
					Exercises	5	Assoc. prof. dr. sc. Ivan Plaščak
Assoc. prof. dr. sc. Mislav Đidara	Hygienic and sanitary measures in the hunting grounds	0	3	30	Lectures	15	Assoc. prof. dr. sc. Mislav Đidara
					Seminars	5	Assoc. prof. dr. sc. Mislav Đidara
					Exercises	10	Assoc. prof. dr. sc. Mislav Đidara
Prof. dr. sc. Tihomir Florijančić	Hunting Legislation	0	3	30	Lectures	5	Prof. dr. sc. Tihomir Florijančić
						5	Prof. dr. sc. Siniša Ozimec
					Seminars	10	Assoc. prof. dr. sc. Ivica Boskovic
					Exercises	10	Assoc. prof. dr. sc. Ivica Boskovic

Postgraduate doctoral study in AGRICULTURAL SCIENCES, Major: PLANT BREEDING AND SEED PRODUCTION

Head of studies: prof. dr. sc. Sonja Vila

Secretary of studies: prof. dr. sc. Vlado Guberac

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. dr. sc. Sonja Petrović	Quantitative genetics	M	5	50	Lectures	30	prof. dr. sc. Sonja Petrović
					Seminars	20	Assoc. prof. dr. sc. Andrijana Rebekić
					Exercises	-	
Prof. dr. sc. Georg Drezner	Population genetics II	M	5	50	Lectures	15	Prof. dr. sc. Georg Drezner
					Lectures	15	Prof. dr. sc. Zvonimir Zdunić
					Seminars	20	Prof. dr. sc. Georg Drezner
					Exercises	-	
Prof. dr. sc. Sonja Vila	Plant Breeding	M	5	50	Lectures	10	Prof. dr. sc. Sonja Vila
					Seminars	30	Prof. dr. sc. Sonja Vila
					Exercises	10	Prof. dr. sc. Sonja Vila
Prof. dr. sc. Vlado Guberac	Methods of seed production	M	5	50	Lectures	15	Prof. dr. sc. Vlado Guberac
						5	Prof. dr. sc. Sonja Vila
					Seminars	20	Prof. dr. sc. Vlado Guberac
						10	Prof. dr. sc. Sonja Vila
					Exercises	-	
Prof. dr. sc. Tihana Teklić	Seed Physiology	O	4	40	Lectures	10	Prof. dr. sc. Tihana Teklić
					Seminars	15	Prof. dr. sc. Tihana Teklić
					Exercises	15	Asst. Ph.D. sc. Dejan Agić
Prof. dr. sc. Vlado Guberac	Production of Cereal Seeds	O	4	40	Lectures	40	Prof. dr. sc. Vlado Guberac

					Seminars	-	
					Exercises	-	
Prof. dr. sc. Sonja Vila	Plant Genetic Resources	0	4	40	Lectures	10	Prof. dr. sc. Vlado Guberac
						5	Prof. dr. sc. Sonja Vila
					Seminars	25	Prof. dr. sc. Sonja Petrović
					Exercises	-	
Prof. dr. sc. Sonja Vila	Breeding of Small Grain Cereal Crops	0	4	40	Lectures	20	Prof. dr. sc. Sonja Vila
					Seminars	20	Prof. dr. sc. Vlado Guberac
					Exercises	-	
Prof. dr. sc. Sonja Vila	Maize Breeding	0	4	40	Lectures	10	Prof. dr. sc. Sonja Vila
					Lectures	10	Prof. dr. sc. Mirto Rasti
					Lectures	20	Prof. dr. sc. Zvonimir Zdunić
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Manda Antunović	Breeding of industrial plants	0	4	40	Lectures	15	Prof. dr. sc. Manda Antunović
					Lectures	5	Asst. Ph.D. sc. Ivan Varga
					Seminars	10	Prof. dr. sc. Manda Antunović
					Seminars	10	Asst. Ph.D. sc. Ivan Varga
					Exercises	-	
Prof. dr. sc. Gordana Bukvić	Breeding Forage Crops	0	4	40	Lectures	15	Prof. dr. sc. Gordana Bukvić
					Lectures	15	Assoc. prof. dr. sc. Ranko Gantner
					Lectures	10	Asst. Ph.D. sc. Sonja Grljušić
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Manda Antunović	Seed Production of Industrial Plants	0	4	40	Lectures	20	Prof. dr. sc. Manda Antunović
						10	Asst. Ph.D. sc. Ivan Varga
					Seminars	5	Prof. dr. sc. Manda Antunović
						5	Asst. Ph.D. sc. Ivan Varga
					Exercises	-	
Prof. dr. sc. Gordana Bukvić	Seed Production of Forage Crops	0	4	40	Lectures	30	Prof. dr. sc. Gordana Bukvić
						10	Assoc. prof. dr. sc. Ranko Gantner
					Seminars	-	
					Exercises	-	

Assoc. prof. dr. sc. Tomislav Vinkovic	Seed Production Technology in Horticulture	0	4	40	Lectures	10	Assoc. prof. dr. sc. Tomislav Vinković
					Seminars	20	Assoc. prof. dr. sc. Tomislav Vinković
					Exercises	10	Assoc. prof. dr. sc. Tomislav Vinković
Prof. dr. sc. Jasna Šoštarić	Irrigation of Seed Crops	0	4	40	Lectures	40	Prof. dr. sc. Jasna Šoštarić
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Mirjana Brmež	Quarantine pests and diseases	0	4	40	Lectures	20	Prof. dr. sc. Mirjana Brmež
						10	Prof. dr. sc. Karolina Vrandečić
						10	Prof. dr. sc. Jasenka Cosic
					Seminars	-	
					Exercises	-	
Assoc. prof. dr. sc. Boris Đurđević	Fertilization	0	4	40	Lectures	30	Assoc. Prof. Ph.D. Boris Đurđević
					Seminars	10	Assoc. Prof. Ph.D. Boris Đurđević
					Exercises	-	
Prof. dr. sc. Darko Kiš	Seed processing and storage	0	4	40	Lectures	10	Prof. Ph.D. Gordana Bukvić
						10	Prof. Ph.D. Darko Kiš
						10	Prof. Ph.D. Vlatka Rozman
					Seminars	10	Prof. Ph.D. Gordana Bukvić
					Exercises	-	
Prof. dr. sc. Pero Mijić	Introduction to scientific work	0	4	40	Lectures	10	Prof. dr. sc. Pero Mijić
					Seminars	20	Prof. dr. sc. Pero Mijić
					Exercises	10	Prof. dr. sc. Pero Mijić
Prof. dr. sc. Drazen Horvat	Biometrics	0	4	40	Lectures	30	Prof. dr. sc. Drazen Horvat
						10	Prof. dr. sc. Domagoj Šimić
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Zdravko Tolušić	Marketing and market in seed production	0	4	40	Lectures	20	Prof. dr. sc. Zdravko Tolušić
					Seminars	20	Prof. dr. sc. Zdravko Tolušić
					Exercises	-	

Prof. dr. sc. Darko Kiš	Technology in the production and processing of seeds	0	4	40	Lectures	20	Prof. dr. sc. Darko Kiš
					Seminars	20	Prof. dr. sc. Darko Kiš
					Exercises	-	
Assoc. prof. dr. sc. Drago Bešlo	Biochemistry and molecular biology	0	5	50	Lectures	50	Assoc. prof. dr. sc. Drago Bešlo
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Zdenko Lončarić	Heavy metals in agroecosystem	0	5	50	Lectures	25	Prof. dr. sc. Zdenko Lončarić
						15	Prof. dr. sc. Sonja Vila
					Seminars	5	Prof. dr. sc. Zdenko Lončarić
						5	Prof. dr. sc. Sonja Vila
					Exercises	-	

Postgraduate doctoral study in AGRICULTURAL SCIENCES, Major in ANIMAL HUSBANDRY

Head of studies: prof. dr. sc. Goran Kušec

Secretary of studies: Assoc. Prof. dr. sc. Ivona Djurkin Kušec

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Assoc. prof. dr. sc. Mislav Đidara	Physiology-selected chapters	M	3	30	Lectures	10	Assoc. prof. dr. sc. Mislav Đidara
					Lectures	10	Prof. dr. sc. Marcela Šperanda
					Seminars	5	Prof. dr. sc. Marcela Šperanda
					Exercises	5	Assoc. prof. dr. sc. Mislav Đidara
Prof. dr. sc. Pero Mijić	Introduction to scientific work	M	3	30	Lectures	10	Prof. dr. sc. Pero Mijić
					Seminars	10	Prof. dr. sc. Pero Mijić
					Exercises	10	Prof. dr. sc. Pero Mijić
Prof. dr. sc. Gordana Kralik, Prof. Emer.	Biometrics in Zootechnics	M	3	30	Lectures	20	Prof. dr. sc. Gordana Kralik, prof. emer.
					Seminars	-	
					Exercises	10	Prof. dr. sc. Zoran Skrtić
Assoc. prof. dr. sc. Drago Bešlo	Biochemistry - selected chapters	M	3	30	Lectures	29	Assoc. prof. dr. sc. Drago Bešlo
					Seminars	1	Assoc. prof. dr. sc. Drago Bešlo
					Exercises	-	
Prof. dr. sc. Vesna Gantner	Current Procedures in Animal Selection	O	3	30	Lectures	10	Prof. Ph.D.Sc. Vesna Gantner
					Lectures	10	Prof. Ph.D.Sc. Vesna Gantner
					Seminars	10	Prof. Ph.D.Sc. Vesna Gantner
					Exercises	-	
Assoc. prof. dr. sc. Mislav Đidara	Animal Health Protection and Animal Welfare	O	3	30	Lectures	20	Assoc. prof. dr. sc. Mislav Đidara
					Seminars	5	Assoc. prof. dr. sc. Mislav Đidara

					Exercises	5	Assoc. prof. dr. sc. Mislav Đidara
Assoc. prof. dr. sc. Nikola Raguž	Methods for Breeding Value Estimation	0	3	30	Lectures	20	Assoc. prof. dr. sc. Nikola Raguž
					Seminars	10	Assoc. prof. dr. sc. Nikola Raguž
					Exercises	-	
Prof. dr. sc. Marcela Šperanda	Endocrinology and Reproduction of Domestic Animals	0	3	30	Lectures	10	Assoc. prof. dr. sc. Mislav Đidara
						10	Prof. dr. sc. Marcela Šperanda
					Seminars	5	Assoc. prof. dr. sc. Mislav Đidara
						5	Prof. dr. sc. Marcela Šperanda
					Exercises	-	
Prof. dr. sc. Pero Mijić	Cattle Production – Selected Chapters	0	3	30	Lectures	10	Prof. dr. sc. Pero Mijić
						5	Assoc. prof. dr. sc. Tina Bobić
					Seminars	10	Prof. dr. sc. Pero Mijić
					Exercises	5	Prof. dr. sc. Pero Mijić
Prof. dr. sc. Gordana Kralik, Prof. emer.	Pig farming - selected chapters	0	3	30	Lectures	15	Prof. dr. sc. Gordana Kralik, prof. emer.
					Seminars	10	Assoc. prof. dr. sc. Vladimir Margeta
					Exercises	5	Assoc. prof. dr. sc. Vladimir Margeta
Prof. dr. sc. Gordana Kralik, Prof. emer.	Poultry-selected chapters	0	3	30	Lectures	15	Prof. dr. sc. Gordana Kralik, prof. emer.
					Seminars	5	Prof. dr. sc. Zoran Skrtić
						5	Prof. dr. sc. Zlata Kralik
					Exercises	2.5	Prof. dr. sc. Zoran Skrtić
						2.5	Prof. dr. sc. Zlata Kralik
Prof. dr. sc. Bell Antunović	Sheep and goat breeding- selected chapters	0	3	30	Lectures	15	Prof. dr. sc. Zvonko Antunović
					Seminars	10	Prof. dr. sc. Zvonko Antunović
					Exercises	5	Assoc. prof. dr. sc. Josip Novoseelec
Prof. dr. sc. Mirjana Baban	Horse breeding - selected chapters	0	3	30	Lectures	10	Prof. dr. sc. Mirjana Baban
					Seminars	10	Prof. dr. sc. Mirjana Baban
					Exercises	10	Prof. dr. sc. Mirjana Baban
Prof. dr. sc. Goran Kušec	Quality of animal products (meat	0	3	30	Lectures	8	Prof. dr. sc. Goran Kušec
						8	Prof. dr. sc. Pero Mijić

	and milk)				Seminars	8	Assoc. prof. dr. sc. Ivona Djurkin Kušec
					Exercises	6	Prof. dr. sc. Goran Kušec
Prof. dr. sc. Goran Kušec	Growth and development of domestic animals	O	3	30	Lectures	10	Prof. dr. sc. Goran Kušec
					Seminars	10	Prof. dr. sc. Goran Kušec
					Exercises	10	Assoc. prof. dr. sc. Ivona Đurkin Kušec
Assoc. prof. dr. sc. Ivona Đurkin Kušec	Molecular Methods in Animal Science	O	3	30	Lectures	10	Assoc. prof. dr. sc. Ivona Đurkin Kušec
					Seminars	10	Assoc. prof. dr. sc. Ivona Đurkin Kušec
					Exercises	10	Prof. dr. sc. Goran Kušec
Assoc. prof. dr. sc. Mislav Đidara	Food Quality and Safety Management	O	2	20	Lectures	15	Assoc. prof. dr. sc. Mislav Đidara
					Seminars	5	Assoc. prof. dr. sc. Mislav Đidara
					Exercises	-	
Prof. dr. sc. Daniela Čačić-Kenjeric	Animal products in human nutrition	O	2	20	Lectures	16	Prof. dr. sc. Daniela Čačić-Kenjerić
					Seminars	-	
					Exercises	4	Prof. dr. sc. Daniela Čačić-Kenjerić
Prof. dr. sc. Pero Mijić	Farm Animal Ethology	O	3	30	Lectures	5	Prof. dr. sc. Pero Mijić
						5	Assoc. prof. dr. sc. Tina Bobić
					Seminars	10	Prof. dr. sc. Pero Mijić
					Exercises	10	Prof. dr. sc. Pero Mijić

Postgraduate doctoral study in AGRICULTURAL SCIENCES, TECHNICAL SYSTEMS IN AGRICULTURE

Head of studies: Prof. Dr. Sc. Luka Šumanovac

Secretary of Studies: Prof. Ph.D. Mladen Jurišić

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. dr. sc. Mladen Jurišić	Methods of scientific research of technical systems in agriculture	M	6	60	Lectures	25	Prof. dr. sc. Mladen Jurišić
					Seminars	35	Prof. dr. sc. Mladen Jurišić
					Exercises	-	
Prof. dr. sc. Tomislav Jurić	Technical systems in an agroecological environment	M	6	60	Lectures	10	Prof. dr. sc. Tomislav Jurić
						10	Prof. dr. sc. Đuro Banaj
						5	Prof. dr. sc. Davor Kralik
					Seminars	15	Prof. dr. sc. Tomislav Jurić
					Seminars	10	Prof. dr. sc. Đuro Banaj
					Seminars	10	Prof. dr. sc. Davor Kralik
					Exercises	-	
Asst. Ph.D. sc. Željko Barac	Strategies for maintaining technical systems in agriculture	O	4	40	Lectures	20	Asst. Ph.D. sc. Željko Barac
					Seminars	20	Asst. Ph.D. sc. Željko Barac
					Exercises		
Assoc. prof. dr. sc. Ivan Cloak	Technological design of workshops	O	4	40	Lectures	20	Assoc. prof. dr. sc. Ivan Plaščak
					Seminars	20	Assoc. prof. dr. sc. Ivan Plaščak
					Exercises		
Prof. dr. sc. Irene Rabčan	Technical systems in Preparing Feed	O	4	40	Lectures	10	Prof. dr. sc. Irena Rapčan
						10	Assoc. prof. dr. sc. Ivan Plaščak
					Seminars	15	Prof. dr. sc. Irena Rapčan
						5	Assoc. prof. dr. sc. Ivan Plaščak
					Exercises	-	

Prof. dr. sc. Goran Heffer	Theory of Operation of Agricultural Machinery	0	4	40	Lectures	20	Prof. dr. sc. Goran Heffer
					Seminars	20	Prof. dr. sc. Goran Heffer
					Exercises	-	
Prof. dr. sc. Goran Heffer	Theory of Reliability of Technical Systems in Agriculture	0	4	40	Lectures	20	Prof. dr. sc. Goran Heffer
					Seminars	20	Prof. dr. sc. Goran Heffer
					Exercises	-	
Assoc. prof. dr. sc. Vjekoslav Tadić	Machines and Devices for Fertilizing, Nursing and Crop Protection	0	4	40	Lectures	20	Assoc. prof. dr. sc. Vjekoslav Tadić
					Seminars	20	Assoc. prof. dr. sc. Vjekoslav Tadić
					Exercises	-	
Prof. dr. sc. Đuro Banaj	Technical Systems for Crop Harvesting	0	4	40	Lectures	20	Prof. dr. sc. Đuro Banaj
					Seminars	20	Prof. dr. sc. Đuro Banaj
					Exercises	-	
Prof. dr. sc. Davor Kralik	Livestock Husbandry Processes Management	0	4	40	Lectures	30	Prof. dr. sc. Davor Kralik
						10	Prof. dr. sc. Davor Kralik
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Davor Kralik	Facilities and Air-Condition in Livestock Husbandry	0	4	40	Lectures	30	Prof. dr. sc. Davor Kralik
						10	Prof. dr. sc. Davor Kralik
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Darko Kiš	Operations Research of Technical Systems in Agriculture	0	4	40	Lectures	20	Prof. dr. sc. Darko Kiš
					Seminars	20	Prof. dr. sc. Darko Kiš
					Exercises	-	
Prof. dr. sc. Tomislav Jurić	The Effectiveness of Technical Systems in the Function of Preserving the Soil	0	4	40	Lectures	20	Prof. dr. sc. Tomislav Jurić
					Seminars	20	Prof. dr. sc. Tomislav Jurić
					Exercises	-	
Prof. dr. sc. Tomislav Jurić	Ergonomic Principles in the Construction of Agricultural Machinery	0	4	40	Lectures	20	Prof. dr. sc. Tomislav Jurić
					Seminars	20	Asst. Ph.D. sc. Željko Barac
					Exercises	-	

Prof. dr. sc. Luka Šumanovac	Technical Systems of TransLuka in Agriculture	0	4	40	Lectures	10	Prof. dr. sc. Luka Šumanovac
					Lectures	10	Prof. dr. sc. Daniel South
					Seminars	15	Prof. dr. sc. Luka Šumanovac
					Seminars	5	Prof. dr. sc. Daniel South
					Exercises	-	
Prof. dr. sc. Luka Šumanovac	Technical Systems in Horticulture, Orchards and Vineyards	0	4	40	Lectures	10	Prof. dr. sc. Luka Šumanovac
					Lectures	10	Asst. Ph.D. sc. Domagoj Zimmer
					Seminars	15	Prof. dr. sc. Luka Šumanovac
					Seminars	5	Asst. Ph.D. sc. Domagoj Zimmer
					Exercises	-	
Prof. dr. sc. Mladen Jurišić	Geographic Information Systems in Agriculture	0	4	40	Lectures	20	Prof. dr. sc. Mladen Jurišić
					Seminars	10	Prof. dr. sc. Mladen Jurišić
						10	Assoc. prof. dr. sc. Monika Marković
					Exercises	-	
Prof. dr. sc. Goran Heffer	Tribology of technical systems in agriculture	0	4	40	Lectures	20	Prof. dr. sc. Goran Heffer
					Seminars	20	Prof. dr. sc. Goran Heffer
					Exercises	-	
Prof. dr. sc. Davor Kralik	Alternative Energy Resources in Agriculture	0	4	40	Lectures	20	Prof. dr. sc. Davor Kralik
					Seminars	20	Prof. dr. sc. Davor Kralik
					Exercises	-	
Prof. dr. sc. Davor Kralik	Technical systems in milk production	0	4	40	Lectures	20	Prof. dr. sc. Davor Kralik
					Seminars	20	Prof. dr. sc. Davor Kralik
					Exercises	-	
Prof. dr. sc. Goran Heffer	Design and Development of Agricultural Machines and Equipment	0	4	40	Lectures	20	Prof. dr. sc. Goran Heffer
					Seminars	20	Prof. dr. sc. Goran Heffer
					Exercises	-	
Prof. dr. sc. Darko Kiš	Systems of Artificial Drying and Preservation of Agricultural Products	0	4	40	Lectures	20	Prof. dr. sc. Darko Kiš
					Seminars	20	Prof. dr. sc. Darko Kiš
					Exercises	-	
Prof. dr. sc. Darko Kiš		0	4	40	Lectures	20	Prof. dr. sc. Darko Kiš

	Quality of Agricultural Products and Drying Media				Seminars	20	Prof. dr. sc. Darko Kiš
					Exercises	-	
Prof. dr. sc. Tomislav Šarić	Robots and manipulators in agriculture	0	4	40	Lectures	20	Prof. dr. sc. Tomislav Šarić
					Seminars	20	Prof. dr. sc. Tomislav Šarić
					Exercises	-	

Postgraduate doctoral study in AGRICULTURAL SCIENCES, PLANT PROTECTION

Head of studies: prof. dr. sc. Ivana Majić

Secretary of Studies: Assoc. Ph.D. sc. Ankica Sarajlić

2022/2023

Module coordinator	Name of the module	Mandatory/optional	ECTS	Student workload	Type of teaching	Number of hours	Teacher
Prof. dr. sc. Drazen Horvat	Principles of Scientific Work in Plant Protection	M	6	60	Lectures	10	Prof. dr. sc. Drazen Horvat
						5	Prof. dr. sc. Mirjana Brmež
						5	Prof. dr. sc. Jasenka Cosic
					Seminars	20	Prof. dr. sc. Drazen Horvat
					Exercises	10	Prof. dr. sc. Mirjana Brmež
						10	Prof. dr. sc. Jasenka Cosic
Prof. dr. sc. Mirjana Brmež	Ecology in Plant Protection	M	6	60	Lectures	10	Prof. dr. sc. Mirjana Brmež
						5	Prof. dr. sc. Karolina Vrandečić
						5	Prof. dr. sc. Renata Baličević
					Seminars	30	Prof. dr. sc. Mirjana Brmež
					Exercises	5	Prof. dr. sc. Jasenka Cosic
						5	Prof. dr. sc. Renata Baličević
Prof. dr. sc. Ivana Majić	Morphology and physiology of insects	O	2	20	Lectures	5	Prof. dr. sc. Ivana Majić
					Seminars	5	Prof. dr. sc. Ivana Majić
					Exercises	10	Prof. dr. sc. Ivana Majić
Prof. dr. sc. Ivana Majić	Systematics of insects	O	2	20	Lectures	5	Prof. dr. sc. Ivana Majić
					Seminars	10	Prof. dr. sc. Ivana Majić
					Exercises	5	Prof. dr. sc. Ivana Majić
Prof. dr. sc. Ivana Majić	Pests of Field Crops	O	4	40	Lectures	10	Prof. dr. sc. Ivana Majić
					Seminars	15	Prof. dr. sc. Ivana Majić
					Exercises	15	Prof. dr. sc. Ivana Majić

Asst. Ph.D. sc. Ankica Sarajlić	Horticultural entomology	0	4	40	Lectures	10	Asst. Ph.D. sc. Ankica Sarajlić
					Seminars	15	Asst. Ph.D. sc. Ankica Sarajlić
						15	Asst. Ph.D. sc. Ankica Sarajlić
					Exercises	15	Asst. Ph.D. sc. Ankica Sarajlić
Prof. dr.sc. Mirjana Brmež	Pests of Fruit Trees and Grape Vines	0	4	40	Lectures	10	Prof. Ph.D. Mirjana Brmež
					Seminars	15	Prof. dr. sc. Mirjana Brmež
					Exercises	15	Prof. dr. sc. Mirjana Brmež
Prof. dr. sc. Vlatka Rozman	Pests in Storages	0	3	30	Lectures	10	Prof. dr. sc. Vlatka Rozman
					Seminars	10	Prof. dr. sc. Vlatka Rozman
					Exercises	10	Prof. dr. sc. Vlatka Rozman
Prof. dr. sc. Vlatka Rozman	Control Methods of Stored Pests	0	2	20	Lectures	10	Prof. dr. sc. Vlatka Rozman
					Seminars	5	Prof. dr. sc. Vlatka Rozman
					Exercises	5	Prof. dr. sc. Vlatka Rozman
Prof. dr. sc. Ivana Majić	Plant Resistance to Pests	0	2	20	Lectures	10	Prof. dr. sc. Ivana Majić
					Seminars	5	Prof. dr. sc. Ivana Majić
					Exercises	5	Prof. dr. sc. Ivana Majić
Prof. dr. sc. Enrih Merdic	Urban entomology	0	2	20	Lectures	10	Prof. dr. sc. Enrih Merdic
					Seminars	5	Prof. dr. sc. Enrih Merdic
					Exercises	5	Prof. dr. sc. Enrih Merdic
Prof. dr. sc. Mirjana Brmež	Quarantine pests	0	1	10	Lectures	5	Prof. dr. sc. Mirjana Brmež
					Seminars	5	Prof. dr. sc. Mirjana Brmež
					Exercises	-	
Prof. dr. sc. Ivana Majić	Acarology	0	2	20	Lectures	5	Prof. dr. sc. Ivana Majić
						5	Prof. dr. sc. Anita Liška
					Seminars	10	Prof. dr. sc. Ivana Majić
					Exercises	-	
Prof. dr. sc. Mirjana Brmež	Nematology	0	4	40	Lectures	20	Prof. dr. sc. Mirjana Brmež
					Seminars	-	
					Exercises	20	Prof. dr. sc. Mirjana Brmež

Prof. dr. sc. Mirjana Brmež	Nematode Ecology	0	2	20	Lectures	10	Prof. dr. sc. Mirjana Brmež
					Seminars	10	Prof. dr. sc. Mirjana Brmež
					Exercises	-	
Asst. Ph.D. sc. Ankica Sarajlić	Zoocides	0	4	40	Lectures	20	Asst. Ph.D. sc. Ankica Sarajlić
					Seminars	20	Asst. Ph.D. sc. Ankica Sarajlić
					Exercises	-	
Prof. dr. sc. Jasenka Cosic	Laboratory methods in mycology	0	2	20	Lectures	-	
					Seminars	-	
					Exercises	15	Prof. dr. sc. Jasenka Cosic
						5	Prof. dr. sc. Karolina Vrandečić
Prof. dr. sc. Jasenka Cosic	Quarantine diseases	0	1	10	Lectures	5	Prof. dr. sc. Karolina Vrandečić
					Seminars	5	Prof. dr. sc. Jasenka Cosic
					Exercises	-	
Prof. dr. sc. Karolina Vrandečić	Seed diseases	0	2	20	Lectures	5	Prof. dr. sc. Jasenka Cosic
					Seminars	5	Prof. dr. sc. Jasenka Cosic
						5	Prof. dr. sc. Karolina Vrandečić
					Exercises	5	Prof. dr. sc. Jasenka Cosic
Prof. dr. sc. Jasenka Cosic	Vegetable Protection	0	4	40	Lectures	10	Prof. dr. sc. Jasenka Cosic
					Seminars	20	Prof. dr. sc. Jasenka Cosic
					Exercises	10	Prof. dr. sc. Jasenka Cosic
Prof. dr. sc. Jasenka Cosic	Diseases of Arable Crops	0	4	40	Lectures	5	Prof. dr. sc. Jasenka Cosic
						5	Prof. dr. sc. Karolina Vrandečić
					Seminars	10	Prof. dr. sc. Jasenka Cosic
						10	Prof. dr. sc. Karolina Vrandečić
					Exercises	5	Prof. dr. sc. Jasenka Cosic
						5	Prof. dr. sc. Karolina Vrandečić
Prof. dr. sc. Jasenka Cosic	Toxicogenic fungi and mycotoxins	0	2	20	Lectures	10	Prof. dr. sc. Jasenka Cosic
					Seminars	10	Prof. dr. sc. Jasenka Cosic
					Exercises	-	

Prof. dr. sc. Karolina Vrandečić	Diseases of Tree Fruits and Grapevine	0	4	40	Lectures	10	Prof. dr. sc. Karolina Vrandečić
					Seminars	20	Prof. dr. sc. Karolina Vrandečić
					Exercises	10	Prof. dr. sc. Karolina Vrandečić
Prof. dr. sc. Suzana Kristek	Soil microbiology	0	4	40	Lectures	10	Prof. dr. sc. Suzana Kristek
					Seminars	20	Prof. dr. sc. Suzana Kristek
					Exercises	10	Prof. dr. sc. Suzana Kristek
Prof. dr. sc. Edita Štefanić	Herbology	0	4	40	Lectures	20	Prof. dr. sc. Edita Štefanić
					Seminars	20	Prof. dr. sc. Edita Štefanić
					Exercises	-	
Assoc. prof. dr. sc. Sanda Rašić	Special herbology	0	4	40	Lectures	20	Assoc. prof. dr. sc. Sanda Rašić
					Seminars	20	Assoc. prof. dr. sc. Sanda Rašić
Prof. dr. sc. Renata Balicevic	Weed control in arable crops	0	4	40	Lectures	20	Prof. dr. sc. Renata Baličević
					Seminars	10	Prof. dr. sc. Renata Baličević
					Exercises	10	Prof. dr. sc. Renata Baličević
Prof. dr. sc. Renata Baličević	Herbicides (New Cognition)	0	2	20	Lectures	10	Prof. dr. sc. Renata Baličević
					Seminars	10	Prof. dr. sc. Renata Baličević
					Exercises	-	
Prof. dr. sc. Renata Baličević	Interaction Herbicide – Soil – Plant	0	1	10	Lectures	10	Prof. dr. sc. Renata Baličević
					Seminars	-	
					Exercises	-	
Assoc. prof. dr. sc. Sanda Rašić	Pesticides Application and Legislative	0	2	20	Lectures	20	Assoc. prof. dr. sc. Sanda Rašić
					Seminars	-	
					Exercises	-	
Prof. dr. sc. Ivana Majić	GMO in Plant protection	0	2	20	Lectures	10	Prof. dr. sc. Ivana Majić
					Seminars	10	Prof. dr. sc. Ivana Majić
					Exercises	-	
Assoc. prof. dr. sc. Sanda Rašić	Orchard and Vineyard Protection Against Weeds	0	4	40	Lectures	20	Assoc. prof. dr. sc. Sanda Rašić
					Seminars	20	Assoc. prof. dr. sc. Sanda Rašić
					Exercises	-	

Assoc. prof. dr. sc. Sanda Rašić	Weed Management in Vegetable Crops	0	4	40	Lectures	20	Assoc. prof. dr. sc. Sanda Rašić
					Seminars	20	Assoc. prof. dr. sc. Sanda Rašić
					Exercises	-	
Prof. dr. sc. Edita Štefanić	Allergenic Plants: Monitoring and Control	0	2	20	Lectures	10	Prof. dr. sc. Edita Štefanić
					Seminars	-	
					Exercises	10	Assoc. prof. dr. sc. Sanda Rašić
Prof. dr. sc. Edita Štefanić	Weed Communities in Agricultural Crops	0	2	20	Lectures	10	Prof. dr. sc. Edita Štefanić
					Seminars	5	Prof. dr. sc. Edita Štefanić
					Exercises	5	Assoc. prof. dr. sc. Sanda Rašić
Asst. Ph.D. sc. Marija Ravlić	Plant Protection in Organic Agriculture	0	4	40	Lectures	10	Asst. Ph.D. sc. Marija Ravlić
					Seminars	15	Asst. Ph.D. sc. Marija Ravlić
					Exercises	15	Asst. Ph.D. sc. Marija Ravlić
Asst. Ph.D. sc. Suzana Čavar	Toxicology and Ecotoxicology	0	2	20	Lectures	10	Asst. Ph.D. sc. Suzana Čavar
					Seminars	5	Asst. Ph.D. sc. Suzana Čavar
					Exercises	5	Asst. Ph.D. sc. Suzana Čavar

LEARNING OUTCOMES

2022./2023.

POSTGRADUATE DOCTORAL STUDY "AGRICULTURAL SCIENCES"

Sveučilište Josipa Jurja Strossmayera u Osijeku
Fakultet agrobiotehničkih znanosti Osijek

CONTENT

1. INTRODUCTION

The Faculty of Agrobiotechnical Sciences in Osijek has developed and, for many years, has been running a postgraduate doctoral study program in Agricultural Sciences. The departments within the Faculty of Agrobiotechnical Sciences in Osijek have engaged in activities in both general and specialized agricultural sciences. By consolidating initiatives, achievements, and the distinctive strengths of its departments, the doctoral program in Agricultural Sciences was established. This development was further supported by the program's inclusion in the European Higher Education Area, in alignment with national strategic priorities based on knowledge in agriculture.
The concept of the doctoral study program in Agricultural Sciences, which offers eight specializations (Agroeconomics, Agrochemistry, Animal Nutrition and Feed Technology, Hunting and Cynology, Plant Breeding and Seed Production, Animal Husbandry, Agricultural Technical Systems, and Plant Protection), represents the highest level of scientific integration at the Faculty of Agrobiotechnical Sciences in Osijek and serves as a significant contribution to the research and educational spheres of scientific activity.

The reasons for launching the doctoral program are to provide opportunities for graduates with engineering degrees in agriculture, as well as master's degree holders in agriculture, to gain scientific knowledge in the field. Utilizing the latest scientific insights and technologies, they are encouraged to personally contribute to the advancement of agricultural science in line with national research priorities and the needs of both the public and private sectors.

The postgraduate doctoral study program in Agricultural Sciences is founded on the latest global scientific knowledge, making it a catalyst for the development of new knowledge, skills, and technologies essential for a knowledge-based society, addressing both national and international priorities. The program is rooted in scientific activities carried out within active research projects, and the continuity and growth of research are reflected in the Faculty of Agrobiotechnical Sciences in Osijek's increased scientific activities, including the development of new project proposals. These research projects form the basis for collaborative research among the departments within the faculty and foster partnerships with other faculties and scientific institutes.

Joint research is embedded in the very concept of the program, which includes eight specializations. Specifically, the need to explain certain problems arises from a higher level of scientific integration, i.e., the level of agricultural science, while explanations require an understanding of processes and mechanisms at a lower level of scientific integration, represented by the branches of agriculture covered in the study modules: agrochemistry, seed production, genetics and breeding of plants, animals, and microorganisms, crop production, phytomedicine, animal husbandry, animal nutrition, hunting, agricultural engineering, and technology.

The aim is to direct the scientific work of program participants toward research activities within projects conducted both on scientific project sites and within production resources in the private and public agricultural sectors, as well as in collaboration with other scientific institutions, so that the results are directly applicable in practice.

In terms of concept, program structure, and implementation, the study is aligned with the latest knowledge and is comparable to similar programs offered at other European higher education institutions, especially those within the European Union.

AGROECONOMICS

2. LIST OF COMPULSORY AND ELECTIVE MODULES WITH NUMBER OF TEACHING HOURS REQUIRED FOR THEIR PERFORMING AND ECTS CREDITS AND LEARNING OUTCOMES FOR EACH MAJOR AND MODULE

2.1. Modules of major Agroeconomics

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Methods and Sources of Economic and Production Theories	60	6
2.	Instruments and Policies of Agrarian and Rural Development	60	6

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Mathematical and Statistical Models in Agoreconomics	40	4
2.	History of Agriculture and Rural Sociology	40	4
3.	Economics of Agrocomplex	40	4
4.	Farm Management	40	4
5.	Entrepreneurship in Agriculture	40	4
6.	Market of Agricultural Products	40	4
7.	Financial Management in Agriculture	40	4
8.	Entrepreneurial Accounting	40	4
9.	Food Marketing	40	4
10.	Economics of National Resources	40	4

2.1.1. Learning outcomes of major Agroeconomics

Module name	**Methods and Sources of Economic and Production Theories**	
Module coordinator	Zdravko Tolušić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 30, E - 0, S -30

Module aim

To inform postgraduate students with agroeconomic problems (allocation, distribution, stabilization, and the mechanisms of the free market.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Describe the nature of economics as a science that deals with solving the problems of scarcity.
2. Using analysis of supply and demand to analyze economic developments in the market.
3. Assess the factors affecting the production and costs.
4. Analyze business of enterprises in different market structures.
5. Explain how market factors of production are functioning.
6. Analyze business cycle using aggregate demands and aggregate supplies.
7. Recognize how economics laws affect the market of agricultural and food products market.
8. Evaluate and argument how to use knowledge about economics categories applied in daily work of agricultural subjects.

Module content

Aggregate supply, economic growth and macroeconomic policies. Growth policies and stability, international trade and the world economy. Risk, uncertainty, and game theory. Seminar in international trade and the global economy. Seminar in risk, uncertainty, and game theory.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☒ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students are required to attend minimum 50% of the classes. Students should be prepared for discussion and solving practical tasks using relevant literature. Students should write mandatory seminar. Seminars will be presented orally, with Power Point program and its duration should not be longer than 20 minutes. Schedule of oral presentations will be agreed in advance. Seminar is precondition for attending oral exams.

Literature

Required reading:

1. Ferenčak, I. (1998): Počela ekonomije, Ekonomski fakultet u Osijeku, Osijek.
2. Samuleson, P. A., Nordhaus, W. (2000): Ekonomija, Mate, Zagreb.

Recommended literature:

1. Mankiw, G.,(2006): Osnove ekonomije, Mate, Zagreb.
2. Parkin, M. (1990): Economics, Addison-Wesley Publishing Company, New York.
3. Dyal, A. J., Karatjas, N. (1985): Basic Economics, McMillan Publishing Company, New York.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.20	1-8	The study of literature and application of statistical software for analysis of real data	Discussion, continuous monitoring of individualwork on tasks
Seminar	1.20	1-8	The application of knowledge and skills acquired in lectures and exercises in the independent development of a seminar paper	Discussion in the formof consultation on themethods that the student in preparing aseminar paper
Final exam	3.60	1-8	The writng and the presentation of the seminar paper; oral examination of the methods used in the seminar paper	Oral exam
Total	6.00			

The way of calculating ECTS credits for certain activities:

Module carries 6 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
6 ECTS credits = 150 hours of module loads
30 teaching hours (lectures) = 1.20 ECTS (30 teaching hours/150 hours of total load x 100 = 20.00% from total of 6 ECTS)
Seminar paper = 1.20 ECTS (30/150 hours of total load x 100 = 20.00% from total of 6 ECTS)
Orall exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Instruments and Policies of Agrarian and Rural Development**	
Module coordinator	Krunoslav Zmaić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 25, E - 0, S - 35

Module aim

Goal of studying this module is to acquire knowledge in the field of funds, instruments and measures of agricultural and rural policy which provides students with a scientific approach in the research process of problems of individual agroeconimic and agrarian policy actions on agricultural production.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate contemporary methods in the productive functions, costs, supply, demand, consumption and competition.
2. Assess and evaluate the economic development of the Lewis model, Jorgensonov model, KWC model, Ranis-Fei fashion.
3. Rank and compare indicators of the development of modern agriculture contribution to overall economic development.
4. Identify and choose the newer methods and procedures in the analysis of the funds, instruments and measures of agricultural policy.
5. Evaluate the effects of agricultural policy measures on income and competitiveness of the agricultural sector.

Module content

Basic concepts in the field of agricultural economics and agricultural policy, methods and data sources in agroeconomic and in agricultural policy research. General economic principles of production functions and costs, supply, demand, consumption, elasticity, competition, monopoly, market and state, effect of macroeconomic variables on agriculture. Showing theory of economic development through industrialization as a model of economic development, Lewis model, Jorgens model, KWC model, Ranis-Fei model, and analysis of contribution indicators of development of modern agriculture to overall economic development. Analysis of the means, instruments and measures of agricultural and rural policy, and show their effect on the risk and uncertainty in agricultural production through agricultural supply and the factors which determine with measures to support the development of agriculture, matrix of macroeconomic objectives, PAM matrix, DCR ratio.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students are obliged to prepare for seminars using recommended literature. Students prepare a seminar work which is compulsory. As part of the seminar work student at the specific research project deals with teaching units from lectures. Creating PAM matrix and DCR ratio calculation as indicators of competitiveness, and assembling of workflow of measures and rational expectations in the agricultural and rural development. Monitoring of the seminar work is ongoing, as well as verification of acquired knowledge, by public defense of the seminar paper and by oral exam ends knowledge verification.

Literature

Required reading:

1. Baban, Lj. (1999): Ogledi iz agrarne ekonomije, Sveučilišni udžbenik, Ekonomski fakultet u Osijeku, Osijek.
2. Defilipis, J. (2002): Ekonomika poljoprivrede, Školska knjiga, Zagreb.
3. Ghatak, S., Ingerstent, K. (1984): Agriculture and Economic Develpoment, Whawatsheaf Books Ltd, Brighton, Sussex.
4. Petrač, B. (2002): Agrarna ekonomika, Sveučilišni udžbenik, Ekonomski fakultet u Osijeku, Osijek.
5. Trasy, M. (1982): Agriculture in Western Europe, Challenge and Resource, Grande, London.

Recommended literature:

1. Harwood, I. J., Vailey, W. K. (1994):The World Market, Goverment Intervention and Multilateral Policy Reform, U.S.D.A, Washington, USA.
2. Helmberger, G. P. (1991): Economic Analysis of Farm Programs, University of Wisconsin, Mc Graw-Hill, Inc., USA.
3. Eric A. M., Scott, R. P. (1998): The Policy Analysisi Matrix for Agricultural Development, Cornell University Press, Ithaca and London.
4. Republic of Croatia, Competitiveness in Agriculture and EU Accession (2001): A Strategy for Croatian Agriculture, Landel Mills Limited, Trowbridge, Wiltshire, United Kingdom.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.00	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments

Seminar	1.40	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	3.60	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	6.00			

The way of calculating ECTS credits for certain activities:
Module carries 6 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
6 ECTS credits = 150 hours of module loads
25 teaching hours (lectures + exercises) = 1.00 ECTS (25 teaching hours/150 hours of total load x 100 = 16.67% from total of 6 ECTS)
Seminar paper = 1.40 ECTS (35 hours/150 hours of total load x100 = 23.33% from total of 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment
It is envisaged evaluation by students, lecturers on study and by experts in the field of study, and if necessary international supervision.

Module name	**Mathematical and Statistical Models in Agoreconomics**	
Module coordinator	Nenad Šuvak	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 20, S - 0

Module aim

Introducing PhD students to mathematical and statistical models in agroekonomics that are most commonly applied to solving problems in practice. The emphasis is on understanding of application of statistical methods in real situations and training for independent use of available statistical software.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Analyze methods and models used in statistical reasoning.
2. Understand statistical methods used in statistical reasoning.
3. Demonstrate the ability of analizing the real data using models and methods covered with this course.
4. Understand benefits and limitations of statistical data analysis in applications.
5. Present the results of statistical analysis and their applicability to general public and experts.
6. Use the computers and appropriate statistical software packages.

Module content

Mathematical and statistical models; Probability (classical and statistical approach to probability; axioms of probability, random variables); Important distributions (discrete distribution: Bernoully, binomial, geometric and Poisson; continuous distributions: uniform, exponential, normal, Student and F distribution); Numerical characteristics of random variables (expectation, variance, skewness, kurtosis); Random sample; Estimation of numerical characteristics - point estimation and confidence intervals, estimation of distribution; Hypothesis testing; Regression analysis; Modeling and risk estimation; Linear and dynamic programming, network analysis and network planning.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

In addition to participating in class, each student is required to write a seminar paper on a given topic and to pass the final exam. On the final exam, the student is required to submit a text of the seminar paper and to present and defend the theme and the content of the seminar paper. If the seminar paper is a high-level paper, it could be revised for publication in a professional or scientific journal.

Literature

Required reading:

1. Benšić, M., Šuvak, N. (2013): Primijenjena statistika, Sveučilište J.J. Strossmayera, Odjel za matematiku, Osijek.
2. Benšić, M., Šuvak, N. (2014): Uvod u vjerojatnost i statistiku, Sveučilište J.J. Strossmayera, Odjel za matematiku, Osijek.
3. Bazaraa, M. S., Sherali, H. D., Shetty, C. M. (2006): Nonlinear Programming. Theory and Algorithms, 3rd Edition, Wiley, New Jersey.
4. Taha, H. A. (2006): Operations Research: An Introduction; 8th ed, Prentice Hall.

Recommended literature:

1. Scitovski, R. (2013): Kvantitativne metode za poslovno odlučivanje, nastavni materijali, Odjel za matematiku, sveučiliša J.J. Strosmmayera u Osijeku; http://www.mathos.unios.hr/~scitowsk/Kvantitativne/materijali.html.
2. Pauše, Ž. (1993): Uvod u matematičku statistiku, Školska knjiga, Zagreb.
3. McClave, J. T., Benson, P.G., Sincich, T. (2001): Statistics for Business and Economics, Prentice Hall, New York.
4. Bhattacharyya, G. K., Johnson, R. A. (1977): Statistics Concepts and Methods, J. Wiley.
5. Barković, D. (2010): Operacijska istraživanja, drugo izdanje, Sveučilište u Osijeku, Osijek. 6. Neralić L. (2003): Uvod u matematičko programiranje, Element, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and seminars	0.80	1-6	The study of literature and application of statistical software for analysis of real data	Discussion, continuous monitoring of individualwork on tasks
Excercises	0.80	1-6	The application of knowledgeand skills acquired in lecturesand exercises in the independent development of a seminar paper	Discussion in the formof consultation on themethods that the student in preparing a seminar paper
Final exam	2.40	1-6	The writng and the presentation of the seminarpaper; oral examination of the methods used in the seminar paper	Oral exam
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

20 teaching hours (lectures+seminar) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Excercises = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

It is envisaged evaluation by students, lecturers on study and by experts in the field of study, and if necessary international supervision.

Module name	**History of Agriculture and Rural Sociology**	
Module coordinator	Antun Šundalić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim
To indicate the modern socio-economic context of agro orientation today, as well as sociological dimension of the villages and their population in Slavonia and Baranya. Also in the terms of world integration process to locate the importance of agricultural activities in Croatian society.

Terms of admission
No prerequisites

Expected learning outcomes
After completing the module, student will be able to:
1. Identify current social processes (for example modernization).
2. Understand the consequences of modernization on the life in rural areas.
3. Analyze the influence that globalization has over agro-economic activities in Croatian society.
4. Construct a possible direction of rural and agricultural development in Republic of Croatia.

Module content
Peasants society and modernization.Villages and farm transformation. Rural area and modernization. New identity of rural area and farmers in global integration conditions.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Attending lectures and seminars, writing a paper, taking the exam.

Literature
Required reading:

1. Šundalić, A. (2010): Selo, iz autentičnosti u neprepoznatljivost. Osijek: Ekonomski fakultet u Osijeku.
2. Cifrić, I. (2003): Ruralni razvoj i modernizacija. Zagreb: Institut za društvena istraživanja.

Recommended literature:

1. Šundalić, A. (2002): Evolucija seljačkog posjeda i njezin utjecaj na seoski okoliš. U: Štambuk, M., Rogić, I., Mišetić, A.: Prostor iza. Zagreb: Institut društvenih znanosti Ivo Pilar.
2. Mendras, H. (1976): Seljačka društva. Zagreb: Globus.

3. Mirković, M. (1950): Održanje seljačkog posjeda. Zagreb: Hrvatska naklada.
4. Župančić, M. (2000): Tranzicija i modernizacijske perspektive hrvatskog sela. Sociologija sela. Vol.38, No.1-2.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.80	1-3	Studying of literature and application of statistical software foranalysis of real data	Discussion, continuous monitoring of individual work on tasks
Seminar	0.80	3-4	Application of knowledge and skillsacquired in lectures and exercises in the independent development of a seminar paper	Discussion in the form of consultation on themethods that the student in preparing a seminar paper
Final exam	2.40	1-4	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Student survey. Analysis of student's exam results.

Module name	**Economics of Agrocomplex**	
Module coordinator	Krunoslav Zmaić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Goal of studying this module is to acquire knowledge in the field of economics of the agrocomplex functioning through the analysis of the economics of the agricultural industry and food production, and their implications for the overall development of agriculture which provides students with a scientific approach in the process of research problems in the functioning of agrocomplex.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate contemporary methods in short supply chains.
2. Assess and evaluate the competition of agrocomplex.
3. Rank and compare indicators of supply and demand and other external and internal parameters.
4. Identify and choose the newer methods and procedures in market and social coordination mechanisms management of agrocomplex.
5. Evaluate the requirements for food safety and food security, and also for legislation and business ethics.

Module content

Terminology used in defining the theory of enterprise, institutions in producer-processing-distribution consumer chain, product differentiation, competition and quality in the promotion and food processing chain of agri-food products. Economics of the agricultural industry through the supply, demand, substitutes, marginalism,free market-efficiency and social coordination of activities of different mechanisms. The basics of human nutrition, food safety requirements for food security, monitoring of food quality, legal regulations and business ethics.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars using recommended literature. Students prepare a seminar work which is compulsory. As part of the seminar work student at the specific research project deals with teaching units from lectures. Monitoring of the seminar work is ongoing, as

well as verification of acquired knowledge, by public defense of the seminar paper and by oral exam ends knowledge verification.

Literature

Required reading:

1. Samuleson, P. A. (1992): Ekonomija, Mate d.o.o., Zagreb.
2. Tracy, M. (1996): Država i poljoprivreda u Zapadnoj Europi 1880-1998, Mate d.o.o., Zagreb.
3. Tracy, M. (2000): Hrana i poljoprivreda u tržnom gospodarstvu, Mate d.o.o., Zagreb.
4. Wayne, H. M., Josling, E. T. (1990): Agricultural Policy Reform, Politics and Process in the EC and USA, Iowa State University Press, Ames.

Recommended literature:

1. Shy, O. (1995): Industrial organization: Theory and application. MIT Press, Massachusets.
2. Carlton, D., Perloff, J. M. (1994): Modern industrial organization. Harper Collins College Publisher, New York.
3. Milgrom, P., Roberts, J. (1992): Economics, Organization and Management. Prentice Hall International Editions, Englewood Cliffs.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-5	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.80	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.40	1-5	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

It is envisaged evaluation by students, lecturers on study and by experts in the field of study, and if necessary international supervision.

Module name	**Farm Management**	
Module coordinator	Jadranka Deže	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E- 10, S - 10

Module aim

Training for proper farm equipping and selection of the best structure and organization of production customed to the changing conditions of open market and free entrepreneurship. Coordination between the factors of production. Rational performance with a view to save raw materials, supplementary materials, labour of people and machinery, to increase human labor productivity, economics and profitability of production and successful farm business.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Analyze the conditions and results of agricultural production.
2. Calculate the costs and results of basic production lines.
3. Plan the optimal production structure.
4. Compile economic feasibility study recommendation.
5. Recommend organizational and economic measures to improve business results.
6. Estimate economic results of the farm business.

Module content

Characteristics and types of business operators and family farms. Business functions and contemporary forms of organizational structure. Organizational culture and changes. Relations within and between production factors. The concept, purpose, goals and systems of planning. Principles and objects of planning as well as plan types. Analysis of the production function. Labour organization and personnel management. Application of CPM methods and LP. Designing an information system required for the decision-making process. Developing organizational-economic project. Organization of management including its styles and methods of leadership. Analysis of economic indicators of production and business success. Controlling and benchmarking.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are obliged to attend lectures and exercises. During the module duration, students and module coordinator will determine the topic of seminar. The seminar should be brought for review, after which an individual presentation should be performed. After that, students can take written and oral final exam.

Literature

Required reading:

1. Sikavica, P. (2011): Organizacija, Školska knjiga, Zagreb.
2. Sikavica, P., Hunjet, T., Ređep Begičević, N., Hernaus, T. (2014): Poslovno odlučivanje, Školska knjiga Zagreb.
3. http://web.efzg.hr/dok/OIM/thernaus/poslovno_odlucivanje_za_web.pdf.
4. Weihrich, H., Koontz, H. (1994): Menedžment, deseto izdanje, MATE d.o.o., Zagreb.
5. Schroeder, R. (1999): Upravljanje proizvodnjom, Odlučivanje u funkciji proizvodnje, MATE d.o.o., Zagreb.
6. Armstrong, M. (2001): Kompletna managerska znanja, Upravljanje poslovima i aktivnostima, MEP Consult, Zagreb.
7. Osmanagić Bedenik, N. i sur. (2010): Kontroling između profita i održivog razvoja, MEP Consult, Zagreb.

Recommended literature:

1. Osmanagić Bedenik, N (2002): Operativno planiranje, Školska knjiga, Zagreb.
2. Bebić, M. (2011): Potpore i javni natječaji iz EU fondova, NOVA knjiga, RAST, Zagreb.
3. Busse, F.J. (2003): Grundlagen der betrieblichen Finanzwirtschaht 5.Auflage Oldenbourg Wissenschaftsverlag Gbh, Muenchen.
4. Horne, M.G. (2009): Vodič za upravljanje projektima, Dva&Dva, Zagreb.
5. Buble, M. (2006): Osnove menadžmenta, Sinergija, Zagreb.
6. Bendeković, J. i sur. (2007): Priprema i ocjena investicijskih projekata, FOIP, Zagreb.
7. Program ruralnog razvoja Republike Hrvatske za razdoblje 2014. - 2020. Ministarstvo poljoprivrede.
8. Ministarstvo poljoprivrede, poticaji i natječaji.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.20	1-6	The literature review and solving assignments	Examination of solved assignments
Seminar	0.40	1-6	The literature review and seminar presentation	Evaluation of seminar
Final exam	2.40	1-6	Preparation for the exam by studying therequired and recommended literature	Written and oral final exam
Total	4.00			

The way of calculating ECTS credits for certain activities:
Module has a 4 ECTS credits
1 ECTS credit = 25 hours of student work
4 ECTS credit = 100 module hours
20 hours of lectures = 0.80 ECTS (20 hours of lectures/100 total module hours × 100 = 20.00% of 4 ECTS credit)
Seminar = 0.40 ECTS (10 hours/100 total module hours × 100 = 10.00% of 4 ECTS credit)
Exercise = 0.40 ECTS (10 hours/100 total module hours × 100 = 10.00% of 4 ECTS credit)
Final exam = 2.40 ECTS (60 hours/100 total module hours × 100 = 60.00% of 4 ECTS credit)

Module quality assessment
The quality and effectiveness of module is going to be carried by teachers and experts in the field of the study, if necessary, international supervisors will be involved in the process.

Module name	**Entrepreneurship in Agriculture**	
Module coordinator	Jadranka Deže	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 15, E - 0, S - 25

Module aim
Apply entrepreneurial knowledge and methods of management in the growth and development of the company based on creativity and innovation in agriculture.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Categorize methods of generating ideas and creative problem solving.
2. Planning process of new product development and manufacturing.
3. Propose an entrepreneurial strategy of introducing new products, new market entry and reduce the risk in the new entry.
4. Create a growth strategy and management implications of growth.
5. Suggest ways to entrepreneurial venture finish and start with a new.
6. Select the appropriate form of strategic integration and virtual organization of production and business in agriculture.

Module content
Entrepreneurship applications in a changing environment with the rationalizing of use available factors in agricultural production. Development and the growth enterprises with agricultural productions are possible when used entrepreneurial methods and strategies. Accession and development of the international market.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
The obligation of the student to be present in class. During the course students choose the topic of the seminar. Completed seminar will present the use of Power Point. After that, students take written and oral final exam.

Literature

Required reading:

1. Hisrich, R. D. Peters, M. P., Shepherd, D. A. (2008): Poduzetništvo, Sedmo izdanje. MATE, Zagreb.
2. Timmons, A. J. (1999): New venture Creation, Entrepreneurship for the 21st century, 5th Edition, IRWINIM McGraw, Hill Companies, USA.
3. Kolaković, M. (2006): Poduzetništvo u ekonomiji znanja, Sinergija, Zagreb.

Recommended literature:

1. Olson, D. K. (2004): Farm Management, Principles and Strategies, Iowa State Press a Blackwell Publishing Company.
2. Kay R.D., Edwards W. M., Duffy, P. A. (2008): Farm Management Sixth Edition, McGraw – Hill International Edition.
3. Ćesić, Z. i sur. (2006): Primijenjeno poduzetništvo, zbirka tekstova, Beretin Split, Cera Prom, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.60	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	1.00	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exan	2.40	1-6	Preparing for exam by studying required and recommended literature	Oral exam
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
15 lectures teaching hours = 0.60 ECTS (15 teaching hours/100 hours of total load x 100 = 15.00% from total of 4 ECTS)
Seminar paper = 1.00 ECTS (25 hours/100 hours of total load x 100 = 25.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Market of Agricultural Products**	
Module coordinator	Zdravko Tolušić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S -20

Module aim

To introduce students to postgraduate doctoral studies of new knowledge and the problems that occur in the market of agricultural products and agro-marketing.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Describe specifics of the agricultural produts' market.
2. Notice problems occuring in the market of agricultural products in each stage of the life cycle of agricultural product.
3. Explain possible strategy to enter the market.
4. Compare strategies in market entering (highlight the advantages/disadvantages).
5. Demonstrate the importance of promotion of the entry and or retention in a particular market.
6. Use market research methods to solve problems and gathering data information on the selected market segment.
7. Indentify possible strategies for action.
8. Present chosen strategy performance on the market for specific product groups.

Module content

Market and non-market regulators of social reproduction (the effectiveness of market function, morphology, structure, market transparency). Introducing the existing problems of the global market (economic, political, legal and cultural environment). Strategies to enter foreign markets (exports of goods and services, leasing, contracting international cooperation, foreign investment analysis strategies to enter foreign markets). Market research (research project, types and methods of research, secondary and primary data, evaluating information). Methods and tools of market research (marketing). Promotion and advertising, direct sale and sales promotion. Salespeople and sales communication, new forms of sale. Market analysis and market forecasts of agri-food products in Croatia.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are required to attend minimum 50% of the classes. Students should be prepared for discussion and solving practical tasks using relevant literature. Students should write mandatory seminar. Seminars will be presented orally, with Power Point program and its duration should not be longer than 20 minutes. Schedule of oral presentations will be agreed in advance. Seminar is precondition for attending oral exams.

Literature

Required reading:

1. Tolušić, Z. (2011): Tržište i distribucija poljoprivredno prehrambenih proizvoda, Grafika Osijek.
2. Bratko, S. (1980): Organizacija tržišnog poslovanja, FOI Varaždin, Varaždin.
3. Goodman, D., Watts, M. J. (1997): Globalizing Food, Agrarian Questions and Global Restructuring, Routleedge, London.
4. Družić, I. (1997): Tranzicijska funkcija poljodjelstva, HAZU, Zagreb.
5. Samardžija, V. (2002): Prilagodbe politikama unutarnjeg tržišta EU, Ministarstvo za Europske integracije, Zagreb.

Recommended literature:

1. Kohls, R.-Uhl, J. (1985): Marketing of Agricultural Products, Mc Millan Publisihing Company, New York.
2. Kotler, O. (1994): Upravljanje marketingom, analiza, planiranje, primjena i kontrola, Informator, Zagreb.
3. Meler, M. (1999): Marketing, Sveučilište J.J. Strosmayera Osijek, Ekonomski fakultet u Osijeku.
4. Previšić, J. Ozretić Došen, Đ. (2000): Osnove međunarodnog marketinga, Masmedia, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-5	Participation in the debate and expressing opinions	Attendance of the classes frequency and involvement into discussion
Seminar	0.80	3-8	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	2.40	1-8	Preparing for the examby studying required and recommended literature	Exam-presenting facts, argumenting, analysing case studies
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Final exam (oral) = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Financial Management in Agriculture**	
Module coordinator	Ivan Štefanić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

The aim of the module is to gain theoretical and practical knowledge and skils required for quality financial management and decision making at corporate level in uncertain economic environment. Learning about appropriate economic methods to evaluate scientific experiments.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Transform business idea into fully developed business plan or investment study.
2. Understand the influence of financial structure on financial result in uncertain economic environment.
3. Assess financial result of various entrepreneurial endevours with help of static and dynamic methods.
4. Valuation of nonmaterial business assets i assessment of its financial impact.
5. Select appropriate economic method to evaluate scientific experiment.

Module content

Tematic units are: sources of financing including financing of corporate businesses, financial indicators of success, static and dynamic methods of investment apraisal, partial and aggregate financial analysis of agricultural business or farm, economic evaluation of scientific experiments, valuation of non-material assets, improving financial results with help of financial instruments, business simulation "The leverage game".

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Studenats are expected to attend the classes regularly and participate in class discussions. Every student have an obligation to prepare fully developed business plan on given topic. During semester, three partial assessments are foreseen:

1. Partial assessment - preparing financial plan for corporate business - esay minimal 1000 words, without tables and graphs.
2. Partial assessment - selecing appropriate economic method to evaluate scientific experiment - esay minimal of 1000 words, without tables and graphs.

3. Partial assessment - valuation of non-material assets - esay minimal 1000 words, without tables and graphs.
After lectures are finished, students couls approch written examination. Presentations used during the lectures and all literature are available via distance learning system MERLIN. Student assessment is continous and include public presentation of individual project.

Literature

Required reading:

1. Brandes, W., Odening, M. (1992): Investizion, Finazierung und Wachstum in Landwirtschaft. Ulmer, Sttutgart.
2. Van Horn, James, C. (1993): Financijsko upravljanje i politika. MATE, Zagreb.
3. Barry, P. J., Ellinger, P.N., Hopkin, J. A., Baker, C. B. (1995): Financial Management in Agriculture. Interstate Publishers, Inc., Danville, Illinois.

Recommended literature:

1. Karić, M., Štefanić, I. (1999): Troškovi i kalkulacije u poljoprivrednoj proizvodnji, Poljoprivredni fakultet u Osijeku, Osijek.
2. Tracy, J. A. (1994): Kako čitati i razumjeti financijski izvještaj. Jakubin i sin, Zagreb.
3. Oltmans, A. W. (1995): The leverage Game, Agricultural Finance review, London.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-5	Attending lectures, discussions during the lectures ans seminars, assignment work literature studying and preparation for the lectures	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar, preparation and presentation of project assignment	0.80	1-5	Literature studying, preparation and presentation of project assignment	Project assignment examination and evaluation according to the pre-established criteria
Final exam	2.40	1-5	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Entrepreneurial Accounting**	
Module coordinator	Ljubica Ranogajec	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 15, E -10, S - 15

Module aim

To introduce candidates with an entrepreneurial opportunities of accounting in the decision making process on starting and managing business ventures; To present methods of preparation accounting information for decision making in small businesses.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the contribution of accounting in the process of deciding on the initiation and managing business ventures.
2. Explain the purpose and methods of simplified accounting information systems by small business owners.
3. To present methods of preparation accounting information for planning and capital gain in small businesses.
4. Inspired by the construction of accounting information systems adapted to special needs of monitoring and control of the financial situation of small businesses.
5. Determine price of agricultural products.
6. Recommend entrepreneurs the most suitable cost accounting systems.

Module content

Contribution accounting entrepreneurial success; Accounting Principles; Methods and techniques of accounting; Methods of simplified accounting; Accounting cash flows; Planning the necessary capital, planning to get; Projection founding balance sheet; Tax Accounting; Policy of lending and of collection of receivables; Accounting Inventory reproductive materials and agricultural products; Analysis of break-even point; Determination of prices of agricultural products; Using formal financial statements on an ongoing basis; Analysis of accounting and financial reports; The use of computers in the system an entrepreneurial accounting.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students prepare a seminar work that is required. Seminar students present orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. After that, students write a final exam. Students are recommended to prepare exams from the obligatory reading.

Literature

Required reading:

1. Anthony, R. N. (1997): Pregled osnova računovodstva, prijevod s engleskog, Jakubin i sin, Zagreb.
2. Belak, V. (2012): Osnove suvremenog računovodstva, Belax Excellens d.o.o., Zagreb.
3. Očko, Jasmina, Švigir, Andreja (2009): Kontroling - upravljanje iz backstagea, Miš, Zagreb.
4. Parać, B. (2008): Poduzetničko računovodstvo i financijsko izvještavanje, M.E.P. Consult, Zagreb.
5. Skupina autora (2014): Računovodstvo poduzetnika, RRiF-plus d.o.o., Zagreb.

Recommended literature:

1. Guzić, Š. (1999): Poduzetničko računovodstvo, TEB poslovno savjetovanje, Zagreb.
2. Habek, M. (2000): Računovodstvo poduzetnika – s primjerima knjiženja, RriF plus, Zagreb.
3. Lloyd, E. Goodyear (2012): Bookkeeping and Cost Accounting for the Farm, Forgotten Books.
4. Meigs, R. F. i Meigs, W. B. (2000): Računovodstvo: Temelj poslovnog odlučivanja, MATE, Zagreb.
5. McKay, M. i Rosa, E. (2000): The Accountant's Guide to Professional Communications, The Dryden Press.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	0.60	1-6	Studying literature	Checking the activities carried through the oral conversation
Seminar	0.60	1-6	Studying literature, making, and presentation of seminars	Review and evaluation of the seminar work according to preestablished criteria
Exercises	0.40	1-6	Making assignments	Checking activities through oral conversationand the surrender and review assignments made
Final exam	2.40	1-6	Preparation for the exam by studying recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:
The module has 4 ECTS credits
1 credit = 25 hours of load (hours of student work)
4 credits = 100 hours of load modules
15 hours of lectures = 0.60 ECTS (15 teaching hours / 100 hours total load x 100 = 15.00% of total 4 ECTS)
15 hours of seminar work = 0.60 ECTS (15 hours / 100 hours total load x 100 = 15.00% of total 4 ECTS)
10 hours of exercises = 0.40 ECTS (10 hours / 100 hours total load x 100 = 10.00% of total 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation / 100 hours of total work hours x 100 = 60.00% of total 4 ECTS)

Module quality assessment
The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Food Marketing**	
Module coordinator	Mirna Leko Šimić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E- 0, S - 20

Module aim

The aim of this module is to capacitiate students to apply major marketing concepts in the food sector (agriculture and food industry). It will enable them to make scientific approach to the research process and problem solutions in creation of efficient marketing of this sector.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify elements of the marketing process within the food system.
2. Interpret and explain specific features of different marketing activities on different levels of the food system.
3. Evaluate the efficiency of different marketing strategy and activity applications in case studies.
4. Identifiy key element of consumer/buyer behaviour in the food market.
5. Design basic elements for the food product marekting strategy.
6. Analiyze global trends on food market and their impact on marketing strategy creation in a company.

Module content

Major elements of the marketing concept and thier application in the food sector (agriculture and food industry): marketing research and marketing segmentation, marketing strategy creation,marketing mix, consumer behaviour, food trends in global and local market.

Types of teaching

☒lectures	☐ individual tasks
☒seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☒ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Class attendance and, seminar work as an access project for the exam.

Literature

Required reading:

1. Leko-Šimić, M. (2002): Marketing hrane, Ekonomski fakultet u Osijeku, Osijek.
2. Kolega, A. (1994): Tržništvo poljodjelskih proizvoda, Globus, Zagreb.

Recommended literature:

1. Vajić, I. (1989): Ekonomika prehrambene industrije, Informator, Zagreb.
2. Strecker, O. et al (1990): Marketing fuer Lebensmittel, DLG, Framkfurt a/M.
3. Hungate, L. S., Sherman, R. W.(1979): Food and Economics, AVI Westport, Conn.
4. Mennel, S. et al. (1998): Prehrana i kultura – sociologija hrane, Jesenski i Turk, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.80	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Exam	2.40	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Economics of National Resources**	
Module coordinator	Tihana Sudarić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agroeconomics	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Goal of studying this module is to acquire knowledge in the field of allocation of national resources in relation to population growth through dimension, influence factors on global issues of protection of national resources including market trends, production and intervention in the part of protection of national resources which provides students with a scientific approach in the process of exploring the problem of allocation of national resources.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Assess and evaluate national resources according to the model of stabilization and development of the economy.
2. Identify and choose modern methods and procedures during the activation resources.
3. Evaluate the comparative and competitive advantages of the national economy.
4. Define the role of private and public actors in alocation of goods and services.
5. Analyze global trends of agricultural resources, food production and environmental protection.

Module content

Private and public mechanisms for allocation of goods and services, cooperation and coordination of activities of different mechanisms, current problems of agricultural resources, production, consumption and international trade in the world and the Republic of Croatia related to the problems of food production and nutrition, international trade of agricultural products. Analysis of factors of economic development, market restructuring and privatization as a model of stabilization and development of the Croatian economy with protection of national resources.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars using recommended literature. Students prepare a seminar work which is compulsory. Students make the seminar work on a specific research project related to the economics of national resources and their protection in the integration process of joining European and world markets. Monitoring of the seminar work is ongoing, as

well as verification of acquired knowledge, by public defense of the seminar paper and by oral exam ends knowledge verification.

Literature

Required reading:

1. Crkvenac, M. (1997): Ekonomska politika, Informator, Zagreb.
2. Družić, I. (2003): Hrvatsko gospodarstvo, Ekonomski fakultet u Zagrebu, Zagreb.
3. Markandya, A., Richardson, J. (1992): Environmental Economics, Earthscan Publications, Ltd., London.

Recommended literature:

1. Hall, R. E., Taylor J. B. (1986): Macroeconomic Theory, Performance and Policy, W. W. North of Company, New York.
2. Wayne, H. M., Josling, E. T. (1990): Agricultural Policy Reform, Politics and Process in the EC and USA, Iowa State University Press, Ames.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-5	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.80	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.40	1-5	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

It is envisaged evaluation by students, lecturers on study and by experts in the field of study, and if necessary international supervision.

After completing the major Agroeconomics, student will be able to:

Learning Outcome 1	Analyse global trends of agricultural resources, food production and environment protection
Learning Outcome 2	Rank and compare modern agriculture contribution indicators to overall economic development
Learning Outcome 3	To synthesize, apply and evaluate contemporary methods in the production function, costs, supply, demand, consumption and competition
Learning Outcome 4	To evaluate the results of agro-business economy
Learning Outcome 5	Estimate the financial impact of entrepreneurial enterprise with static and dynamic methods
Learning Outcome 6	Create a growth strategy and management implications of growth business venture

AGROCHEMISTRY

2.2. Modules of major Agrochemistry

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Land Resources	60	6
2.	Soil Biology	60	6
3.	Plant Physiology	60	6
4.	Fertilizers and Fertilization	60	6

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Field Soil Research	30	3
2.	Determining Fertilizer Needs	30	3
3.	Modelling of Agroecosystems	30	3
4.	Nutrition of Woody Plants	30	3
5.	Fertilization in Organic Production	30	3
6.	Fertilization in Greenhouses	30	3
7.	The Quality of Plant Products	30	3

2.2.1. Learning outcome of major Agrochemistry

Module name	**Land Resources**	
Module coordinator	Vesna Vukadinović	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 45, E - 0, S - 15

Module aim

Module introduces students with soil as a substrate of plant nutrition from pedological and agrochemical point of view, soil/land properties, plant biotope productivity, physical, chemical and biological indicators of soil quality, minimal conditions for its usage and preservation or protection measures.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Interpret morphological, biological, physical and chemical properties of soil / land.
2. Identify the soil type, recognize its limitations in agricultural production and to propose measures repairs.
3. Explain the soil fertility and the status and dynamics of soil nutrients.
4. Interpret impact of soil fertility and nutrient content in plants on plant productivity, growth and yield.
5. Explain chemical properties and nutrients forms in soil.
6. Classify the soil / land by using modern trends in evaluation.
7. Determine the minimum requirements and recommended optimal solution for land use.
8. Evaluate land degradation and propose changes in land use.

Module content

Morphological, chemical and physical soil properties, soil genesis, systematic and soil types related to its beneficial value and quality.Soil as a substrate of plant nutrition; organo-mineral soil complex; spare nutrients, mobilisation and imobilisation of nutrients; buffering and sorption; forms, mobility and dinamic equilibrium of plant nutrients in soil; nutrients potential; soil fertility and plant productivity. Methods of soil suitability determination for different purposes, type and modality of soil/land management as well as degradation and restoration processes, soil amelioration and preservation measures.

Types of teaching	☒ lectures	☐ individual tasks
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratory
	☐ distance education	☐ mentoring
	☐ field work	☐ other

Student requirements

Students will make seminar papers by studing scientific literature within a given theme. Seminar papers students present orally for up to 20 minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance.It is desirable to actively engage in laboratory work aims to introduce and mastering the methodology of physical and chemical soil analysis. Students are advised to prepare exams from required literature list. The exam is oral and/or written.

Literature

Required reading:

1. Škorić, A. (1986): Postanak razvoj i sistematika tla. Sveučilište u Zagrebu, Fakultet poljoprivrednih znanosti. Zagreb.
2. Škorić, A. (1991): Sastav i svojstva tla. Sveučilište u Zagrebu, Fakultet poljoprivrednih znanosti. Zagreb.
3. Husnjak, S. (2014): Sistematika tala Hrvatske. Hrvatska Sveučilišna Naklada. Zagreb.
4. Salisbury, F. B., Ross, C. W. (1995): Plant Physiology, Wadsforth Publishing Company, USA.
5. Vukadinović, V., Vukadinović, V. (2011): Ishrana bilja. Sveučilište J.J.Strossmayera u Osijeku, Poljoprivredni fakultet u Osijeku. Osijek.
6. Rengel, Z. (1999): Mineral Nutrition of Crops. Fundamental Mechanisms and Implications. Food Products Press. New York. London. Oxford.
7. Sharma, C. P. (2006): Plant micronutrients. Science Publishers. Enfield.
8. FAO (1976): A Framework for Land Evaluation. Food and Agriculture Organizations of the United Nations. Rome. http://www.fao.org/docrep/x5310e/x5310e00.htm

Recommended literature:

1. Resulović, H., Čustović. H. (2002): Pedologija. Univerzitet u Sarajevu. Sarajevo.
2. Pachepsky, Ya., Rawls, W.J. (edit.) (2004): Development of Pedotransfer Functions in Soil Hydrology. Elsevier, Development in Soil Science, Volume 30.
3. Hillel, D. (2004): Introduction to environmental soil physics. Elsevier Academic Press. Amsterdam.
4. Brady, N. C., Weil, R. R. (2002): The Nature and Properties of Soils, Prentice Hall, New Yersey
5. Bohn, H. L. McNeal, B. L., O'Connor, G. A. (1985): Soil Chemistry, Second Edition, John Willey and Sons, New York.
6. Vukadinović, V., Lončarić, Z. (1998.): Ishrana bilja, Poljoprivredni fakultet u Osijeku.
7. FAO (1996): Agro-ecological Zoning, Guidelines. Food and Agriculture Organizations of the United Nations. Rome. http://www.fao.org/docrep/w2962e/w2962e00.htm
8. Kalogirou, S. (2002): Expert systems and GIS: an application of land suitability evaluation. Computers, Environment and Urban Systems. 26: 89-112.
9. Jurišić, M., Plaščak, I. (2009): Geoinformacijski sustav, GIS u poljoprivredni i zaštiti okoliša. Poljoprivredni fakultet u Osijeku. Osijek.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.80	1-8	Literature studying	Checking acquired knowledge orally
Seminar	0.60	1-8	Literature studying, seminar preparation and presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	3.60	1-8	Preparing for exam by studying required and recommended literature	Exam (oral, written)
Total	6.00			

The way of calculating ECTS credits for certain activities:

Module carries 6 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

6 ECTS credits = 150 hours of module loads

45 lectures hours = 1.80 ECTS (45 lectures hours / 75 hours of total load x 100 = 30.00 % from total of 6 ECTS)

Seminar paper = 0.60 ECTS (15 hours / 75 hours of total load x 100 = 10.00 % from total of 6 ECTS)

Final exam = 3.6 ECTS (90 hours of preparation / 75 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment

Evaluation of teachers and quality of modules implementing anonymous student surveys.

Module name	**Soil Biology**	
Module coordinator	Gabriella Kanižai Šarić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 50, E - 0, S - 10

Module aim
Get doctorants acquainted with life component of soil –pedofauna and micro organisms in soil.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Classify and compare the living component of soil.
2. To determine the significance and impact pedofaune on soil fertility and plant production.
3. Integrate processes of microbial metabolism and metabolic differences between soil microorganisms.
4. Predict the impact of crop management on soil biodiversity.
5. Assess the importance and role of beneficial microorganisms of the soil.
6. Recommend and apply microbiological preparations depending on the environmental conditions.

Module content
Acquaint with animal worlds in soil (edafon; pedofauna); microfauna (protozoa, nematodes), mezofauna (spiders, maggots) and macrofauna (insects, annelids and etc.), their importance's and influences on soil fertility and plant cultivation, ecology, mutual relationship in food chain. Influence of agriculture (agritechnics) on pedofauna and biological diversity of soil.Microbiological diversity of soil's ecosystems. Transformations of energy and metabolic activity of soil's micro organisms. Control processes in soil. Through lectures and seminars elaborate the most important fungi and bacteria who we using in preparation of microbiological fertilizers. Bio fertilization of the soil - actual knowledge's

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Tate, R. L. (1995): Soil Microbiology. Wiley, New York.
2. Van Elsas, J. D., Trevors, J. T., Wellington, E. M. H.(1997): Modern Soil Microbiology. Marcel Dekker Inc., New York.
3. Maier, R. M., Pepper, I. L., Gerba, C. P. (2009): Environmental Microbiology. Academic Press Inc., San Diego.
4. Alef, K., Nannipieri, P. (1995): Methods in Applied Soil Microbiology and Biochemistry. Academic press Inc., San Diego.

Recommended literature:

1. Sylvia, D. M., Fuhrmann, J. J., Hartel, P. G., Zuberer, D. A. (2004): Principles and Applications of Soil Microbiology. Prentice Hall Inc., New York.
2. Varma, A., Oelmüller, R. (2007): Advanced Techniques in Soil Microbiology. Springer.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	2.00	1-6	Literature studying	Checking student activity orally (conversation), reviewing student's work
Seminar	0.40	1-6	Literature studying, seminar preparation andpresentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	3.60	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	6.00			

The way of calculating ECTS credits for certain activities:

Module carries 6 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
6 ECTS credits = 150 hours of module loads
50 teaching hours (lectures + exercises) = 2.00 ECTS (50 teaching hours/150 hours of total load x100 = 33.33% from total of 6 ECTS)
Seminar paper = 0.40 ECTS (10 hours/150 hours of total load x100 = 6.67% from total of 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	Plant Physiology	
Module coordinator	Tihana Teklić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	P - 45, E - 0, S - 15

Module aim

An overview ofmetabolism pathways at cell, tissue and plant levels, the consideration of conections among abiotic environmental factors and physiological processes, with particular emphasis on ecophysiological and molecular aspect of their regulation and the role of mineral nutrients in crop yield and quality formation.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Recognise and describe the linkage of plant physiological processes with morphological, ontogenetic and ecological factors.
2. Distinguish an impact of the abiotic and biotic factors on plant growth, development and productivity.
3. Evaluate stress indicators in plants by the analysis of phenotypic and chemical parameters.
4. Setup and perform the research in the area of plant physiology independently, as well as to make data analyses and to anotate the obtained results.
5. Write a scientific report based on the performed research.

Module content

Plant metabolism basics, the functions of inorganic and organic compounds in plant metabolism, primary and secondary metabolism pathways (biosynthesis and transformations of carbohydrates, proteins and lipids, biosynthesis and the role of secondary metabolism products). The influence of stressfull abiotic factors in the environment (light, water, temperature, mineral nutrient disorders, polutants) on the physiological processes in plants, as well as on their growth, development and yield formation. Plant nutrients uptake and transport in plant, an impact of the particular mineral nutrients on physiological processes and plant productivity.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☒ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminar and final exam using particular literature. Students are obliged to perform an independent seminar work. Performing some practical research work as the main part of the seminar, related to one or several thematic parts of the course, based on

the usage of relevant literature (journal papers, books and internet sources). Seminar work should be submitted in form of scientific paper prior to the final exam.

Literature

Required reading:

1. Pevalek-Kozlina, B. (2003): Fiziologija bilja. Profil International. Zagreb
2. Kastori, R.; Maksimović, I. (2008): Ishrana biljaka. Vojvođanska akademija nauka i umetnosti. Novi Sad.
3. Vukadinović, V., Lončarić, Z. (1998): Ishrana bilja. Udžbenik. Poljoprivredni fakultet Osijek.

Recommended literature:

1. Berg, J. M., Tymoczko, J. L., Stryer, L. (2013): Biokemija. 6. englesko izdanje i 1. hrvatsko izdanje. Školska knjiga, Zagreb
2. Lisjak, M., Špoljarević, M., Agić, D., Andrić, L. (2009): Praktikum iz fiziologije bilja. Poljoprivredni fakultet Osijek.
3. Taiz, L., Zeiger, E. (2006): Plant Physiology. 4th Edition. Sinauer Associates, Inc.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.80	1-2	Literature studying	Checking student activity through the consultations related to course topics and literature usage
Seminar	0.60	1-5	Literature studying, seminar preparation and presentation	Seminar evaluation
Final exam	3.60	1-5	Preparing for exam by studying required and recommended literature	Written exam
Total	6.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
6 ECTS credits = 150 hours of module loads
45 teaching hours (lectures + exercises) = 1.80 ECTS (45 teaching hours/150 hours of total load x100 = 30.00% from total of 6 ECTS)
Seminar paper = 0.60 ECTS (15 hours/150 hours of total load x100 = 10.00% from total of 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Fertilizers and Fertilization**	
Module coordinator	Zdenko Lončarić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 50, E – 0, S - 10

Module aim

Information on the effect of fertilization on the quantity and quality of agricultural crops, on methods of determining the need for fertilization, and the quantities and types of fertilizers.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Integrate knowledge about conditioners and fertilizers.
2. To assess the quality and fertilization value of organic fertilizers.
3. Evaluate the potential and impact of fertilization on soil fertility and product quality.
4. Compare the different methods of calculating the optimal fertilization.
5. Select the appropriate method of maintaining soil fertility, fertilization optimization and selection of fertilizers.

Module content

Soil conditioners, origin, composition, mode of action and their application. The origin and method of preparation of organic fertilizers. Composition and fertilization effect, and determining fertilizer requirements in organic fertilizers. Simple fertilizers, complex mineral fertilizers. The technology for producing fertilizers. Methods for determining the need for nutrients and fertilization of different plant species. Elements of soil fertility and method of determining fertilizer requirements. Calculator for calculate the dose of fertilization. Systematic soil fertility control and legislation in Croatia.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Lončarić, Z., Parađiković, N., Popović, B., Lončarić, R., Kanisek , J. (2015): Gnojidba povrća, organska gnojiva i kompostiranje. Sveučilišni priručnik. Poljoprivredni fakultet Sveučilišta u Osijeku.
2. Lončarić, Z., Karalić, K. (2015): Mineralna gnojiva i gnojidba ratarskih usjeva. Sveučilišni priručnik. Poljoprivredni fakultet Sveučilišta u Osijeku.
3. Lončarić, Z., Rastija, D., Popović, B., Karalić, K., Ivezić, V., Zebec, V. (2014): Uzorkovanje tla i biljke za agrokemijske i pedološke analize. Sveučilišni priručnik. Poljoprivredni fakultet Sveučilišta u Osijeku.
4. Lončarić, Z., Rastija, D., Baličević, R., Karalić, K., Popović, B., Ivezić, V. (2014): Plodnost i opterećenost tala u pograničnom području. Sveučilišni priručnik. Poljoprivredni fakultet Sveučilišta u Osijeku.
5. Lončarić, Z., Rastija, D., Karalić, K., Popović, B., Ivezić, V., Lončarić, B. (2015.): Kalcizacija tala u pograničnome području. Sveučilišni priručnik. Poljoprivredni fakultet Sveučilišta u Osijeku.
6. Vukadinović V. i Vukadinović Vesna (2011): Ishrana bilja, III izdanje. Poljoprivredni fakultet u Osijeku.

Recommended literature:

1. Bergman, W. (1992): Nutritional Disorders of Plants. Gustav Fisher, Jena.
2. Finck, A. (1982) Fertilizer and Fertilization. Verlag Chemie, Weinheim
3. Marschner P. editor (2011): Marschner's Mineral Nutrition of Higher Plants. Academic Press; 3 edition
4. Mengel, K. and Kirkby, E. A. (2001): Principles of plant nutrition, 5th ed., Kluwer Academic Publishers.
5. Sparks, D. L. (2002): Environmental Soil Chemistry, Academic Press; 2 edition
6. Butorac, A. (1999): Opća agronomija. Školska knjiga Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	2.00	1-5	Literature studying	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.40	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	3.60	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	6.00			

The way of calculating ECTS credits for certain activities:

Module carries 6 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

6 ECTS credits = 150 hours of module loads

50 teaching hours (lectures) = 2.00 ECTS (50 teaching hours/150 hours of total load x100 = 33.3 % from total of 6 ECTS)

Seminar paper = 0.,40 ECTS (10 hours/150 hours of total load x100 = 6.70 % from total of 6 ECTS)

Final exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00 % from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Field Soil Research**	
Module coordinator	Domagoj Rastija	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

Introducing students of postgraduate doctoral study with field research and with methods of pedological research depending on research standards and goals. Soil monitoring for different purposes.

Terms of admission

Module Pedology at undergraduate study.

Expected learning outcomes

After completing the module, student will be able to:

1. Plan field soli research.
2. Prepare and georeference bases for pedological maps creating.
3. Determine validity of appearance and relation of soil elemental areas.
4. Systematize the analytical data and prepare database for visualization.
5. Create soil thematic maps.
6. Evaluate soil for multipurpose use in the agriculture.

Module content

Types of pedological research for different purposes. Preparatory analyses for the field research. Creating photointerpretative maps in soil evaluation in relation to aim and scope of pedological researches.Defining validity of appearance and relation of mapped elemental areals. Geographic and soil information systems. Soil evaluation for multi-purpose in agriculture, forestry, engineering and soil protection. Soil monitoring for different purposes.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☒ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Regular attendance on lectures or consultations. Active participation in field research and in creating land informations system by GIS-tools. Studying the relevant literatures and recent projects. Stdents make individual seminar work and give an oral presentation on final exam.

Literature

Required reading:

1. JDPZ (1967): Priručnik za terenska istraživanja zemljišta. Beograd.
2. Bogunović, M., (1986): Pedološko kartiranje (interna skripta). Zagreb.

3. Burrough, P. A. (1989): Principles of Geographical Information Systems for Land Resources Assessment. Oxford, p.op. 194.

Recommended literature:

1. Frančula, T. (1999): Digitalna fotografija.
2. Canadian SSS, USA (1993): Soil Sampling and Methods of Analysis. Edited by Martin R. Carter.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.50	1-2	Literature studying	Discussion
Field research	0.50	3	Field research and validation of analytical data	Discussion of particular situation on field
Individual task	1.00	4-6	Literature studying, writing and prezentation of individual task	review and evaluation of the seminar work according to pre-established criteria
Exam	1.00	1-6	Preparation for the exam by studying required and recommended literature	Oral exam
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
Lectures = 0.50 ECTS (12,5 teaching hours/75 hours of total load x100 = 16.70 % from total of 3 ECTS)
Field research= 0.50 ECTS (12,5 teaching hours/75 hours of total load x100 = 16.70 % from total of 3 ECTS)
Seminar paper = 1.00 ECTS (25 hours/75 hours of total load x100 = 33.30% from total of 6 ECTS)
Final exam = 1.00 ECTS (25 hours/75 hours of total load x100 = 33.30% from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Determining Fertilizer Needs**	
Module coordinator	Boris Đurđević	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 30, E - 0, S - 0

Module aim

Module "Determining Fertilizer Needs" introduces laboratory and field methods of determining needs for fertilization of crops and permanent crops to Ph.D. students, trains them for interpretation of results of soil and plant tissue analysis and for issuing fertilization recommendation, nutrient balance, nutrient budget and management and also for spatial visualization, analysing and planning of crop production.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
1. Define and explain sampling of soil and plant.
2. Define and explain chemical methods of soil and plant tissue analysis.
3. Analyze and explain results of soil and plant tissue analysis.
4. Analyze and explain results of fertilization recommendations for crops and to choose optimal formulations and quantities of fertilizer for crops
5. Analyze and apply computer methods of determining fertilizer needs by using analytical and other data on plant species, soil, climate, agrotechnic, etc.
6. Form and apply interpretation data base

Module content

Introduction to methodology of soil and plant tissue sampling for the purpose of creation of fertilization recommendations, soil fertility control and calibration of chemical extractive methods, methods of chemical analysis and interpretation of results. Calculation of fertilizer needs on the basis of results gained through soil and plant tissue analysis, gathered dana on soil, climate, crop, type of production, level of investment, etc.
Mastering advanced methods of development of fertilization recommendations by using compters (fertilizer recommendation calculator) and interpretational dana bases.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☒ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to continuously attend lectures or consultations and to activly participate in discussions and in solving presented task. After this, students will be obliged to take the final exam. Students are advised to prepare exams from required literature.

Literature

Required reading:

1. Vukadinović, V., Vukadinović, V. (2011): Ishrana bilja. Poljoprivredni fakultet u Osijeku, Osijek.
2. FAO (2003): Assessment of soil nutrient balance, Approaches and methodologies, Rome.
3. Finck, A. (1982): Fertilizers and Fertilization, Introduction and practical guide to crop fertilization). Verlag Chemie, Weinheim.
4. Đurđević, B. (2014): Praktikum iz ishrane bilja. Poljoprivredni fakultet u Osijeku, Osijek.
5. Vukadinović, V., Bertić, B. (2013): Filozofija gnojidbe.

Recommended literature:

1. Marschner, H. (1995): Mineral nutrition of higher plants. Academic Press.
2. Follet, R. F. (1987): Soil Fertility and Organic Matter as critical Components of Production System. SSSA Special Publication Number 19. Soil Science Society of America. Madison, Wisconsin, USA.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.20	1-6	Studing from requiredand recommended literature, assignment work	Checking the activities carried out through oral conversation, reviewing student's work and assignments
Final exam	1.80	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
30 teaching hours (lectures + exercises) = 1.20 ECTS (30 teaching hours/75 hours of total load x100 = 40% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Modelling od Agroecosystems**	
Module coordinator	Zdenko Lončarić	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E – 5, S - 10

Module aim

Introduce the students with the basics of computer modeling. Using practical examples teach students how to develop its own model based on ecosystem properties, and how to use existing models for analytical and forecasting purposes.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the types and levels of system boundaries, elements and characteristics of the system.
2. Classify the types and levels of models and relationships within the models and methods of optimization, testing and validation of the model.
3. Explain stages of development of simulation models.
4. Describe the elements and properties of ecosystem in the area of soil quality, the basic physiological processes and plant growth and development, root growth, soil moisture and nutrients adoption.
5. Describe the purpose, structure and operation of existing models.
6. Collect initial data set for the description of the system and compile a description of the mathematical model.
7. Test simulation model of the plant production to existing data set, and then validate the new data set.
8. Explain the advantages and disadvantages, scope and application of simulation models in plant production.

Module content

Systems and models: types, levels, borders, elements, attributes, stages of analyzing the system and creating the model, model development, model structure, types of input data for the model work, testing and validation of models. Recognition of the existing different models ecosystem. Computer modeling agrophytocoenoses using example of winter wheat or sugar beet. In the exercises, study the existing computer models, the structure of the various data sets required for the models, analytical and forecasting use of models. Practical work with computer programs, information on the findings of simulation models in forecasting and analytical modes, create own model of a certain segment of the ecosystem (from the structural model to computor simulation model). Choosing the system based on personal professional competence, and then in the seminar include a description of the system, mathematical and (or) computer model, a set of data for the model, test results and model validation.

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Lončarić, Z. (2010): Modeliranje biljne proizvodnje. Poljoprovredni fakultet u Osijeku. Interna skripta.
2. Lončarić, Z. (1999): Matematičko modeliranje rodnosti ozime pšenice. Doktorska disertacija. Poljoprivredni fakultet u Osijeku. Osijek.
3. Driessen, P. M. (1986): The Q.L.E. primer. A first introduction to quantified land evaluation procedures. Agricultural University, Wageningen, The Netherlands.

Recommended literature:

1. Hanks, J., Ritchie, J. T. (1991): Modelling Plant and Soil Systems. Number 31 in the series Agronomy. ASA, CSSA, SSSA. Madison, Wisconsin, USA.
2. Boote, K. J., Loomis, R. S. (1991): Modeling Crop Photosynthesis – from biochemistry to Canopy. CSSA Special Publication Number 19. CSSA, ASA. Madison, Wisconsin, USA.
3. Jones, J.W., Mishoe, J.W., Boote, K. J. (1987): Introduction to simulation and modeling. Food&Fertilizer Technology Center. Technical Bulletin 100.
4. Rengel, Z. (1993): Mechanistic simulation models of nutrient uptake: A review. Plant and Soil 152: 161-173.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-8	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.40	1-8	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to thepre-established criteria
Final exam	1.80	1-8	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)

Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)

Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Nutrition of Woody Plants**	
Module coordinator	Lepomir Čoga	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 30, E - 0, S - 0

Module aim

Highlight and explain differences in nutrition and fertilization of woody plants which store certain nutrients in the form of organic compounds such reserve in relation to a one-year agricultural cultures which receive nutrients continuously throughout the growing season.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the differences in nutrition of perennial in relation to a one-year agricultural cultures.
2. Explain and compare the fertilization of woody and annual crops.
3. Identify and enumerate the essential macro and micronutrients.
4. Recognize the symptoms of deficiency and excess of certain nutrients in the vegetative and generative organs of woody plants.
5. Carry out sampling of soil and plant material.
6. Plan and calculate quantities and select the best type of fertilizer according to soil analysis and woody species requirements.

Module content

Discuss biogenic elements and their physiological role in woody plants nutrition. Discuss the specifics and differences at woody plants nutrition and accurately determine the amount and time of basic fertilization of woody plants based on soil reaction and chemical analysis of the soil, as well as the time of topdressing depending of developmental stages of the plant.Discuss optimal chemical properties of soil and plant nutritional capacity of the soil for the cultivation of certain woody plants. Discuss the problem of sampling of soil and plant material and chemical methods for the analysis of soil and plant material.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☒ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to continuously attend lectures or consultations and to activly participate in discussions and in solving presented task. After this, students will be obliged to take the final exam. Students are advised to prepare exams from required literature.

Literature

Required reading:

1. Ćosić, T. (2003): Ishrana bilja, Agronomski fakultet Sveučilišta u Zagrebu.
2. Škvorc, Ž., Ćosić, T., Sever, K. (2014): Ishrana bilja. Šumarski fakultet Sveučilišta u Zagrebu.
3. Vukadinović, V., Vukadinović, V. (2011): Ishrana bilja. Poljoprivredni fakultet u Osijeku, Osijek.
4. Vukadinović, V., Bertić, B. (2013): Filizofija gnojidbe. Poljoprivredni fakultet Osijek, Osijek.
5. Finck, A. (1982): Fertilizers and Fertilization, Introduction and practical quide to crop. Baselertilization.
6. Butorac, A. (1999): Opća agronomija. Školska knjiga, Zagreb.

Recommended literature:

Bergmann, W. (1992): Nutritional Disorders of Plants. Gustav Fisher, Jena.
2. Marschner, H. (1995): Mineral nutrition of higer plants. Academic Press.
3. Mengel, K., Kirkby, E. A. (1987): Principles of Plant Nutrition. International Potash Institute, Bern, Switzerland.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.20	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	1.80	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
30 teaching hours (lectures + exercises) = 1.20 ECTS (30 teaching hours/75 hours of total load x100 = 40.00% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Fertilization in Organic Production**	
Module coordinator	Brigita Popović	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 0, S - 10

Module aim

Introduce soil suitability for organic production, aspects of fertilization in organic farming, evaluation of the quality of fertilizers and conditioners in order to maintain and improve soil fertility, achieving optimal yield and environmental impact.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Interpret the importance and role of soil productivity with ecological and fertilization aspects.
2. Identify existing legislation on organic farming.
3. Describe the manufacture and properties of liquid and solid organic fertilizers.
4. Describe composting process and compost properties.
5. Describe the importance of the permitted minerals and conditioning materials in organic agriculture.
6. Create a seminar paper on nutrients balancing on organic farm.

Module content

The legislation in organic agriculture with emphasis on nutrient management. Production and properties of liquid and solid organic fertilizers as well as composting and production of various types of compost. Ecological aspects of organic fertilization. The use of the permitted materials for mineral fertilization and materials for soil properties improving and measurements for soil melioration in organic agriculture. Evaluation of quality, fertilization and environmental effects of applied fertilizers on the environment. Calculations of optimal quantity of organic fertilizers or conditioners required for cultivation of various crops in organic agriculture.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works. Schedule of presentations will be arranged in advance. After the lectures, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Vukadinović, V., Lončarić, Z. (1998): Ishrana bilja. Poljoprivredni fakultet Osijek.
2. Butorac, A. (1999): Opća agronomija. Školska knjiga Zagreb.
3. Finck, A. (1982) Fertilizer and Fertilization. Verlag Chemie, Weinheim.
4. Znaor, D. (1996): Ekološka poljoprivreda. Nakladni zavod „Globus". Zagreb.
5. Epstein, E. (1997): The Science of Composting. Technomic, Basel.

Recommended literature:

1. Magdoff, F. R., Tabatabai, M. A., Hanlon, E. A. (1996): Soil Organic Matter: Analysis and Interpretation. SSSA Special.
Publication Number 46. SSSA. Madison, Wisconsin, USA.
2. Benčević, K. (1993): Biokont. Osnove biološkog poljodjelstva. Poslovna zajednica za stočarstvo. Zagreb.
3. Adams, F. (1984): Soil acidity and liming. Number 12 in th series Agronomy. ASA, CSSA, SSSA. Madison, Wisconsin, USA.
4. (1996): Methods of Soil Analysis. Part 3-Chemical methods. Soil Science Society of America. Madison USA.
5. (1990): Soil Testing and Plant Analysis. Soil Science Society of America. Madison USA.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-6	Required and recommended literature studying	Checking student activity orally (conversation) and by activity in class
Seminar	0.40	1-6	Literature studying, nutrient balance calculation within the seminar paper	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.80	1-6	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Fertilization in Greenhouses**	
Module coordinator	Tomislav Vinković	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

Get candidates acquainted with technology choice in greenhouse growing vegetables and flowers as well as fertilization methods by applying modern technical – technological system focusing on crop rotation.

Terms of admission

Passed modules from first semester.

Expected learning outcomes

After completing the module, student will be able to:

1. Define growing conditions of plants in greenhouses.
2. Describe effect of abiotic and biotic factors on plant growth and development in the controlled conditions.
3. Explain concept of fertilization in greenhouses growing.
4. Describe fertilizer water - irrigation system.
5. Select choice of nutritive solution in hydroponic growing by cultures (rations and interval).
6. Explain agro-ecological aspects of growing plants in greenhouse.

Module content

Growing conditions of plants in greenhouses. Effect of abiotic and biotic factors on plant growth and development in the controlled conditions. Concept of fertilization in greenhouses growing (warm beds, plastic houses and glasshouses), fertilizer water - irrigation system, choice of nutritive solution in hydroponic growing by cultures (rations and interval), agro-ecological aspects (soil changes, growing with substrates and without, polymer materials application, climate in greenhouses., biotechnology, organization approach, economic importance.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Final exam is oral. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Bergmann, W. (1983): Ernahhrungsstorungen Bergmann, W. (Hrsg.), Ernährungsstörungen bei Kulturpflanzen – Entstehung und Diagnose – VEB Gustav Fischer Verlag, Jena.
2. Parađiković, N. (2009): Opće i specijalno povrćarstvo. Poljoprivredni fakultet Osijek.
3. Parađiković, N. (2009): Zaštićeni prostori plastenici – staklenici. Poljoprivredni fakultet Osijek.
4. Parađiković, N. (2014): Opće i specijalno povrćarstvo. Poljoprivredni fakultet u Osijeku (http://www.pfos.unios.hr/~dsego/ftp/Nastava/Op%C4%87e%20i%20specijalno%20povr%C4%87arstvo/).
5. Parađiković, N. (2014): Osnove florikulture. Poljoprivredni fakultet Osijek http://www.pfos.unios.hr/~dsego/ftp/Nastava/Nastava%20Florikultura/.

Recommended literature:

1. Delaplane, K. S., Mayer, D. F. (2000): Crop pollination by bees. CABI Press, New York.
2. Free, J. . (1993): Insect pollination of crops. Academic Press, London, UK, and San Diego, CA.
3. Sonneveld, C., Voogt, W. (2009): Plant Nutrition of Greenhouse Crops, Springer, New York, U.S.A.
4. Taiz, L., Zeiger, E. (1998): Plant Physiology. Sinauer Associates, Inc. Publishers. Sunderland, Massachusetts, U. S. A.
5.Tanji, K. K. (1990): Agricultural salinity assessment and management. American Society of Civil Engineers, New York, U.S.A.
6. Scientific and expert pappers from relevant journals and databases related fertilization of vegetable and flowers grown in greenhouse.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.40	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.80	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads

20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**The Quality of Plant Products**	
Module coordinator	Drago Bešlo	
Study programme	Postgraduate university study of Agricultural Sciences, major Agrochemistry	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 23, E - 0, S - 7

Module aim

Interpret the need to achieve a good quality crop plant products, which by their chemical composition and specific functional components affect human health and their safety. Emphasis will be placed on energy and the biological function of plant based foods in the human diet. Phytochemicals and their antioxidant activity, and their great importance, for human health and animal health.

Terms of admission

Physiology of plants.

Expected learning outcomes

After completing the module, student will be able to:

1. To analyze the energy and biological role of introduced foods.
2. Explain the structure and conditions of synthesis of secondary matabolita (phytochemicals).
3. Determine the quality of forage crops on arable land (cereals, legumes, root-tuber and other fodder crops).
4. Categorize toxic substances in roughage.
5. Analyze and determine total phenols and determine antioxidant activity.
6. Analyze and interpret scientific and professional papers from-functional food of plant origin.

Module content

A complete overview of the energy and the biological role of plant-based foods in the human diet. Conditions of synthesis and the synthesis of phytochemicals in plants and their role in human health. Catabolism and anabolism of flavonoids. Antioxidant activity and importance in human nutrition. Processing of scientific and technical literature and interpretation of results.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

A complete overview of the energy and the biological role of plant-based foods in the human diet. Conditions of synthesis and the synthesis of phytochemicals in plants and their role in human health. Catabolism and anabolism of flavonoids. Antioxidant activity and importance in human nutrition. Processing of scientific and technical literature and interpretation of results.

Literature

Required reading:

1. Mandić, M. (2003): Znanost o prehrani-hrana i prehrana u čuvanju zdravlja. Prehrambeno-tehnološki fakultet Osijek, Tisak TIPO Osijek.
2. Vaclavik, V. A. (2003): Essentials of Food Science. Chapman and Hall, Bon.
3. Johnson, I. T., Williamson, G. (2003): Phytochemical Function Food. Woodhead Publishing.
4. Devlin, T. M. (2008): Textbook of Biochemistry with Clinical Correlation. Seventh Edition. John Wiley and Sons.
5. Časopisi: Phytochemistry, Food Research Internationl, Journal of Food Composition and Analyses, Communications in Soil Science and Plant Analyses i dr.

Recommended literature:

1. Voet, D., Voet, J. G., Pratt, C. W. (2008): Principles of Biochemistry. Third Edition. John Wiley and Sons.
2. Bešlo, D. (2014): Praktikum iz biokemije. Poljoprivredni fakultet u Osijeku.
3. Boyer, R.F. (1993): Modern experimental biochemistry. Second Edition. The Benjamin / cumming Publishing Company Inc.
4. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2004): Essential cell biology. Second Edition. Garlad Science, Taylor Francis Group.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and seminars	0.80	1-6	The study of literature and prepares questions	Checking renewed activity through oral discussion and explanation prepared questions.
Writing term papers	0.40	1-6	Studying and writing term papers from the problematic.	Review and evaluation of seminar papers.
Final exam	1.80	1-6	Preparation for the exam by studying compulsory and prepoučene literature.	Exam (written and oral).
Total	3.00			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1 ECTS = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
23 hours of instruction (lectures and repeat) = 0.80 ECTS (23 teaching hours/75 hours of total work hours x 100 = 30.67% of the total 3 ECTS)
7 hours Papers = 0.40 ECTS (7 hour/75 hours of total work hours x 100 = 9.33% 3 ECTS)
Final exam = 1.80 (45 hours preparation/75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment

Evaluation of teachers and the quality of the following is the module via anonymous student surveys.

After completing the major Agrochemistry, student will be able to:

Learning Outcome 1	Evaluate the soil as a substrate of plant nutrition from pedological and agrochemical point of view
Learning Outcome 2	Determine biological indicators of soil quality and predict their role in agro-eco system
Learning Outcome 3	Define impact of agroecological factors on physiological processes in plants and evaluate role of mineral nutrients in crop yield and quality
Learning Outcome 4	Assess the effect of fertilization on soil fertility, crops yield and quality
Learning Outcome 5	Apply field and analytical procedures and methods in the analysis of soil and plants and recommend soil remediation based on the analysis
Learning Outcome 6	Apply computer simulation model based on ecosystem properties in analytical and forecasting purposes
Learning Outcome 7	Manage the production in ecologically sustainable way
Learning Outcome 8	Synthesize knowledge from agrochemistry and carry out the applied research in this area

ANIMAL FEEDING AND FORAGE TECHNOLOGY

2.3. Modules of major Animal Feeding and Forage Technology

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Introduction to Scientific Work	30	3
2.	Biometrics in Zootechnics	30	3
3.	Selected Topics in Biochemistry	30	3
4.	Physiology	30	3
5.	General Feeding	60	6

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Forage Crops	40	4
2.	Special Feeding I – Herbivores	40	4
3.	Special Feeding II- Omnivores	40	4
4.	Economics in Livestock Production	40	4
5.	Technology of Feed Mixtures Production	40	4
6.	Feeding Pathology	40	4
7.	Premises and Equipment in Livestock	40	4
8.	Micropopulation in Digestive System of the Domestic Animals	40	4

2.3.1. Learning outcomes of major Animal Feeding and Forage Technology

Module name	**Introduction to Scientific Work**	
Module coordinator	Pero Mijić	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 30, S - 0, E - 0

Module aim
The aim of this module is to introduce the postgraduate students to the basic principles of the scientific research, including the composition and publication procedures.

Terms of admission
No preconditions

Expected learning outcomes
After completing the module, student will be able to:
1. Apply the scientific method to the example of his own research.
2. Set scientific hypotheses and objectives of the work.
3. Conduct and write your own scientific work at the predicted structure of scientific work.
4. Own devise a current scientific topic and present a paper.
5. Apply the computer in scientific research, and analyze the collected scientific papers.
6. Critically evaluate the scientific and professional work, and klasifikicirati used literature.

Module content
Significance of the scientific research, scientific workers and their professionalization, scientific methods, choosing the research topic, experimental research, publication types, structure of a scientific work, preparing the manuscript for the publication, oral presentation of the scientific results, legislation.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
Students are advised to prepare exams from the successful exam.

Literature

Required reading:

1. Knežević, I., Mijić, P. (2006): Uvod u znanstveni rad – drugo, dopunjeno i izmjenjeno izdanje. Poljoprivredni fakultet u Osijeku, Sveučilište J. J. Strossmayera u Osijeku. pg 80.
2. Knežević, I. (1988): Uvod u znanstveni rad. Poljoprivredni fakultet, Osijek. pg 54.

Recommended literature:

1. Mijić, P., Knežević, I. (2005): Uporaba Interneta u poljoprivredi. Stočarstvo, 59 (1) 71-78.
2. Zelenika, R. (2000): Metodologija i tehnologija izrade znanstvenog i stručnog djela. Četvrto izdanje. Ekonomski fakultet u Rijeci.
3. Baban, Lj., Ivić, Kata, Jelinić, S., Lamza-Maronić, Maja, Šundalić, A. (2000): Primjena metodologije stručnog i znanstvenog istraživanja. Ekonomski fakultet u Osijeku, Osijek.
4. Zelenika, R. (1991): Kako nastaje recenzija znanstvenog i stručnog rada. Zavod za istraživanja i razvoj sigurnosti, Zagreb.
5. Silobrčić, V. (1989): Kako sastaviti i objaviti znanstveno djelo. Drugo izdanje. JUMENA, Zagreb.
6. Žugaj, M. (1989): Osnovi znanstvenog i stručnog rada. «Zagreb» r. o. za grafičku djelatnost, Samobor.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	1.20	1-6	Studying literature, assignments	Checking the activities carried out through oral conversation, delivery and review assignments made
Final exam	1.80		Preparation for theexam by studying recommended literature	Oral examination
Total	3.00			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1ECTS point = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
30 hours of instruction (lectures and practice) = 1.20 ECTS (30 teaching hours / 75 hours total load x100 = 40% of the total 3 ECTS)
Final exam = 1.80 ECTS (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Biometrics in Zootechnics**	
Module coordinator	Andrijana Rebekić	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 10, S - 0

Module aim

To introduce students of doctoral studies with basic statistical methods, specificities of setting up experiments in zootechniques and data processing. The aim is to enable students to independently perform scientific work and to analyze results.

Terms of admission

None

Expected learning outcomes

After completing the module, student will be able to:

1. Describe statistical methods used in the zootechnical.
2. Select statistical method depending on the set problem.
3. Use advanced statistical packages when working with a computer.
4. Comment the results of statistical calculations.
5. Interpret the results for statistical hypothesis testing.
6. Justify why certain applied the statistical method in certain calculations.
7. To select the most appropriate statistical method for data processing.

Module content

Adopting theoretical knowledge of mammal organism functioning. Form and function of the cells. Students will be able to explain tissue composition, metabolic processes, centres of gene expression and regulation. They will be able to define defence mechanisms from pathogens and stressors. They will be introduced with action of nutritive and biologically active substances on modification of immune cell response. Students will be able to prepare seminar using up to date scientific literature.

Types of teaching

☒ lectures	☒ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Participation in teaching and solving the problem. Students will solve tasks with the help of some of the recognized statistical package (Statistica, SAS, SPSS). Lectures will take place with the help of power point presentation to students easily understand the course content. During the semester is scheduled for the final exam, which includes one task from three areas: 1st. distribution, hypothesis testing and determine the sample size; 2nd. ANOVA and MANOVA; 3rd Regression and correlation analysis.The final exam consists of written part (five tasks, of which

two dealt exclusively with the aid of computers) and oral (interpretation of results).Due to the complexity of formulas to calculate assignments students can use all the available literature, lecture notes and presentations in Power Point 2013. Students are advised to conduct lecture notes.The entire teaching material for students will be available in electronic form.

Literature

Required reading:

1. Kralik, G., Škrtić, Z., Kralik Z. (2012): Biometrika u zootehnici. Grafika, Osijek.
2. Horvat, D., Ivezić, M. (2005.): Biometrika u poljoprivredi. Grafika, Osijek.
3. Kaps, M., Lamberson, W.R. (2004): Biostatistics for animal science. CABI Publishing, CAB International, Wallingford, UK.
4. Šošić, I. (2004.): Primijenjena statistika. Školska knjiga, Zagreb.
5. Gogala, Z. (2001.): Osnove statistike. Nakladništvo Sinergija d.o.o.
6. Šošić J., Serdar V. (2000): Uvod u statistiku. Školska knjiga, Zagreb.

Recommended literature:

1. Priručnici za korištenje statističkih programa

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.2	1-7	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	1.8	1-7	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
30 teaching hours (lectures + exercises) = 1.20 ECTS (30 teaching hours/ and exercises/75 hours of total load x 100 = 40.00% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Selected Topics in Biochemistry**	
Module coordinator	Drago Bešlo	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 30, E - 0, S - 0

Module aim

Link metabolic processes of various organs and their way of regulation. Then explain the interaction of metabolic pathways in the example of the flow of molecules through three key metabolic crossroads. These glucose-6-phosphate, pyruvate and acetyl-CoA. Then follows a discussion of the major hormonal regulators of energy metabolism as well as the storage, transfer of information and the regulation of gene expression.

Terms of admission

No conditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand and catabolism and anabolism linked macromolecules.
2. Analyse the processes in organs and their regulation.
3. Interpret the hormonal regulation of metabolism.
4. Connecting signaling of glucose levels and understand the role of coordination of hormones in different tissues.
5. Determine how you entered excess food is stored as glycogen or triacylglycerols.
6. Analyze and interpret the knowledge gained in biochemistry with knowledge obtained in other areas to determine the proper animal nutrition.
7. Analyse and describe the mechanisms that regulate gene transcription and regulation of metabolism explain the coordinated regulation synthesis of enzymes at the level of gene transcription and regulation postsintetske and enzyme activity in cells and energy charge needs of certain metabolites.
8. Qualify PhD student to interpret data from the literature and their application.

Module content

A complete view of catabolic and anabolitičkih aspects of metabolic processes with a focus on the molecular basis of metabolism, including material information molecules, their synthesis and methods of action and complex regulation of gene expression.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

PhD students are required to attend lectures. Come to classes prepared where the processed reading materials so that they can equally participate in the discussions.

Literature

Required reading:

1. Berg J. M., Tymoczko J. L., Stryer L. (2013) Biochemistry, 6th edition England, 1st edition Croatia, School book, Zagreb.
2. Bešlo D. (2014)Practicum of boichemistry, Faculty of Agriculture in Osijeku.
3. Devlin T. M.(2008) Textbook of Biochemistry with Clinical Correlation, Seventh Edition, John Wiley @Sons.
4. Voet D., Voet J. G., Charlotte Ch W. Pratt W. (2008) Principles of Biochemistry; Third Edition , John Wiley @Sons.
5. Karlson P. (2003) Biochemistry, School book, 2003.

Recommended literature:

1. Voet D., Voet J. G., Charlotte, Ch. W., Pratt, W. (2006) Fundamentals of Biochemistry, Life at the molecular level, John Wiley@Sons.
2. Albert B., Bray D., Lewis J., Raff M., Roberts K., Watson, J. D. (1994) Molecular biology of the cell, Third Edition, Garland Publishing, Inc. New York@London.
3. Alberts B., Bray D., Hopkin K., Johnson A., Lewis J., Raff M., Roberts K., Walter P. (2004) Essential cell biology, Second Edition, Garlad Science, Taylor Francis Group.
4. Boyer, R. F. (1993) Modern experimental biochemistry, Second Edition, The Benjamin/cumming Publishing Company, Inc.
5. Nelson D. L., Cox M. M. (2000) Lehninger Principles of Biochemistry, Worth Publishers.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dlexercises	1.20	1-8	The study of literatureand prepares questions.	Checking renewed activity through oral discussion andexplanation prepared questions.
Final exam	1.80	1-8	Preparation for the exam by studying compulsory and prepoučene literature.	Exam (written and oral).
Total	3.00			

The way of calculating ECTS credits for certain activities:
The module has 3 ECTS credits
1 ETCS= 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
30 hours of instruction (lectures) = 1.20 ECTS (30 teaching hours / 75 hours of total work hours x 100 = 40.00%
Final exam = 1.80 (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment
Evaluation of teachers and the quality of the following is the module via anonymous student surveys.

Module name	**Physiology**	
Module coordinator	Marcela Šperanda	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S - 5

Module aim

Adopting theoretical knowledge of mammal organism functioning. Form and function of the cells. Students will be able to explain tissue composition, metabolic processes, centres of gene expression and regulation. They will be able to define defence mechanisms from pathogens and stressors. They will be introduced with action of nutritive and biologically active substances on modification of immune cell response. Students will be able to prepare seminar using up to date scientific literature.

Terms of admission

No prerequisite.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand cell membrane transport, intercell communication an control of gene expression.
2. Integrate the metabolism of nutrients and their bioavailability depending on other nutrients.
3. Distinguish the trace elements metabolism.
4. Enumerate innate and acquired immune system. Describe role of mucosal immunity.
5. Understand role of the endocrine system in the metabolic processes.
6. Evaluate parameters of clinical evaluation in the light of production tasks.

Module content

Defining the structures and functions of cell compartments. Ways of cross membrane transport and intercell communication. Functioning of the specific and nonspecific immune defence. Functioning of the gut lymphoid tissue, influence of feed composition and gut microflora on tissue defence. Endocrine glands, form and function, functions of growth hormone, steroid hormones, insulin, glucagon and gastrointestinal hormones. Metabolism of the nutrients and biological active substances. Determination of biochemical parameters. Estimation of liver function, metabolic and energetic status, acid-base balance.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Participate in the teaching process, prepare literature

Literature

Required reading:

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2007): Molecular biology of the cell. 5th edition, Garland Science, Taylor and Frencis Group, New York, USA.2. Cooper G. M., Hausman R. E. (2004): Stanica, molekularni pristup. Medicinska naklada, Zagreb.
3. Squires, E. J. (2003): Applied Animal Endocrinology. CABi Publishing International.
4. D'Mello J. P. F. (2000): Farm Animal Metabolism and Nutrition. CABi Publishing.
5. Ojeda, S. (2011): Textbook of Endocrine Physiology. Oxford University Press.
6. Doppenberg, J., van der Aar, P. (2010): Dynamics in animal nutrition. Wageningen Academic Publishers.
7. Tyzard I. (2013): Veterinary immunology, Saunders company.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1	1-5	Studying the literature	Verification activities
Seminar	0.2	3-5	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.8	1-6	Preparing for exam by studying required literature	Exam (oral)
Total	3			

The way of calculating ECTS credits for certain activities:

Modul has 3 ECTS credits; 20 L, 5 S, 5 E.
1 ECTS = 25 hours
3 ECTS boda = 75 hours
25 hours lectures= 1 ECTS (25 hours/75 total load x 100 = 33.33% from total 3 ECTS)
Seminar= 0.2 ECTS (5 hours/75 total load x 100 = 6.67% from total 3 ECTS)
Final exam= 1.8 ECTS (45 hours/75 total load hours x 100 = 60.00% from total 3 ECTS

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**General Feeding**	
Module coordinator	Matija Domaćinović	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 40, E - 15, S - 5

Module aim

To present the importance of specific chemical structure of nutrients and their nutritional functions in the body of animals. To evaluate tracking pathway of matter and energy in the body of animals through exact practical methods.

Terms of admission

Physiology- selected chapters, Biochemistry

Expected learning outcomes

After completing the module, student will be able to:

1. Present methods for estimating digestibility of nutrients of feed materials and methods of evaluation of balance of carbon and nitrogen.
2. Determine the energy value of forage by using newer energy units.
3. Assess the nutritional value of certain nutrients and standardize their needs in animal nutrition.
4. Establish nutritional and anti-nutritive value of different ingredients and to propose their optimal amount in food of an individual animal.

Module content

Determination of digestibility through direct and indirect method, impact on digestibility, and forming bilance of N and C. Calculation of energy value of feed expressed in energy units - starch value, oat unit, barley units, TDN, total energy, digestible energy, metabolizable energy and productive energy. Practical exercises dealing with the basic analysis of animal feed. Energy and building nutrients (carbohydrates, fats, proteins, minerals, vitamins, etc. active ingredient) - their structure and metabolism. Feed materials for animal feeding, nutritional value and recommendations for their application.

Types of teaching

☒lectures	☐ individual tasks
☒seminars and workshops	☐ multimedia and network
☒exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Each student should prepare a written essay based on recommended literature and to present it orally as a Power Point presentation. The student is obliged to participate in laboratory analysis of the basic fodder.

Literature

Required reading:

1. Domaćinović, M. (2006): Hranidba domaćih životinja, Hranjive tvari, Krmiva, Poljoprivredni fakultet Osijek.
2. Jeroch, H., W. Drochner, Simon, O. (1999): Ernährung landwirtschaftlicher Nutztiere, Verlag Eugen Ulmer, Stuttgart.
3. Kirchgeßner, M., F. X. Roth, F. J. Schwarz, G. I. Stangl (2008): Tierernährung, Verlag, Frankfurt am Main.

Recommended literature:

1. Mc Donald, P., Edwards, R. A., Grenhalgh, J. F. D., Morgan, C. A. (2002): Animal nutrition, 6th ed. Person Education. Edinburg.
2. Mc Dowell, L. R. (2000): Vitamins in animal and human nutrition, 2nd ed. Iowa State University Press/Ames.
3. Underwood, E. J., Suttle, N. F. (2001): The Mineral nutrition of livestock. 3rd ed. CABI Publishing.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	2.20	1-4	The study of literature, calculation tasks	Checking the activities carried out through oral conversation, delivery and review of calculated tasks
Seminars	0.2	1-4	The study of literature, preparation, and presentation of seminars	Evaluating the quality of written and presented seminar paper
Final exam	3.6	1-4	The study of required and recommended literature	Exam (written and oral)
Total	6			

The way of calculating ECTS credits for certain activities:

The module has 6 ECTS credits
1ECTS point = 25 hours of workload (hours of student work)
6 ECTS credits = 150 hours of load modules
55 hours of teaching workload (lectures and practice) = 2.20 ECTS (55 hours /150 hours total load x100 = 36.67 of total 6 ECTS)
Seminar = 0.2 ECTS (5 hours /150 hours total load x100 = 3.33% of total 6 ECTS)
Final exam = 3.6 ECTS (90 hours of preparation /150 hours of total work hours x 100 = 60.0% of total 6 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above described module via anonymous student surveys.

Module name	**Forage Crops**	
Module coordinator	Gordana Bukvić	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 10, S - 0

Module aim
To organize forage production and conservation for arable and grassland forages, accordingly to the livestock nutrition needs and environmental conditions.

Terms of admission
No prerequisites

Expected learning outcomes
After completing the module, student will be able to:
1. To choose the adequate forage crop for forage production according to the agroecological conditions
2. To estimate and calculate the needed amounts of various forages
3. To plan various ways of forage utilization (cutting, grazing) in accordance with available resources (land area, labor, technical equipment, finance)
4. To organize the forage production on arable land and/or grasslands
5. To organize the conservation of forages

Module content
Environemntal factors in forage crops production (soil, climate, plant nutrition, plant pests, agronomy for forages). Forages on arable land (perennial legume and grasses) - production, quality, ways of utilization. Forage production on permanent grasslands. Grassland resources in Croatia and the World, productivity traits of grasslands and their's determination, measures for maintenance and improvement of productivity (grassland agronomy and amelioration), rational utilization of grasslands for forage (cutting, grazing), assessment of the grasslands importance in forage production and environement protection. Conservation of forages. Choice of forage system in accordance with environemental conditions (soil and climate) and available resources (land area, labor, technical equipment, finances). Estimation of productivity potential of the available resources in the given environment. Harmonization of forage production with livestock nutrition needs.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Countinous and active attendance and participation (in discussions) during the teaching. Active participation in solving the tasks during the exercises. After the completion of lectures and exercises students take an oral examination.

Lectures will be supported by PowerPoint presentations to provide the better explanation of issues being discussed.

Printed presentations (handouts) will be available to students, though, students are adviced to register their own notes, which will help them to prepare for the final exam.

Literature

Required reading:

1. Stjepanović, M., Štafa, Z., Bukvić, G. (2008): Trave za proizvodnju krme i sjemena. Sveučilišni udžbenik. Hrvatska mljekarska udruga. Zagreb

2. Stjepanović, M., Zimmer, R., Tucak, M., Bukvić, G., Popović, S., Štafa, Z. (2009): Lucerna. Sveučilišni udžbenik. Poljoprivredni fakultet u Osijeku i Poljoprivredni institut Osijek. Osijek

3. Stjepanović, M., Steiner, Z., Domaćinović, M., Bukvić, G. (2002): Konzerviranje krme. Priručnik. Agroekološko društvo u Osijeku.

Recommended literature:

1. Alibegović-Grbić, S. i sur. (2005.): Unapređenje proizvodnje krme na prirodnim travnacima. Sveučilišni udžbenik. Univerzitet u Sarajevu, Poljoprivredni fakultet. Sarajevo, Bosna i Hercegovina.

2. Barnes, R. F., Nelson, J. C., Moore, K. J., Collins, M. (2007.): Forages. Volume II, The science of grassland agriculture, 6th edition. Blackwell Publishing. Ames, Iowa, USA.

3. Frame, J., Charlton J. F. L., Laidlaw A. S. (1998): Temperate forage legumes. CAB International. Alibegović-Grbis, S. i sur. (2005.): Unapređenje proizvodnje krme na prirodnim travnacima. Sveučilišni udžbenik. Univerzitet u Sarajevu, Poljoprivredni fakultet. Sarajevo, Bosna i Hercegovina.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.6	1-5	Studing the literature, solving the tasks	Activity during the teaching, evaluation of the offered solutions of the tasks
Final exam	2.4	1-5	Studing the required reading and recommended literature	Oral examination ofthe acquired knowledge
Total	4			

The way of calculating ECTS credits for certain activities:
Total sum of ECTS is 4 points.
1 ECTS point = 25 hours of students work
4 ECTS points = 100 hours of students work
40 hours of teaching (lessons + exercises) = 1.6 ECTS points (40 hours of teaching / 100 hours of total work × 100% = 40% of the total of 4 ECTS)
Final exam = 2.4 ECTS points (60 hours of preparation / 100 hours of total work ×100% = 60% of the total 4 ECTS)

Module quality assessment
Lecturer and the module will be eavaluated by anonimous questionnaire to students.

Module name	**Special Feeding I - Herbivores**	
Module coordinator	Zvonimir Steiner	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 25, E – 15, S - 0

Module aim

The aim and task of this module is to introduce PhD students to the basics of animal nutrition - the digestibility of feed, energy balance of N and C, energy balance, nutrient units, nutrients and their metabolism and integrate contemporary knowledge in feeding of certain categories of ruminants; cattle, sheep and goats. Present models of feeding which will PhD students as a practical nutritionists know how to control the desired flow of production and product quality.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Assess and evaluate the anatomical and physiological characteristics of the digestive system of individual animals
2. Generate terms of digestibility, energy balance of N and C, energy balance, nutrient units, nutrients and their metabolism
3. Identify problems of feeding dairy cattle, calves, beef cattle and breeding heifers. Know and make a meal mixture for certain categories of animals.
4. Identify problems of feeding sheep and goats. Know and make a meal mixture for certain categories of animals.
5. Recommend nutritional aspects of modeling productivity and quality cattle, sheep and goat products, and choose a healthy meal and mixtures for different categories of sheep and goats.
6. Synthesize, apply and evaluate contemporary achievements in feeding ruminants

Module content

The application of advanced knowledge in nutrition of ruminants. Nutritional value of feed materials and their applications in the standardization of meals ruminants. Anatomical and physiological characteristics of digestion and digestive system with special emphasis on the microbial ecology of the rumen of ruminants. Feeding modeling productivity and metabolic profile preživača.Izračunavanje selection index, assessment of physical fitness and assembling meals and mixtures for different categories of cattle, sheep and goats. Computer training in the composing of compound feed for poligastrične animals. Students will be recommended titles term papers and magazines with relevant scientific and professional articles necessary for their writing according to scientific interest of participants

Differences in feeding depending on the direction of production and growing conditions.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students are required to attend lectures and exercises (consultations). For laboratory work students need emergency protective laboratory clothing (angle). After that, students write a final exam. Students are advised to prepare exams from mandatory literature.

Literature

Required reading:

1. Domaćinović M. (2006) Hranidba domaćih životinja. Poljoprivredni fakultet Osijek
2. Domaćinović, M., Antunović, Z., Džomba, M., Opačak, A., Baban, M., Mužic, S. (2015): Specijalna hranidba domaćih životinja. Poljoprivredni fakultet u Osijeku, Osijek.
3. NRC- Nutrient requirements of dairy cattle (2001): The National Academy Press. Washington DC, USA
4. Freer, M., Dove, H. (2002): Sheep Nutrition. Cabi Publishing and CSIRO Publishing.
5. Cannas, A., Pulina, G. (2008): Dairy goats feeding and nutrition. CAB International.
6. Senčić, Đ., Antunović, Z., Mijić, P., Baban, M., Puškadija, Z. (2011): Ekološka zootehnika. Poljoprivredni fakultet Osijek.
7. NRC- Nutrient requirements of small ruminants (2007): The National Academy Press. Washington DC, USA.
8. Nehring, K. (1972): Lehrbuch der tierernährung und futtermittelkunde. Verlag J. Neumann - Neudamm, Berlin.
9. Underwood, E. J., Suttle, N. F. (2001): The Mineral nutrition of livestock. 3 ed. CABI Publishing.
10. Mc Donald, P., Edwards, R. A., Grenhalgh, J. F. D., Morgan, C. A. (2002): Animal nutrition, 6-th ed. Person Education. Edinburg.

Recommended literature:

1. Ensminger M.E., Oldfield J.E., Heinmann W.W.(1990) Feeds and nutrition.
2. Paulina, G., Bencini, R. (2004): Dairy sheep nutrition. CAB Publishing.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.6	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	2.4	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:
Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
40 teaching hours (lectures + exercises) = 1.60 ECTS (40 teaching hours/100 hours of total load x 100 = 40.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Special Feeding II- Omnivores**	
Module coordinator	Matija Domaćinović	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 32, E - 8, S - 0

Module aim

To integrate recent technological solutions on feeding of certain categories of pigs, poultry and fish. To recommend recent norms according to which the balance of meals for monogastric animals and fish is performed. To present different ways of feeding used by the automatic feeding systems.

Terms of admission

Compulsory modules

Expected learning outcomes

After completing the module, student will be able to:

1. Prepare the computer-bread mixture for certain categories of pigs and poultry.
2. Anticipate the most appropriate feeding for certain categories of pigs
3. Propose feedstuffs and appropriate technology feeding for certain categories of poultry.
4. Propose forage and specificity of technology for feeding pigs intended for the production of durable goods.
5. Recommend the best technology solutions in feeding of fishes.

Module content

Application of computer in the preparation of the recipe mixture for certain categories of pigs and poultry. The importance of choice of feed materials and their preparation in pigs and poultry, standardization of needs of different categories of pigs and poultry, the importance of the ideal protein in feeding of monogastric animals. Specificity of fish digestion, digestion and metabolism of nutrients, natural and additional food, feedstuffs and feeding mixtures in fish feeding, fish feeding technology -young and adult fish.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☒ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

The students are obliged to participate in practical tasks dealing with the preparation of recipes of complete and supplementary feeding mixtues in feeding of poultry and pigs. To study the recommended literature needed in the preparation of the final exam.

Literature

Required reading:

1. Domaćinović, M., Antunović, Z., Džomba, E., Opačak, A., Baban, M., Mužic, S. (2015): Specijalna hranidba domaćih životinja.
2. Senčić, Đ (2011): Tehnologija peradarske proizvodnje, Poljoprivredni fakultet u Osijeku.
3. Domaćinović, M. (1999): Praktikum vježbi hranidbe domaćih životinja. Poljoprivredni fakultet u Osijeku, Osijek.
4. Jeroch, H., Drochner, W., Simon, O. (1999): Ernährung landwirtschaftlicher Nutztttiere, Verlag Eugen Ulmer Stuttgart.
5. Kirchgeβner, M., Roth, F. X., Schwarz, F. J., Stangl, G. I. (2008): Tierernährung, Verlag, Frankfurt am Main.
6. Grbeša, D. (2004) : Metode procjene i tablice kemijskog sastava i hranjive vrijednosti krmiva. Hrvatsko agronomsko društvo, Zagreb.
7. Bogut, I., Adamek, Z., Pavličević, J., Fijan, N., Katavić, I., Novoselić, D., Selak, V. (2004): Ribarstvo i zaštita voda.
8. Tacon, A. (1990): Standard Methods for the Nutrition and Feeding of Farmed Fish and Shrimph. Argent Laboratories Press.Redmond, Washington, USA.

Recommended literature:

1. Stručni časopis; Krmiva, Stočarstvo, Poljoprivreda – domaći stručni časopisi.
2. NRC (1998) Nutrient requirement of Swine. 10th Edition. National Academy Press, Washington DC
3. NRC (1994) Nutrient requirement of Poultry. 9th Edition. National Academy Press, Washington DC
4. Haider, G. (1986): Nutzfische halten Eine Anleitung zur Teichwirtschaft, Ferlag Eugen Ulmer.
5. Friesecke, H. (1994): Praktische Fütterung von Süßwasserfischen. Verlagsunionagrar Frankfurt, München, Wien, Bern.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.0	1-5	The study of literature, calculation tasks	Checking the activities carried out through oral conversation, delivery and review of calculated tasks
Final exam	3.0	1-5	The study of required andrecommended literature for exam preparation	Exam (written and oral)
Total	4.0			

The way of calculating ECTS credits for certain activities:

The module has 4 ECTS credits
1ECTS point = 25 hours of workload (hours of student work)
4 credits = 100 hours of load modules
25 hours of teaching workload (lectures and practice) = 1.0 ECTS (25 hours / 100 hours total load x100 = 25.0% of the total of 4 ECTS)
Final exam = 3.0 ECTS (75 hours preparation / 75 hours of total work hours x 100 = 75.00% of total 4 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above described module via anonymous student surveys.

Module name	**Economics in Livestock Production**	
Module coordinator	Krunoslav Zmaić	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 0, S - 10

Module aim

Introduce postgraduates with the action of economic laws in agriculture through the use of modern means, instruments and measures of agricultural policy, and apply entrepreneurial knowledge and skills based on creativity and innovation in livestock production.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate the strategic development of small and medium farms.
2. Assess the analyzed risks and rank priorities in minimizing the consequences of risky situations.
3. Rank and compare indicators of competitive advantage on the basis of production and resources, products and pricing, distribution and promotion.
4. Identify and choose the newer methods and procedures in the analysis of the funds, instruments and measures of agricultural policy.
5. Valorize the effects of agricultural policy measures on income and competitiveness of the agricultural sector.

Module content

Analyze the means, instruments and measures of agricultural policy that may affect the reduction of risks and uncertainties of doing business in livestock production. The basics of business planning by applying creativity and innovation in livestock production due to the current agricultural policy measures.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars using recommended literature. Students prepare a seminar work which is compulsory. As part of the seminar work student at the specific research project deals with teaching units from lectures. Monitoring of the seminar work is ongoing, as well as verification of acquired knowledge, by public defense of the seminar paper and by oral exam ends knowledge verification.

Literature

Required reading:

1. Tracy M. (2000): Hrana i poljoprivreda u tržnom gospodarstvu, uvod u teoriju, praksu i politiku (prijevod: T. Žimbrek), MATE d.o.o., Zagreb.
2. Tracy M. (1996): Država i poljoprivreda u Zapadnoj Europi 1880.-1988. (prijevod: T. Žimbrek, R. Franić, S. Vukušić). MATE d.o.o., Zagreb.
3. Zmaić (2008): Osnove agroekonomike, Poljoprivredni fakultet u Osijeku, Osijek.
4. Kolaković M. (2006): Poduzetništvo u ekonomiji znanja, Sinergija Zagreb.
5. Horvat, Đ., Kovačić, M. (2004): Menadžment u malom poduzetništvu, Cera Prom d.o.o. I MEP Consulting, Zagreb.

Recommended literature:

1. Petrač, B. (2002): Agrarna ekonomika, Sveučilišni udžbenik, Ekonomski fakultet u Osijeku, Osijek.
2. http://www.mps.hr
3. Defilipis, J. (2002): Ekonomika poljoprivrede, Školska knjiga, Zagreb.
4. Helmberger, G. P. (1991): Economic Analysis of farm Programs, University of Wisconsin, Mc Graw-Hill, Inc., USA.
5. Bangs, JR H. David (1998): Kako napraviti poslovni plan s kojim će vaše poduzeće uspjeti, VII. izdanje, Jakubin i sin, Zagreb.
6. Brekić, I. (1994): Inovativni management, Alinea, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.80	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.80	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.40	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:
Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment
It is envisaged evaluation by students, lecturers on study and by experts in the field of study, and if necessary international supervision.

Module name	**Technology of Feed Mixtures Production**	
Module coordinator	Matija Domaćinović	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 5, S - 5

Module aim
Theoretical and practical content to present modern technical and technological solutions for the handling and preparation of feed, and the process of mixing of compound feed in feed mills (TSH).

Terms of admission
Compulsory modules

Expected learning outcomes
After completing the module, student will be able to:
1. Independently plan the receipt of goods, to organize its storage and preparation of feed immediately before mixing.
2. Prepare recipes of feeds for individual categories of pigs and poultry based on physical and chemical characteristics of the raw materials.
3. Arrange single technological operations in the production of feed mixtures.
4. Prepare and present a seminar on the subject of production of feed mixtures.

Module content
To clarify the legislation related to the market of feed. To predict forage in the preparation of certain types of feed mixtures and to clarify their nutritional composition. To show the sequence of technological operations in the way of production of feed mixtures in the feed mill. To explain the application of computer programs in the preparation of optimal recipe.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
The student must write an essay on the subject of production of feed mixtures in feed mills. The essay must be written and afterwards orally presented. For the purpose of preparing the final exam students shuld study the required and recommended literature.

Literature
Required reading:

1. McEllhiney, R. R.: Feed Manufakcturing Technology IV, American Feed Industry Association, Inc. 1994.
2. Katić, Z.: Sušenje i sušare u poljoprivredi. Multigraf d.o.o. Zagreb, 1997.

3. Domaćinović, M.: Praktikum vježbi hranidbe domaćih životinja. Poljoprivredni fakultet u Osijeku 1999.
4. Katić, Z.: Industrijska proizvodnja krmnih smjesa. Skripta za poslijediplomski studij. Zagreb, 1982.

Recommended literature:

1. Stručni časopisi: Krmiva, Feed international – proizvodnja stočne hrane.
2. NN (26/1998): Pravilnik o kakvoći stočne hrane.
3. Grbeša, D. (2004) : Metode procjene i tablice kemijskog sastava i hranjive vrijednosti krmiva. Hrvatsko agronomsko društvo, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.4	1-3	The study of literature, calculation practical tasks	Checking the activities carried out through oral conversation, delivery and review of calculated tasks
Seminars	0.2	4	The study of literature, preparation, and presentation of seminars	Evaluating the quality of written and presented seminar paper
Evaluatioon of the quality of written and presented seminar paper or essay	2.4	1-4	The study of requiredand recommended literature	Exam (written and oral)
Total	4			

The way of calculating ECTS credits for certain activities:

The module has 4 ECTS credits
1ECTS point = 25 hours of workload (hours of student work)
4 credits = 100 hours of load modules
35 hours of teaching workload (lectures and practice) = 1.4 ECTS (35 teaching hours / 100 hours total load x100 = 35.0% of the total of 4 ECTS)
Seminar 0.2 ECTS points (5 hours of instruction / 100 hours total load x100 = 5% of the total of 4 credits.
Final exam = 2.4 ECTS (60 hours of preparation / 100 hours of total work hours x 100 = 60.0% of the total of 4 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above described module via anonymous student surveys.

Module name	**Feeding Pathology**	
Module coordinator	Mislav Đidara	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E -10, S -10

Module aim

The aim of this module is to train students for the application of knowledge in the field of pathology of animal nutrition based on the results of previous research, in order to protect animal health.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Distinguish diseases related to animal nutrition according to the etiology.
2. Identify external and internal causes of diseases related to animal nutrition.
3. Distinguish listed diseases according to their economic importance or zoonotic potential.
4. Relate post-mortem changes in animals with disease diagnostics.
5. Analyze each disease with respect to its etiology, pathogenesis, diagnosis, prophylaxis and treatment methods.
6. Apply methods of eradication of diseases to be suppressed by law.

Module content

The module provides students with the latest findings of studies on the impact of animal nutrition on the incidence of diseases related to reproduction, exploitation, supply nutrients and biologically active substances, insufficient or overabundant nutrition and its consequences in certain phases of production and other factors of importance for the production, with the aim of preventing negative consequences. The module extends the knowledge of PhD students gained in previous studies in the area of the most common and important diseases associated with improper feeding of animals.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Antunović, B. (2009): Bolesti životinja u tovu. U Senčić, Đ, Z. Antunović, D. Kralik, P. Mijić, B. Antunović, M. Šperanda, K. Zmajić, Z. Steiner, D. Butko, M. Đidara, J. Novoselec: „Proizvodnja mesa“ (Ur. Đuro Senčić), Osječko-baranjska županija, Osijek, str. 91-98.
2. Šerman, V. (2000):Hranidba domaćih životinja. I : Hranidba konja, hranidba ovaca. Veterinarski fakultet, Zagreb.
3. Šerman, V. (1998): Hranidba goveda, Veterinarski fakultet, Zagreb.

Recommended literature:

1. Jones, T. C., Hunt, R. D. & King, N. W. (1997): Veterinary Pathology. Blackwell Publishing.
2. Jubb, K. V. F., Kennedy, P. C. (2005): Pathology of Domestic Animals. Academic Press.
3. McGavin, M. D., Zachary, J. F. (2006): Pathologic Basis of Veterinary Diseases. 4th Ed. Elsevier.
4. Vegad, J. L. (2007): Text Book of Veterinary General Pathology. 2nd Ed. International Book Distr.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.4	1-6	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student’s work and assignments
Seminar	0.2	1-6	Literature studying, seminar preparation and presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	2.4	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1ECTS credit = 25 workload hours (student’s working hours)
4 ECTS credits = 100 hours of module loads
35 teaching hours (lectures + exercises) = 1.40 ECTS (35 teaching hours/100 hours of total load x 100 = 35.0% from total of 4 ECTS)
Seminar paper = 0.20 ECTS (5 hours/100 hours of total load x 100 = 5.0% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher’s work and evaluation of mentioned module’s quality via anonymous student surveys.

Module name	**Premises and Equipment in Livestock**	
Module coordinator	Davor Kralik	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20 E - 20, S - 0

Module aim

Introduction of students with the latest systems and livestock buildings, and technical achievements that are used in the provision of high-quality micro-climate conditions, introduction to functional and exploitation characteristics of machinery and equipment in livestock production

Terms of admission

no terms

Expected learning outcomes

After completing the module, student will be able to:
1. Synthesize, apply and evaluate modern materials and technology in the process of livestock production
2. To assess and evaluate the contribution of the application of the latest technologies in livestock production.
3. Identify and choose the most adequate technical solutions.
4. Organize and design facilities in livestock production, spatial planning, design of technology, preliminary and final project

Module content

The curriculum includes introduction to the machinery and installed equipment in livestock production and their technical characteristics, operation and maintenance mode:
materials for building machines; machines for preparation and distribution of green mass and silage; machines and equipment for water supply and watering domestic animals: devices, equipment and automation at machine milking; machines and equipment for milk cooling; automatic identification, detection and feeding; machines and devices for manure management; maintenance and repair of livestock production machines and equipment : Organization and designing premises in livestock; spatial planning, developing of technological, conceptual and main project ; Biological-technical environment conditions: dimensioning of stable places, peripheral constructions as well as ventilation and premises isolation ratio; construction-technical factors: physical-construction traits of premises in livestock production, heat balance; Sanitary-technical factors: production conditions of animals housing, airing; types of premises ventilation in pig, cattle and poultry breeding production; premises heating by conventional and alternative energy sources.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students are obliged to prepare for practice using recommended literature. For laboratory work students need standard protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from mandatory literature.

Literature

Required reading:

1. Kralik, G., Adámek, Z., Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D., Kralik, I., Margeta, V., Pavličević, J. (2011.) Zootehnika.
2.Kralik, G., Has-Schön E., Kralik, D., Šperanda, M. (2009.) Peradarstvo - biološki i zootehnički principi .
3. Kralik, G., Kušec, G., Kralik, D., Margeta, V. (2007.) Svinjogojstvo - biološki i zootehnički principi
4.Brčić, J. (1989): Mehanizacija u stočarstvu.
5. Emert, R., Bukvić, Ž., Jurić, T., Filipović, D.(1996): Popravak poljoprivrednih strojeva, Poljoprivredni fakultet, Osijek.
6. Horvath, G.(1989): A tögygyulladás elleni vedekezes. Budapest.
7. Eichhorn, H., Konrad, J.(1988): Landtechnik. Stuttgart.
8. Tanevski, D. (1995): Motori i traktori, Skopje.
9. Vujčić, M. i sur. (1999): Osnove strojarstva. Poljoprivredni fakultet, Osijek.
10. Zimmer, R., Banaj, Đ., Brkić, D, Košutić, S. (1997): Mehanizacija u ratarstvu. Poljoprivredni fakultet, Osijek.
11. Šikić, D. (1980): Elementi projektiranja građevinskih firmi. Poljoprivredno graditeljstvo, Zagreb.
12. Biglbauer, M. (1997): Poljoprivredni objekti, Osijek.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and excercises	1.6	1-5	Study of literature, developmnt of tasks	Evaluation the activities carried outthrough oral conversation, submisson and review of assignments
Final exam	2.4	1-5	Prepeartion for exam trough study of required and recomended literature	Exam (oral or in writting)
Total	4			

The way of calculating ECTS credits for certain activities:
Module carries 4 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
40 teaching hours (lecture) = 1.60 ECTS (40 teaching hours/100 hours of total load x100 = 40% from total of 4 ECTS)
Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment
The evaluation of teaching quality using anonymous student surveys.

Module name	**Micropopulation in Digestive System of the Domestic Animals**	
Module coordinator	Marcela Šperanda	
Study programme	Postgraduate university study of Agicultural Sciences, major Animal Feeding and Forage Technology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 10, S - 0

Module aim

Ph.D. students will be acquainted with micropopulation of digestive system; mutual influences in particular parts of the digestive tube, feed influence for colonisation and growth respective microbials.

Terms of admission

Microbial population in ruminants and the gut environment. Prerequisits for their colonization and reproduction. Bacterial interactions in the gut. Physiological role in multiple-cells organisms.

Expected learning outcomes

After completing the module, student will be able to:

1. Enumerate micropopulation of the foregut and gut in the poligastric animals and gut of the monogastric animals.
2. Discuss about nutrition influence on microbial growth.
3. Link mucosal immunity development with growing microbial population.
4. Analysis of rumen content.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Participate in the teaching process, prepare literature and solve mathematical problems.

Literature

Required reading:

1. Sejrsen K., Hvelšlund T., Nielsen M. O. (2006): Ruminant physiology. Wageningen Academic Publishers. Netherlands.
2. Piva A., Bach Knudsen K. E. (2001): Gut Environment of Pigs. Nottingham University Press.

Recommended literature:

1. D'Mello J. P. F. (2000): Farm Animal Metabolism and Nutrition. CABi Publishing.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	1.6	1-3	Studying the literature	Verification activities
Final exam	2.4	1-3	Preparing for exam by studying required literature	Exam (oral)
Total	4			

The way of calculating ECTS credits for certain activities:

Modul has 4 ECTS credits; 30 L, 10 E.
1 ECTS = 25 hours
4 ECTS boda = 100 hours
40 hours (lectures+excersises) = 1.6 ECTS (40 hours/100 total load x 100 = 40.00% from the 4 ECTS)
Final exam= 2.4 ECTS (60 hours /100 total load x 100 = 60.00% from 4 ECTS

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

After completing the major Animal Feeding and Forage Technology, student will be able to:

Learning Outcome 1	Independently organize production on arable land and pastures for the usual voluminous forage
Learning Outcome 2	Assess the nutritional and energy feed value
Learning Outcome 3	Assess the nutritional value of feed in animal food based on the morphological and physiological characteristics and metabolism of nutrients
Learning Outcome 4	Prepare meal recipes and food mixtures for different kinds and categories of animals
Learning Outcome 5	Propose economically justifiable technology for feeding certain animal species and categories
Learning Outcome 6	Apply the scientific method in an independent research

HUNTING AND CYNOLOGY

2.4. Modules of major Hunting and Cynology

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Principles of Breeding and Protection of Game Animals	60	6
2.	Cynological Zoology	30	3

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Breeding, Diseases and Training of Dogs	30	3
2.	Introduction to Scientific Work	30	3
3.	Selected Statistical and Mathematical Models in Biology	30	3
4.	Selected Topics in Biochemistry and Physiology	30	3
5.	Botany and Phytocoenology	30	3
6.	Ecology of Ichthyophagous Feathered Game Animals	30	3
7.	Technology of Game Meat and Meat Products	30	3
8.	Canine Reproduction	30	3
9.	Nutrition of Dogs	30	3
10.	Cytogenetics	20	2
11.	Diseases of Game Animals	30	3
12.	Management in the Hunting	30	3
13.	Inventory and Arrangement of the Hunting Grounds	30	3
14.	Hygienic and Sanitary Measures in the Hunting Ground	30	3
15.	Hunting Legislation	30	3

2.4.1. Learning outcomes of major Hunting and Cynology

Module name	**Principles of Breeding and Protection of Game Animals**	
Module coordinator	Tihomir Florijančić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 30, E - 20, S - 10

Module aim

To introduce students with means of breeding and protection of game animal in Croatia, Europe and World, with an emphasis on positive and negative effects of the ecological factors on game animals, primarily climate conditions, soil, and other biotic and abiotic factors.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Describe biological ,ecological and zoogeographical characteristics of game animals
2. Describe habitats suitable for living and breeding of game animals
3. Interprete ecological factors in the habitat with an aim to estimate economic capacity of the hunting grounds, and based on that planning the guidelines for management in the hunting ground
4. Classify ranks in the protection of game animals in protected parts of nature and those outside
5. Critically comment chosen topic about game breeding or nature protection

Module content

Biology, breeding and protection of the high, small and feathered game animals. Zoogeographical distribution of game animals in Croatia, Europe and World. Breeding measures in the open and confined hunting ground. Game animals and environment; effect of ecological conditions (climate, soil), biotic factors on habitat or hunting ground; negative effects of environmental pollution. Biotic communities and game animals as part of it. Predation among the game animals, food-webs, periodism, seasonal cycles in the hunting ground. Nature conservation. Consulting selected articles with newest reports in the field of breeding and protection of game animals.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☒ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Regular attendance on teaching and active participation in performing tasks given during the lecture and exercises is expected from the students. Students have an obligation to prepare individual seminar paper, which they present orally in duration 10-15 minute, using PowerPoint presentation. Schedule of presentation will be arranged in advance. Field excercies for students will be organized in the selected hunting ground and in the Nature Park "Kopački rit". After completed with lectures and excercises, an oral exam will be held. Making records during the lectures, and preparing the exam from required literature list is advised to students. During the lecture, PowePoint presentations will be used in teaching and explaining topics.

Literature

Required reading:

1. Tucak, Z. i sur. (2002): Lovstvo, drugo prošireno izdanje. Poljoprivredni fakultet u Osijeku, Osijek.
2. Tucak, Z. i sur. (2006): Zaštita divljači. Poljoprivredni fakultet u Osijeku, Osijek.
3. Janicki, Z. i sur. (2007): Zoologija divljači. Veterinarski fakultet Sveučilišta u Zagrebu, Zagreb.
4. Anonimus : Zbirka zakonskih i podzakonskih propisa iz lovstva. Ministarstvo poljoprivrede www.mps.hr/.../LOVSTVO/Zbirka%20propisa%20iz%20lovstva.pdf
5. Anonimus (2013): Zakon o zaštiti prirode. Narodne novine broj 80.
6. Topić, J., Vukelić, J. (2009): Priručnik za određivanje kopnenih staništa u Hrvatskoj. Državni zavod za zaštitu prirode. Zagreb.

Recommended literature:

1. Bolen, E. G., Robinson W. L. (2003): Wildlife ecology and management. Pearskon education, Inc., New Jersey.
2. Mustapić, Z. (gl.ur.) (2004): Lovstvo. Hrvatski lovački savez. Zagreb.
3. Darabuš, S. i sur. (2009): Osnove lovstva. Hrvatski lovački savez. Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	2.0	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.4	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	3.6	1-5	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	6.0			

The way of calculating ECTS credits for certain activities:

Module carries 6 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

6 ECTS credits = 150 hours of module loads

20 teaching hours (lectures + exercises) = 0.8 ECTS (20 teaching hours/75 hours of total load x100 = 26,67% from total of 3 ECTS)

Seminar paper = 0.4 ECTS (10 hours/75 hours of total load x100 = 13,33% from total of 3 ECTS)

Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60,00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Cynological Zoology**	
Module coordinator	Ivica Bošković	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 10; S – 5

Module aim

To introduce students with following topics: synergic work of man and dog; origin of dog as biological species; domestication of dog and its role in human society: biological and cynological classification of dogs; common and autochthonous dog breeds in Croatia. Students will acquired theoretical and practical knowledge on hunting modes in which dog is used, and specific chracteristics of hunt on particular game animals, and role of a dog.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate modern methods and selection procedures in the assessment of breeding and specific working values of dogs.
2. Estimate and evalate exterior features and training level of dog.
3. Ranking and comparing breeding and working quality of dog.
4. Determine and select the most quality methods and procedures that are convenient for dog training.
5. Evaluate reproductive value and suitability of dog for further breeding.
6. Recommend applicable and best method for training the particular dog for every single activity and usage in hunting.

Module content

Classification of dogs according to morphology, purpose, FCI system; classification of hunting dogs, purpose and usage of hunting dogs; dogs for work on cold and hot footpath of game animals. Methods of dog breeding. Main rules of inheritence in dogs. Cub rearing and selection of cub for further training. Dog and a hunter, communication, socialization, relationship during the hunt. Legislation for using dogs in hunting activities. Individual and joint ways of hunt and role of dogs in them. Role of dog in hunt on particular large and small game animals. Tracking the wounded game animal on blood footpath.

During the field excercises in the hunting ground students will get practical knowledge of an overall role of dog in hunting.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☒ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. Part of the exercises will be carried out as field teaching, for which the students needs to come with appropriate footwear and clothing. After that, students take a final exam. Students are advised to prepare exam from required literature list.

Literature

Required reading:

1. Anonimus (2005): Zakon o lovstvu. Narodne novine broj 140. Zagreb.
2. Čeović, I. (1950): Uređenje lovišta. Lovački savez Hrvatske. Zagreb.
3. Tucak, Z. (gl.ur.) (2002): Lovstvo. Poljoprivredni fakultet u Osijeku. Osijek.
4. Tucak, Z. (gl.ur.) (2003): Lovna kinologija. Poljoprivredni fakultet u Osijeku. Osijek.

Recommended literature:

1. Bauer, M. (1985): Pas moj prijatelj. Liber. Zagreb.
2. Frandson, D. (ur) (2009): Anatomy and Physiology of Farm Animals, Wiley-Blackwell, Philadelphia.
3. Pineda, M. H. (2003): McDonald's Veterinary Endocrinology and Reproduction, Iowa State Press, A Blackwell Publishing Company.
4. Šperanda, M. (2008): Anatomija i fiziologija domaćih životinja – odabrana poglavlja, web skripta.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.4	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.8	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

20 teaching hours (lectures + exercises) = 0.8 ECTS (20 teaching hours/75 hours of total load x100 = 26,67% from total of 3 ECTS)

Seminar paper = 0,.4 ECTS (10 hours/75 hours of total load x100 = 13,33% from total of 3 ECTS)

Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60,00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Breeding, Diseases and Training of Dogs**	
Module coordinator	Ivica Bošković	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E -10; S – 5

Module aim

To introduce students more thoroughly with characterictis of the full bloodline races of dogs, diversity of dog breeds and specifities in inheritance, breeding and training. Also, to introduce with main diseases and health risks for dogs and principles of dog training.

Terms of admission

Passed exam from the compulsory modul Cynological Zoology

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate modern methods and selection procedures in the assessment of breeding values of dogs.
2. Estimate and evaluate breeding quality, exterior features and training level of dog.
3. Ranking and comparing breeding and working quality of dog.
4. Identify importance and values of particular zoohygienic parameters in dog breed houses.
5. Determine and select the most quality methods and procedures that are convenient for dog training.
6. Identify most common causative agents of diseases in dogs and treatment procedures.

Module content

Breeding of dogs. Definition and evidence of full bloodline; certificate on full bloodline. Cynological associations and activities, applicable features of dogs; inherited and learned features. Learning methods; reflexes; methods in training; assessment of the dog character. Scoring in cynology for morphology and working of dogs; specific nomenclature in cynology. Inherited breed characteristics; malformation; keeping of hygiene of dog fur and environment. Accommodation of dog in house, yard, garden o breeding area. Practical presentation of cynological exhibition and competition.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☒ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. Part of the exercises will be carried out as field teaching, for which the students needs to come with

appropriate footwear and clothing. After that, students take a final exam. Students are advised to prepare exam from required literature list.

Literature

Required reading:

1. Bauer, M. (1985.): Pas moj prijatelj. Monografija. Liber. Zagreb.
2. Bauer, M. (2000): Kinologija I – Uzgoj, njega i hranidba pasa. Vlastito izdanje. Zagreb.
3. Taylor, D. (1988.): Vaš pas. Mladost. Zagreb.
4. Willis, M. B. (1984.): Züchtung des Hundes. Verlag Eugen Ulmer. Stuttgart.
5. Tucak, Z. (ur) (2004): Lovna kinologija. Poljoprivredni fakultet u Osijeku. Osijek.

Recommended literature:

1. Cvetnić, S. (1983): Virusne bolesti životinja. Stvarnost i JAZU. Zagreb.
2. Gianinetti, R. (1995.): Veterinar u kući. "Mosta". Zagreb.
3. Smokvina-Boranić, Č. (1977.): Vaši kućni ljubimci. Nakladni zavod "Znanje". Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.0	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work andassignments
Seminar	0.2	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.8	1-6	Preparing for exam by studying required and recommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
25 teaching hours (lectures + exercises) = 1.0 ECTS (20 teaching hours/75 hours of total load x100 = 33.33% from total of 3 ECTS)
Seminar paper = 0.2 ECTS (10 hours/75 hours of total load x100 = 6.67% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Introduction to Scientific Work**	
Module coordinator	Pero Mijić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

The aim of this module is to introduce the postgraduate students to the basic principles of the scientific research, including the composition and publication procedures.

Terms of admission

No preconditions

Expected learning outcomes

After completing the module, student will be able to:

1. Apply the scientific method to the example of his own research.
2. Set scientific hypotheses and objectives of the work.
3. Conduct and write your own scientific work at the predicted structure of scientific work.
4. Own devise a current scientific topic and present a seminar paper.
5. Apply the computer in scientific research, and analyze the collected scientific papers.
6. Critically evaluate the scientific and professional work, and klasifikicirati used literature.

Module content

Significance of the scientific research, scientific workers and their professionalization, scientific methods, choosing the research topic, experimental research, publication types, structure of a scientific work, preparing the manuscript for the publication, oral presentation of the scientific results, legislation.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students prepare a seminar work that is mandatory and which will be presented orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. After that, students take part Written exam of topics Exercises. The laying of the exercises, students acquire the right exit to the oral exam from the lecture topics. Students are advised to prepare exams from the successful exam.

Literature

Required reading:

1. Knežević, I., Mijić, P. (2006): Uvod u znanstveni rad – drugo, dopunjeno i izmjenjeno izdanje. Poljoprivredni fakultet u Osijeku. Osijek.
2. Knežević, I. (1988): Uvod u znanstveni rad. Poljoprivredni fakultet u Osijeku. Osijek.

Recommended literature:

1. Mijić, P., Knežević, I. (2005): Uporaba Interneta u poljoprivredi. Stočarstvo, 59(1): 71-78.
2. Zelenika, R. (2000): Metodologija i tehnologija izrade znanstvenog i stručnog djela. Četvrto izdanje. Ekonomski fakultet u Rijeci. Rijeka.
3. Baban, Lj., Ivić, K., Jelinić, S., Lamza-Maronić, M., Šundalić, A. (2000): Primjena metodologije stručnog i znanstvenog istraživanja. Ekonomski fakultet u Osijeku. Osijek.
4. Zelenika, R. (1991): Kako nastaje recenzija znanstvenog i stručnog rada. Zavod za istraživanja i razvoj sigurnosti. Zagreb.
5. Silobrčić, V. (1989): Kako sastaviti i objaviti znanstveno djelo. Drugo izdanje. JUMENA. Zagreb.
6. Žugaj, M. (1989): Osnovi znanstvenog i stručnog rada. «Zagreb» r. o. za grafičku djelatnost. Samobor.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture and exercise	0.8	1-6	Studying literature, assignments	Checking the activities carried out through oral conversation, delivery and review assignments made
Seminar	0.4	1-6	The study of literature, preparation, and presentation of seminars	Review and evaluation of the seminar work according to pre-established criteria
Final exam	1.8	1-6	Preparation for the exam by studying recommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1ECTS point = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
20 hours of instruction (lectures and practice) = 0.80 ECTS (20 teaching hours / 75 hours total load x100 = 26.67% of the total 3 ECTS)
Seminar = 0.40 ECTS (10 hours / 75 hours total load x100 = 13.33% of the total 3 ECTS)
Final exam = 1.80 ECTS (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student questionnaire.

Module name	**Selected Statistical and Mathematical Models in Biology**	
Module coordinator	Andrijana Rebekić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 10, S - 5

Module aim

To train students for the data collection in scientific research, for the application of statistical methods in data processing and for the interpretation of obtained results.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Indicate and describe possible ways of data collection in biological research.
2. Devise a scientific research, set up a research hypothesis and objectives of the research independently.
3. According to the data type and the fulfillment of parametric assumptions choose the appropriate statistical method for dana analysis.
4. Critically assess the results of researches published in scientific papers, based on the objectives of research, experimental design, performed the statistical analysis and interpretation of the results.

Module content

Motives for the need to apply statistical methods in biological research. Basic statistical dataset. Visual representation and parameters of statistical data. The concept of probability and frequency. Distribution (empirical, discrete and continuous). The law of large numbers. Sampling methodes. The method forf samples and sample size selection. The standard error. Regression analysis. Analysis of the scattering data. Correlations. Statistical tests. Chi-square test, F-test, t-test. Analysis of variance. Univariate and bivarite models. Experiments repeated in time and space and their interpretation.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are expected to actively participate in the assignments during the lectures and exercises. Individually, each student will processes a given topic in written form (according to predefined guidelines) and submit it to arebekic@pfos.hr at least a week before going to the oral examination. Students are advised to keep notes during lectures and to prepare exam from

mandatory literature. The PowerPoint presentations will be used during lectures to help explain the contents discussed in lectures.

Literature

Required reading:

1. Horvat, D. (2005.): Biometrika. Poljoprivredni fakultet u Osijeku. Osijek.
2. Petz, B. (1997.): Osnovne statističke metode za nematematičare. Naklada SLAP. Jastrebarsko.
3. Galić, R., Scitovski, R. (1994.): Vjerojatnost, statistika i vremenska analiza. Elektrotehnički fakultet u Osijeku. Osijek.

Recommended literature:

1. Salkind N. J. (2003): Statistics For People Who (Think They) Hate Statistics. SAGE Publication, 3rd edition, Thousand Oaks. California.
2. http://www.biostathandbook.com
3. http://www.wormbook.org/chapters/www_statisticalanalysis/statisticalanalysis.html

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.6	1-4	The study of literature and activity in class	Checking of conducetd activitiesthrough conversation with students
Excercises and seminar	0.6	1-4	The study of literatureand application of statistical methods by using the statistical software	Review and evaluation of assignments
Practical work	0.8	1-4	Critical review (in writing) on a given topic in the field of statistical analysis	Review and evaluation of workaccording to predetermined criteria
Final exam	1.0	1-4	Preparing for the examination by studying the required and recommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

15 teaching hours (lectures) = 0.60 ECTS (15 teaching hours/75 hours of total load x100 = 20.00% from total of 3 ECTS)

Excercises and seminar = 0.60 ECTS (15 hours/75 hours of total load x100 = 20.00% from total of 3 ECTS)

Practical work = 0.80 ECTS (20 hours//75 hours of total load x 100 =26.67% from total of 3 ECTS)

Final exam = 1.00 ECTS (25 hours of preparation/75 hours of total load x 100 =33.33% from total of 3 ECTS)

Module quality assessment

Evaluation of the of the module quality and teachers' work by an anonymous student questionnaire.

Module name	**Selected Topics in Biochemistry and Physiology**	
Module coordinator	Drago Bešlo	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S - 5

Module aim

Link metabolic processes of various organs and their way of regulation. Explain the importance of the energy changes and electron transfer and oxidative phosphorylation. Then follows a discussion of the major hormonal regulators of energy metabolism as well as the storage, transfer of information and the regulation of gene expression. Then explain the specifics of the physiology of the digestive system of game under enclosed breeding. Consider the specific physiology of dogs. Explain the specificity of the reproductive system of game under enclosed breeding.

Terms of admission

No conditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand catabolism and anabolism linked macromolecules.
2. Analyse the processes in organs and their regulation.
3. Interprete the hormonal regulation of metabolism.
4. Connecting signaling of glucose levels and understand the role of coordination of hormones in different tissues.
5. Determine mechanism for storage of the excessive food as glycogen or triacylglycerols.
6. Analyzing and interpreting knowledge gained in biochemistry with knowledge obtained in other areas to determine the
   proper animal nutrition.
7. Describe specificity in physiology of game under enclosed breeding system, and specificity of the physiology of dogs.
8. Analyze and describe the mechanisms of gene transcription and regulation of metabolism by coordinated
   regulation of enzyme synthesis at the level of gene transcription and postsynthesis regulation, and enzyme activity in cells
   and energy charge needs of certain metabolites.
9. Interprete and apply data from the literature by itself.

Module content

A complete view of catabolic and anabolitičkih aspects of metabolic processes with a focus on the molecular basis of metabolism, including material information molecules, their synthesis and methods of action and complex regulation of gene expression. Explain the specificities of the physiology of game under enclosed breeding system and of their reproductive system. Description of the specific physiology of dogs.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students are required to attend lectures, seminars and laboratory exercises. Come to classes prepared where the processed reading materials and laboratory exercises to be able to equally participate in the discussions. At the seminars come with prepared and processed scientific and professional papers

Literature

Required reading:

1. Berg, J. M., Tymoczko, J.L., Stryer, L. (2013): Biokemija, prijevod 6. izdanja engleskog, 1. hrvatsko, Školska knjiga. Zagreb.
2. Bešlo, D. (2014): Praktikum iz biokemije. Poljoprivredni fakultet u Osijeku. Osijek.
3. Bubenik, A. B. (1985): Reproductive strategies in Cervidea. In: C. P. F. Fennessy & K. R. Drew (ed.) Biology of Deer Production. Rojal Soc. of New Zeland. Bull. 22.
4. Groves, C. P., Grubb, P. (1987): Relationships of living Cervidae. In. C. Wemmer (ed.) Biology and Managment of Cervidea. Smithsonian Intitution Press, Washington, D.C. pp 21-59.
5. Randall, D., Burggern, W., French, K., Fernald, R. (1997): Eckart Animal Physiology. Mechanisms and Adaptation (Fourth edition). W.H. Freeman and Company. New York.

Recommended literature:

1. Voet, D., Voet, J. G., Pratt, C. W. (2006): Fundamentals of Biochemistry, Life at the molecular level, John Wiley@Sons.
3. Janicki Z. (1996): Morfohistokemijske osobitosti interdigitalnih žlijezda u srne (Capreolus capreolus L). Disertacija. Veterinarski fakultet Sveučilišta u Zagrebu. Zagreb.
4. Boyer, R. F. (1993): Modern experimental biochemistry. Second Edition. The Benjamin/ cumming Publishing Company, Inc.
5. Tomašević, M. (2003): Atlas otrovnog bilja slavonskog gorja. Spin Valis. Požega.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.0	1-9	The study of literature and prepares questions	Checking renewed activity through oral discussion andexplanation prepared questions

Papers from the seminars and laboratory exercises	0.2	1-9	Processing the results obtained by the implementation of experiments in the laboratory and processed scientific and professional papers.	Review and evaluation obtained and analyzed results
Final exam	1.8	1-9	Preparation for the exam by studying therequired and recommended texts.	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1 ECTS = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
25 hours of instruction (lectures and laboratory exercises) = 1.0 ECTS (25 hours / 75 hours of total work hours x 100 = 33% of the total 3 ECTS)
5 hours writing reports and term papers = 0.2 ECTS (5 hour / 75 hours of total work hours x 100 = 7% of the total 3 ECTS)
Final exam = 1.80 (45 hours preparation / 75 hours of total work hours x 100 = 60% of the total 3 ECTS)

Module quality assessment

Evaluation of teachers and the quality of the following is the module via anonymous student questinnaire.

Module name	**Botany and Phytocoenology**	
Module coordinator	Siniša Ozimec	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 10; S – 5

Module aim

To educate students about characteristics of the plant cover as a component of the biocoenosis in the hunting ground. Students will be able to apply acquired knowledge about diversity of flora, vegetation and habitat types of Croatia in the hunting management and practice.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Describe hierarchical structure of classification of vegetation units in phytocoenology.
2. Arrange and compare the vegetational zones and belts according to natural and geographical characteristics of Croatia.
3. Identify specific vegetation in the Pannonic, Dinaric and Adriatic types of the hunting grounds in Croatia.
4. Combine composition of vegetation and structure of the habitat types with bonitet and capacity of the hunting ground.
5. Distinguish processes of the changes in vegetation caused by natural and anthropogenic impacts.

Module content

Phytocoenosis and habitats. Flora and vegetation, primary and secundary vegetation. Plants - food source to game animals. Plant diversity in Croatia. Natural, geographical and vegetational characteristics of the Pannonic, Dinaric and Adriatic types of the hunting grounds in Croatia. Students will be given suggestions for topics of the seminar paper and relevant journals containing scientific and professional articles in the field of floristic and vegetational studies, as well as scientific literature needed for preparing the seminar paper. Field practical work comprising methodology of the floristic and vegetational surveys, identification of the habitat types and assessment of the quality of the hunting ground.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☒ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Regular attendance on teaching, and active participation during the lectures and field practical work is expected from the students. All students are required to prepare seminar paper by itself, which they present orally using PowerPoint presentation. Schedule of presentations will be arranged in advance. Students are advised to carry on appropriate wear and equipment needed for the field work in the natural environment.

Literature

Required reading:

1. Tucak, Z., Florijančić, T, Grubišić, M., Topić, J., Brna, J., Dragičević, P., Tušek, T., Vukušić, K. (2002): Lovstvo, drugo prošireno izdanje. Poljoprivredni fakultet u Osijeku. Osijek.
2. Rauš, Đ., Šegulja, N., Topić, J. (1985): Vegetacija sjeveroistočne Hrvatske. Glas. šum. pokuse 21, 179-211.
3. Vukelić, J. (2012): Šumska vegetacija Hrvatske. Sveučilište u Zagrebu, Šumarski fakultet, Državni zavod za zaštitu prirode. Zagreb.
4. Trinajstić, I. (1998): Fitogeografsko raščlanjenje klimazonalne šumske vegetacije Hrvatske. Šum. list 122(9-10), 407-421.

Recommended literature:

1. Trinajstić, I. (2008): Biljne zajednice Republike Hrvatske. Akademija šumarskih znanosti. Zagreb.
2. Topić, J., Vukelić, J. (2009): Priručnik za određivanje kopnenih staništa u Hrvatskoj prema Direktivi o staništima EU. Državni zavod za zaštitu prirode. Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.0	1-5	Literature studying	Checking studentactivity orally (conversation)
Seminar	0.2	1-6	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.8	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

25 teaching hours (lectures + exercises) = 1.0 ECTS (25 teaching hours/75 hours of total load x100 = 33% from total of 3 ECTS)

Seminar paper = 0.2 ECTS (5 hours/75 hours of total load x100 = 7% from total of 3 ECTS)

Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Ecology of Ichthyophagous Feathered Game Animals**	
Module coordinator	Anđelko Opačak	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 10, S – 5

Module aim

To introduce students with biology and basic principles of ecology of wetland birds, especialy those ichthyophagous birds classified as feathered game animals which are living at fishponds and in the wetland habitats.

Terms of admission

Pased compulsory modul Principles of Breeding and Protection of Game Animals

Expected learning outcomes

After completing the module, student will be able to:

1. Describe most important wetland bird,their biological characteristics and ecological importance.
2. Anticipate seasonal migration and assess the status of habitat for their survival at open watercourses and fishponds.
3. Estimate direct and indirect damages occured from predation of ichthyophagous birds at fishponds.
4. Adjust agro-technical procedure in technology of fish production, especially juveniles, with biological requirements of wetland birds.
5. Define marketing concept for producing feathered game animals at fishponds under natural or artifical breeding
6. Recognize and identifiy most critical ecologicl factors which have positive or negative effects on wetland birds.

Module content

Biology and ecology of wetland birds. Daily and seasonal migration; protected bird species. Legal status of wetland birds and ichthyophagous feathered game animals. Ichthyophagous bird at open watercourses and fishponds. Direct and indirect damages from predation of ichthyophagous birds. Possibility for breeding feathered game birds at carp fishponds under natural and artifical way of breeding. Positive and negative effects of ecological factors, such as climate, soil, water and other biotic and abiotic factors, on feathered game animals. Birds as a disease vector for fishes. Agro-technical measures at carp fishponds in function of the sustainabe fish production and enable living conditions for wetland birds. Marketing concept for production of feathered game animals at fishponds.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☒ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☒ mentoring
- ☐ other

Student requirements

Regular attendance on teaching and active participation in performing tasks given during the lecture and exercises is expected from the students. Students will have excercies combined with work in the laboratory. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam.Student have an obligation to prepare individual seminar paper, which they present orally in duration 10-15 minute, using PowerPoint presentation. Schedule of presentation will be arranged in advance. Field excercies for students will be organized in the selected fishpond and in the Nature Park "Kopački rit". After completed with lectures and excercises, an oral exam will be held.

Making records during the lectures, and preparing the exam from required literature list is advised to students. During the lecture, PowePoint presentations will be used in teaching and explaining topics, and students can download it from the web page of the Department of Hunting, Fishery and Beekeeping.

Literature

Required reading:

1. Delić, A. (1987): Prehrana crne liske (Fulica atra L) na Ribnjačarstvu „Končanica“, Ribarstvo Jugoslavije. 2-3, 42, 3-5.
2. Florijančić, T., Ozimec, S., Jurčević, I., Opačak, A. (2002): Ecological breeding of the winged game at fishponds in eastern Croatia: Proceedings of the scientific and proffesional veterinary conference Veterinary days, Rovinj, October 17th - 20 th.
3. Getz, D., Majtorović, V., Manojlović, R., Brna, J., Kajgana, Lj., Horvat, Z. (1997): Ribnjak 1905., Eko-turistički vodič. Osijek.
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18. Treer, T., Safner, R., Aničić, I., Lovrinov, M. (1995): Ribarstvo. Nakladni zavod globus. Zagreb.
19. Tucak Z. i sur., (2002): Lovstvo, drugo prošireno izdanje. Poljoprivredni fakultet u Osijeku. Osijek.
20. Tucak, Z., Šetina, M., Čupić, I. (1996): Organiziranje uzgoja i proizvodnje lovne divljači uz ribogojilišta, Ribarski dani „Osijek '96“, Zbornik radova, gl. ur. dr.sc. Anđelko Opačak, I. Nacionalno znanstveno –stručno savjetovanje „Održivost ribnjačarske proizvodnje Hrvatske“, Bizovac, 28-29. studenoga 1996, Hotel „Termia“.
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Recommended literature:

1. Adamek, Z., Klinger, H., Staub, E. (1997): Cormorants in Europe—the evaluation of EIFAC/FAO questionnaire campaign. Suppl Ric Biol Selvaggina 26:347–353
2. Carss, DN., Bevan, RM., Bonetti, A., Cherubini, G., Doherty, D., El Hili, A., Feltham, MJ., Grade, N., Granadeiro, D., Gromadzka, J., Harari, YNRA., Holden, T., Keller, T., Lariccia, G., Mantovani, R., McCarthy, TK., Mellin, M., Menke, T., Mirowska-Ibron, I., Muller, W., Musil, P., Nazirides, T., Suter, W., Trauttmansdorff, J., Volponi, S., Wilson, B. (1997): Techniques for assessing cormorant diet and food intake: towards a consensus view. Suppl Ric Biol Selvaggina 26:197–230.
3. Dobrowolski, KA., Dejtrowski, R. (1997): Conflict between fisherman and cormorants (Phalacrocorax carbo) in Poland. Ekol Pol 45:279–283
4. Đordević, V., Mikuška, J. (1986): Utjecaj velikog vranca (kormorana) Phalacrocorax carbo L. na uzgoj ribe u ribnjacima PIK “Belje”. Ribarstvo Jugoslavije, 41, 74-76.
5. Feltham, M.J., Davies, J.M. (1997): Daily food intake of cormorants: a summary. Suppl.Ric.Biol. Selvaggina XXVI: 259 -268.
6. Fijan, N. (2002): Stanje akvakulture u svijetu i u Europi. Ribarstvo, 60: 59-75.
7. Gromadzka, J., Gromadzki, M. (1997): Damage made by cormorants (Phalacrocorax carbo) in Europe: preliminary summary of questionnaire answers. Ekol Pol 45: 285–286.
8. Keller, T. (1997): Estimating the daily energy expenditure of wintering Cormorants (Phalacrocorax carbo sinensis) in Bavaria, Southern Germany – methods and handling. Suppl. Ric. Biol. Selvaggina XXVI: 269 – 278.
9. Mikuška, J. (1986): Prilog poznavanja ishrane velikog vranca (Phalacrocorax carbo L.) na ribnjacima Slavonije i Baranje. Ribarstvo Jugoslavije, 41, 24-26.
10.Müller, R. (1986): Die nahrung des Kormorans (Phalacrocorax carbo sinensis) am Bodensee. Fishereiwisseschaft 3, (1), 1-2.
11. Opačak, A., Stević, I. (1998): Štete od velikog vranca (Phalacrocorax carbo L, 1758) na IPK Osijek ‘‘Ribnjacˇ arstvo’’ d.o.o. Donji Miholjac (od 1993. do 1996. godine). Gospodarsko vjesˇ tacˇ enje—Sudski spis III-P-13/96-20, Opc´ inski sud Donji Miholjac, 47 pp.
12. Opačak, A., Stević, I. (2002): Current Cormorant damage problem on carp fish ponds. Proceedings of 3rd National scientific and professional conference with international participation. 20-21 June 2002, Bizovac, Croatia.
13. Pažur, K. (1996): Kormoran – problem i moguće rješenje. Ribarstvo, 54(4), 173-180.

14. Pažur, K. (2002): Kormoran, veliki vranac (Phalacrocorax carbo sinensis L) I štete na ribljem fondu zbog njegove hiperpopulacije. Ribarstvo, 58(3), 141-147.
15. Radović, D., Tutiš, V. (2002): Procjena šteta od ptica na ribnjaku Crna Mlaka tijekom 1997. godine. Zavod za ornitologiju, Zagreb, 1-7.
16. Seiche, K. (1996): Sukobi između zaštite prirode i ribnjačarske proizvodnje na šaranskim ribnjacima – moguća rješenja i strategija. Zbornik radova «Šaranski ribnjaci i zaštita ptica močvarica u Hrvatskoj». Hrvatsko ornitološko društvo, Zagreb, 18-24.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.6	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.6	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	0.8	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:
Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads

20 teaching hours (lectures + exercises) + 15 hours of preparation = 1.6 ECTS (40 teaching hours/75 hours of total load x100 = 53.4% from total of 3 ECTS)
Seminar paper (5 hours + 10 hours of preparation) = 0.6 ECTS (15 hours/75 hours of total load x100 = 20.0% from total of 3 ECTS)
Final exam = 0.8 ECTS (20 hours of preparation/75 hours of total load x 100 = 26.6% from total of 3 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Technology of Game Meat and Meat Products**	
Module coordinator	Ivona Djurkin Kušec	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S - 5

Module aim

To introduce the students to technological operations of game meat production and processing; to introduce the students to ways of assesing hygienic validity of game meat.

Terms of admission

None

Expected learning outcomes

After completing the module, student will be able to:

1. Describe procedures with the game after shooting
2. Analyse chemical composition of meat originating from several game species
3. Recommend appropriate measures of game meat veterinary-sanitary inspection
4. Asses hygienic and microbiological validity of game meat
5. Evaluate game meat quality

Module content

Production of meat and other products from game animals raised in natural and controlled enviroment; procedures with the game after shooting; chemical composition of game meat; processing of other products from game animals (eggs, fure, skin, feather); modern concept of veterinary-sanitary inspection (HACCP); veterinary-sanitary inspection of game meat; procedure with game animals from intensive production (inspection before slaughter, processing after slaughter, inspection of meat and organs); assesment of game meat hygienic validity; enabling of conditionally usable game meat; hygienically unusable meat; radioactive contamination of game meat; assesment of game meat in contagious and other diseases; bacterial contamination of game meat; parasitary diseases; game meat quality; researching current literature on new developments in game meat technology.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to prepare for lectures and exercises by studying recommended literature. In agreement with the lecturer student chooses theme of the seminar paper, which is then presented in the form of PowePoint presentation. The exercises are obligatory. Students are advised to study from required literature.

Literature

Required reading:

1. Lawrie, R. A. (1985): Meat Science. Pergamon Press.
2. Rahelić, S. (1978): Osnove tehnologije mesa. Školska knjiga. Zagreb.
3. Živković, J. (1986): Higijena i tehnologija mesa. Veterinarski fakultet Sveučilišta u Zagrebu. Zagreb.
4. Tucak, Z. (ur.) (2002): Lovstvo, drugo prošireno izdanje. Poljoprivredni fakultet u Osijeku. Osijek.
5. Živković, (1986): Higijena i tehnologija mesa. Veterinarski fakultet Sveučilišta u Zagrebu. Zagreb.
6. Kovačević, D. (2002): Tehnologija mesa. Prehrambeno tehnološki fakultet u Osijeku. Osijek.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Studying the literature	Checking of activitythrough conversation
Exercises	0.2	4-5	Exercises in laboratory and onthe field according to the program of exercises	Succesfully commented resultof the exercises
Seminar	0.2	1-5	Studying the literature,making and presentation of seminar	Review and evaluation according to thepre-established criteria
Exam	1.8	1-5	Preparing for exams bystudying required literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
Lectures = 0.8 ECTS (20 hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)
Laboratory exercises = 0.2 ECTS (5 hours/75 hours of total load x100 = 6.67% from total of 3 ECTS)
Seminar paper = 0.2 ECTS (5 hours/75 hours of total load x100 = 6.67% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of lecturer's work and evaluation of module's quality through anonymous student questionnaire.

Module name	**Canine Reproduction**	
Module coordinator	Marcela Šperanda	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S - 5

Module aim
Understanding the characteristics of the estrous cycle in bitch, development of male sex organs and sperm production, the control of oestrus and ovulation. To familiarize the students with the most important pathologies in males and females.

Terms of admission
No prerequisite.

Expected learning outcomes
After completing the module, student will be able to:
1. Distinguish the organs of the reproductive system of males and females.
2. Enumerate structure and role of reproduction.
3. Connect neurohormonal regulation of the estrous cycle and control of estrus.
4. Enumerate methods for diagnosis of pregnancy.
5. Describe the hormonal regulation in male animals.
6. Enumerate the most common congenital and acquired defects of the male.
7. Demonstrate management of the reproductive cycle.

Module content
Structure and function of male and female sexual organs. Infertility in males and females. Mating. Pregnancy and partus. Control of estrus and pregnancy diagnosis in bitches.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Participate in the teaching process, prepare literature

Literature
Required reading:

1. Dyce K. M., Sack W. O., Wensing C. J. G., (2009): Textbook of Veterinary Anatomy. Saunders. Philadelphia, London, New York, St. Lois, Sydney, Toronto.
2. Sjaastad O. V., Sand O., Hove K., (2010): Physiology of domestic animals. Scandinavian Veterinary Press.
3. Reece W. O. (2010): Physiology of domestic animals. Williams and Wilkins.

Recommended literature:

1. Pineda M.H. (2003): McDonald's Veterinary Endocrinology and Reproduction. Iowa State Press.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.0	1-4, 6	Studying the literature	Verification activities
Seminar	0.2	5, 7	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.8	1-7	Preparing for exam by studying required literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Modul has 3 ECTS credits; 20 L, 5 S, 5 E.
1 ECTS = 25 hours
3 ECTS boda = 75 hours
25 hours lectures= 1 ECTS (25 hours/75 total load x100 = 33.33% from total 3 ECTS)
Seminar= 0.2 ECTS (5 hours/75 total load x100 = 6.67% from total 3 ECTS)
Final exam= 1.8 ECTS (45 hours/75 total load hours x 100 = 60.00% from total 3 ECTS

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Nutrition of Dogs**	
Module coordinator	Ivica Bošković	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 5 ; S – 10

Module aim

To introduce students more thoroughly with nutritional reqirements of dogs, depending on their purpose and activities (for hunt, racing, shepherd role, or as a pet). Different functioning of dog organism requires appropriate mode of nutrition, with various portions of the nutritive substances. Students will be educaed on different nutritional regimes in dogs, depending on physiological period in dog's life (nutrition of cubs, females in gravidity), as well as under the various pathological conditions.

Terms of admission

Passed exam from the compulsory modul Cynological Zoology.

Expected learning outcomes

After completing the module, student will be able to:

1. Evaluate particular foodstuffs and other parts of the food used in nutrition of dogs, regarding their quality and digestability.
2. Evaluate and estimate origin and quantity of nutritional elements, such as proteins, fats, carbohydrates, vitamines.
3. Ranking and comparing quality of food types (dry, semi-dry, wet) and manner of using them in nutrition of dogs.
4. Select the most convenient food, considering the physiological and health condition and age of dog.
5. Recommend applicable and best food considering the seasonality, manner of keeping the dog and usage of dog.
6. Assess the value of particular nutritional mode regarding the health status of dog.

Module content

Main components of the food. Nutrition of various categories of dogs. Main differences between cooked ant other types of processed food. Dietary nutrition in case of an allergies. Special nutrition at diseases of digestive organs; heart diseases diabetes and diseases of urogenital tract.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. Part of the exercises will be carried out as field teaching, for which the students needs to come with appropriate footwear and clothing. After that, students take a final exam. Students are advised to prepare exam from required literature list.

Literature

Required reading:

1. Bedrica, Lj. (2001): Osnove prehrane pasa. Interna skripta. Veterinarski fakultet Sveučilišta u Zagrebu. Zagreb.
2. Tucak, Z. (ur.) (2003): Lovna kinologija. Poljoprivredni fakultet u Osijeku. Osijek.

Recommended literature:

1. Edney, A. T. B. (1988): The Waltham Book of Dog and Cat Nutrition. 2nd edit. Pergamon Press. Oxford.
2. Wills, J. M., Simpson, K. W. (1994): The Waltham Book of Clinical Nutrition of the Dog & Cat. Pergamon Press, Oxford.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.8	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.4	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.8	1-6	Preparing for exam by studying required and recommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures + exercises) = 0.8 ECTS (20 teaching hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.4 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Cytogenetics**	
Module coordinator	Sonja Petrović	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 5, S - 5

Module aim

To educate students to choose and conduct cytogenetic analysis which will show possible chromosome aberations in game and dogs. Students will learn to apply cytogenetics tests as bioindicators in nature, hunting area or in different experimental contidions with aim to determine or predict effect of present or possibly present factor (agens) in specific area.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Outline and decribe cell cycle (mitosis and meiosis) and identfy key stages.
2. Define term karyotype nad karyogram, and describe chromosome organisation and structure.
3. Identfy changes in chromosome structure and number.
4. Identify and choose cytogenetic methods for bioindication.

Module content

Chromosome organisation, Chromosome morphology, Nucleolar organisator, centromere, telomere. Karyotype and karyogram analysis, changes in chromosome number and structure, Cell cycle and mitotical index, Cytogenetic bioindication and species test.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are required to prepare for seminar writing through investigation and study of appropriate literature. Student are obligated to prepare an oral presentation of written seminar by PowerPoint presentation in duration of max. 15 minutes. After presented and evaluated seminar student will writte final exam with an oral explanation of solved problems. Students are advised to prepare for exam using required and recommended literature.

Literature

Required reading:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K.& Watson, J. D. (1994): Molecular biology of the cell. 3th ed. Garland publishing, Inc. New York - London.
2. Blackburn, G. M., Gait, M. J. (1996): Nucleic acids in chemistry and biology. 2nd ed. University Press. Oxford.
3. Griffiths, A. J. F., Miller, J. H., Suzuki, D. J., Lewontin, R. C., Gelbart, W. M. (1993): An Introduction to genetic analysis. W.H. Freeman & Co. New York .
4.Jones, R. N., Karp, A. (1988): Introducing genetics. John Murray Ltd. London.

Recommended literature:

1.Cavalier- Smith, T. (1985): The evolution of genome size. John Wiley & Sons. Chicester-New York.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.6	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.2	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.2	1-4	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	2.0			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
15 teaching hours (lectures + exercises) = 0.6 ECTS (15 teaching hours/50 hours of total load x100 = 30% from total of 2 ECTS)
Seminar paper = 0.2 ECTS (5 hours/50hours of total load x100 = 10% from total of 2 ECTS)
Final exam = 1.2 ECTS (30 hours of preparation/50hours of total load x 100 = 60% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Diseases of Game Animals**	
Module coordinator	Tihomir Florijančić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S - 5

Module aim

To introduce students with epizootiology and diseases of game animals which have an econimical importance or zoonotic potential

Terms of admission

Passed exame from the obligatory module Principles of Breeding and Protection of Game Animals.

Expected learning outcomes

After completing the module, student will be able to:

1. Describe epizootiology in game animals.
2. Classified diseases according to their etiology..
3. Distinguish diseasees according to their economical importance or zoonotic potential..
4. Analyze particular disease regarding its etiology, epizootiology, pathogenesis, diagnostic, treating methods and profilax.

Module content

General epizootiology. Definition and aim of the epizootiology. Researching methods in epizootiology (descriptive, analytical, experimental and theoretical). Infection and invasion. Relationship between causative agent and host, and causative agent and consequences of disease. Epizootiological factors. Sources of infection/invasion. Zoonosis. Infectious diseases (viral, bacterial, fungal, prionic etc.). Parasitic diseases (ektoparasitic and endoparasitic). Poisoning in game animals.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☒ mentoring
- ☐ other

Student requirements

Regular attendance on teaching and active participation in performing tasks given during the lecture and exercises is expected from the students. Students have an obligation to prepare individual seminar paper, which they present orally in duration 10-15 minute, using PowerPoint presentation. Schedule of presentation will be arranged in advance. Field work excercies will be organized in the microbiological laboratory. After completed with lectures and excercises, an oral exam will be held. Making records during the lectures, and preparin the exam from required literature list is advised to students. During the lecture, PowePoint presentations will be used in teaching and explaining topics.

Literature

Required reading:

1. Cvetnić, S. (1993): Opća epizootiologija. Školska knjiga. Zagreb.
2. Cvetnić, S. (2003): Virusne bolesti životinja. Školska knjiga. Zagreb.
3. Cvetnić, S. (2002): Bakterijske i gljivične bolesti. Medicinska naklada. Zagreb.
4. Mustapić, Z. (ur) (2004): Lovstvo. Hrvatski lovački savez. Zagreb.
5. Srebočan, V., Srebočan, E. (2009): Veterinarska toksikologija. Medicinska naklada. Zagreb.

Recommended literature:

1. Peter J., Hudson, P. J., Rizzoli, A., Grenfell, B. T., Heesterbeek, H., Dobson, A. P. (2002): The Ecology of Wildlife Diseases. Oxford University Press. Oxford.
2. Rupić, V. (2009): Zaštita zdravlja domaćih životinja, zarazne i parazitske bolesti. HMU. Zagreb.
3. Herak-Perković, V., Grabarević, Ž., Kos J. (urednici) (2012): Veterinarski priručnik (VI. izmjenjeno izdanje), Medicinska naklada. Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.0	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work andassignments
Seminar	0.2	1-4	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.8	1-4	Preparing for exam by studying required and recommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
25 teaching hours (lectures + exercises) = 1.0 ECTS (25 teaching hours/75 hours of total load x100 = 33.33% from total of3 ECTS)
Seminar paper = 0.2 ECTS (5 hours/75 hours of total load x100 = 6.67% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Management in the Hunting**	
Module coordinator	Tihomir Florijančić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 10, S - 5

Module aim

To introduce students with different means of breeding and protection of game animals, procedure for evaluating the quality of habitats, estimating the capacity of the hunting ground for the game population. Arrangement of the hunting ground.

Terms of admission

Passed exame from the obligatory module Principles of Breeding and Protection of Game Animals.

Expected learning outcomes

After completing the module, student will be able to:

1. Analyze means of management in the hunting grounds and with game animals
2. Estimate hunting productive surface, bonitet and economic capacity of the hunting grounds
3. Planning the guidelines in management of the hunting ground for particular game animals
4. Estimate types, numbers and arrangement of tehnical and managing objects in the hunting grounds
5. Estimate needs for nutrition and feeding the game animals in particular hunting ground
6. Planning the game breeding under controlled conditions.

Module content

Means of the management in the hunting ground under natural game breeding, in the confined area and in combined breeding. Comparison and technological specifities of each management mean. Hunting ground as habitat for game animals; structure of the hunting ground and conditions needed for breeding the particular game species. Procedure for determing te quality of habitats in term of determing capacity of the hunting grounds for each game species. Technical equipment in the hunting grounds, objects aimed for hunting and breeding, their characteristics and spatial arrangement. Study field visit to selected hunting ground, observation of the open and confined hunting ground, breeding places, and making the technical objects and their proper placement.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☒ mentoring
- ☐ other

Student requirements

Regular attendance on teaching and active participation in performing tasks given during the lecture and exercises is expected from the students. Students have an obligation to prepare individual seminar paper, which they present orally in duration 10-15 minute, using PowerPoint presentation. Schedule of presentation will be arranged in advance. Field excercies for students will be organized in the selected hunting ground and in the Nature Park "Kopački rit".
After completed with lectures and excercises, an oral exam will be held. Making records during the lectures, and preparing the exam from required literature list is advised to students. During the lecture, PowePoint presentations will be used in teaching and explaining topics.

Literature

Required reading:

1. Tucak, Z.(ur.) (2002): Lovstvo, drugo prošireno izdanje. Poljoprivredni fakultet u Osijeku. Osijek.
2. Sertić, D. (2008): Uzgoj krupne divljači i uređenje lovišta. Veleučilište u Karlovcu. Karlovac.
3. Pintur, K. (2010): Uzgoj sitne divljači. Veleučilište u Karlovcu. Karlovac.
4. Degmečić, D. (2011): Selekcija jelenske i srneće divljači, Hrvatski lovački savez. Zagreb.
5. Anonimus : Zbirka zakonskih i podzakonskih propisa iz lovstva. Ministarstvo poljoprivrede www.mps.hr/.../LOVSTVO/Zbirka%20propisa%20iz%20lovstva.pdf
6. Tucak, Z. (ur.) (2006): Zaštita divljači. Poljoprivredni fakultet u Osijeku. Osijek.

Recommended literature:

1. Wiliams, B.K., Nichols, J.D., Conroy, M.J. (2002): Analysis and Management of Animal Populations. Academic Press. London.
2. Mustapić, Z. (gl.ur.) (2004): Lovstvo. Hrvatski lovački savez. Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.0	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.2	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.8	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

25 teaching hours (lectures + exercises) = 1.0 ECTS (25 teaching hours/75 hours of total load x100 = 33.33% from total of 3 ECTS)

Seminar paper = 0.2 ECTS (5 hours/75 hours of total load x100 = 6.67% from total of 3 ECTS)

Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Inventory and Arrangement of the Hunting Grounds**	
Module coordinator	Mladen Jurišić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	Second	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

Objective of this module is to acquire knowledge from geionformatizacije and its application in agriculture and in the wider hunting and cynology in the narrow sense. The candidate this module should learn how to use GIS technology, remote sensing and GPS and navigation in the hunting area and beyond. The candidates will master the use of the latest GIS tools and software, and apply them to concrete problems and tasks related to hunting and Kinology. Furthermore, students will be introduced to the methodology of inventory and planning hunting grounds in in order to design high-quality hunting grounds.

Terms of admission

no preconditions

Expected learning outcomes

After completing the module, student will be able to:

1. Prepare and present the basic tenets of GIS technology and Global Positioning System (GPS).
2. Handle some of the basic GIS software in agriculture - inventorying and technique; Open source.
3. Evaluate the application of remote sensing in resource inventories (hunting grounds and wildlife) and create folders and evaluate methods of map production in agriculture).
4. Organize, set up and run systems to navigate in agriculture and applied (D) GPS systems in engineering and transportation.
5. Create maps and plans in hunting, and the introduction of spatial data processing, inventory large areas / monitoring of hunting resources, arranging hunting grounds and making Hunting Management

Module content

Introduction to geoinformation technologies. GIS Software and. Remote sensing (Inventory) maps in agriculture and methodology of the same). Precision agriculture (precision farming). Digital Cartography - satellite imagery and digital aerial photogrammetry. The process of creating a GIS. A global positioning system (GPS and DGPS). Working with GPS and navigation. The use of Global Positioning System in agriculture and agricultural engineering - navigation. GIS Presentations. Maps and plans in hunting, introduction to sampling and spatial data processing, inventory large areas / monitoring of hunting resources, arranging hunting grounds and game management

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☒ other

Student requirements

All students are required to prepare for the seminar and presentation of the study of appropriate literature. Students prepare a seminar work that is required. Seminar students present orally for about 30 minutes with the presentation. Schedule of presentation will be arranged in advance. After that, students verbally lay the theoretical basis of the method of scientific research technical systems in agriculture.

Literature

Required reading:

1. Jurišić, M., Plaščak, I., (2009) : Geoinformacijski sustavi. Poljoprivredni fakultet u Osijeku. Osijek.
2. Jurišić, M. (2013): Geoinformacijski sustavi GIS u poljoprivredi i zaštiti okoliša. Poljoprivredni fakultet u Osijeku. Osijek.
3. www.arkod.hr.

Recommended literature:

1. Ludowicy, C., Schwaiberger, R., Leithold, P. (2002): Precision farming – Hanbuch fur die Praxis. Verlag. Frankfurt am Main.
2. Committee on Assesing Crop Yield (1997): Precision agriculture in 21st century. National Academy Press. Washington.
3. Burrough, P. ., McDonnell R. A. (2006): Principles of Geographical Information Systems – Spatial Information Systems and Geostatistics. Oxford University Press. Oxford.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.4	1-5	Studying literature, assignments	Provjera obavljene aktivnosti kroz usmeni razgovor
Seminar	0.4	1-5	The study of literature, preparation, and presentation of seminars	Pregled i vrednovanje seminarskog rada prema unaprijed utvrđenim kriterijima
Vježbe	0.4	1-5	Studying literature, manuals for exercise	practical work
Final exam	1.8	1-5	Preparation for the exam by studying recommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:
The module has 3 ECTS credits
1ECTS point = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
10 hours of instruction (lectures) = 0.4 ECTS (10 teaching hours / 75 hours total load x100 = 13.33% of the total 3 ECTS)
Seminar = 0.4 ECTS (10 hours / 75 hours total load x100 = 13.33% of the total 3 ECTS)
Exercises = 0.4 ECTS (10 hours / 75 hours total load x100 = 13.33% of the total 3 ECTS)
Final exam = 1.8 ECTS (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment
The evaluation of teachers and the quality of the above modules via anonymous student questionnaire.

Module name	**Hygienic and Sanitary Measures in the Hunting Ground**	
Module coordinator	Mislav Đidara	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 10, S - 5

Module aim

Selection and application of prophylactic measures to protect human health, wildlife and environmental conservation, and establishing and organizing appropriate hygienic-sanitary measures in the hunting area .

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate contemporary methods of soil and water hygiene.
2. Assess and evaluate abiotic and biotic factors significant for hygiene hunting grounds.
3. Rank and compare methods for disinfection, pest and rodent control hunting grounds.
4. Identify and choose newer methods of disinfection, pest and rodent control in hunting grounds according to the characteristics of hunting grounds.
5. Evaluate the economic damage caused by the non-implementation of hygienic-sanitary measures in the hunting area.
6. Recommend biological, mechanical and chemical methods for the implementation of hygienic-sanitary measures in the hunting area.

Module content

Hygiene soil and water. Abiotic and biotic factors. Hygiene of hunting grounds. Chemical-microbiological contamination of hunting grounds. Applied disinfection, types and methods. Disinfectants and mechanism of action. Applied fumigation, control insects and mites, methods of application of insecticides, a division of insecticides, insect resistance, fumigation. Applied eradication, meaning harmful rodents in the environment, diseases, economic damage, reducing the population, biological, mechanical and chemical methods. Rodenticides, applications. Effect of pesticides on the environment.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For

laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Vidović, M. (2002): Zaštita divljači, knjiga 1 - Higijena lovišta. Pučko otvoreno učilište Hubert. Split.
2. Korunić, Z. (2000): Insekticidi, fumiganti i rodenticidi u prometu u Republici Hrvatskoj. Korunić d.o.o. Zagreb.

Recommended literature:

1. Laaksonen, S., Paulsen P. (2015): Hunting Hygiene. Academic Publishers. Wageningen.
2. Block, S. S. (1991): Desinfectio, Sterilization and Preservation. 4nd Edition. Lea & Febiger. Philadelphia.
3. Tomlin, C. (1995): Pesticide manual Incorporating the Agrochemical Handbook. Tenth edition. BCPC. Farnham.
4. Buckle, A. P., Smith, R. H. (1994): Rodent Pests and Their Control. Wallingford.
5. Mehlhorn, B., Mehlhorn, H. (1996): Zecken, Milben, Fliegen, Schaben. 3. Aufl., Springer. Berlin, Heidelberg, New York.
6. Strauch. D., Bohm, R. (2002): Reinigung und Desinfektion in der Nutztierhaltung und Veredelungswirtschaft. 2. vollig neu bearbeitete Auflage. Enke Verlag. Stuttgart.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.0	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.2	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.8	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

25 teaching hours (lectures + exercises) = 1.0 ECTS (25 teaching hours/75 hours of total load x100 = 33% from total of 3 ECTS)

Seminar paper = 0.2 ECTS (5 hours/75 hours of total load x100 = 7% from total of 3 ECTS)

Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 6% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

Module name	**Hunting Legislation**	
Module coordinator	Tihomir Florijančić	
Study programme	Postgraduate university study of Agricultural Sciences, major Hunting and Cynology	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

To introduce students with legislation comprising rearing and protection of game animals, and practical usage of regulations in the hunting management, as well as in the environmental and nature protection.

Terms of admission

Passed exame from the obligatory module Principles of Breeding and Protection of Game Animals.

Expected learning outcomes

After completing the module, student will be able to:

1. Enumerate legal regulations that are relevant for the hunting in Croatia and compare them with EU and global level
2. Interprate laws and subordinate legislation in the field of the hunting management, environmental and nature protection.
3. Assess the validity of the hunting management
4. Estimate consequences of violating legal regulations in hunting.

Module content

History of the hunting legislation (dominal and regal system). Legislation in hunting in the Republic of Croatia with an emphasis on legislation at EU and global level. Procedures in proposing and adopting laws and subordinate regulations, specifically in the field of hunting. Implementation and usage of legislation in practice and consequences for violating the regulations and laws.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☒ mentoring
- ☐ other

Student requirements

Regular attendance on teaching and active participation in performing tasks given during the lecture and exercises is expected from the students. Students have an obligation to prepare individual seminar paper, which they present orally in duration 10-15 minute, using PowerPoint presentation. Schedule of presentation will be arranged in advance. Field excercies for students will be organized in the selected hunting ground and in the Nature Park "Kopački rit". After completed with lectures and excercises, an oral exam will be held. Making records during the

lectures, and preparing the exam from required literature list is advised to students. During the lecture, PowePoint presentations will be used in teaching and explaining topics.

Literature

Required reading:

1. Anonimus : Zbirka zakonskih i podzakonskih propisa iz lovstva. Ministarstvo poljoprivrede www.mps.hr/.../LOVSTVO/Zbirka%20propisa%20iz%20lovstva.pdf

Recommended literature:

1. Lončarić-Horvat, O., Cvitanović, L., Gliha, I., Josipović, T., Medvedović. D., Omejec. J., Seršić, M. (2003): Pravo okoliša, treće izmijenjeno i dopunjeno izdanje. Ministarstvo zaštite okoliša i prostornog uređenja, Organizator, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.4	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.8	1-4	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures + exercises) = 0.8 ECTS (20 teaching hours/75 hours of total load x100 = 26.67 % from total of 3 ECTS)
Seminar paper = 0.4 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student questionnaire.

After completing the major Hunting and Cynology, student will be able to:

Learning Outcome 1	Critically assess the results of researches published in scientific papers, based on the objectives of research, experimental design, performed statistical analysis and interpretation of the results
Learning Outcome 2	Synthesize, apply and evaluate modern methods of feeding and selection procedures of game animals and dogs
Learning Outcome 3	Describe biological, ecological and zoogeographical characteristics of game animals
Learning Outcome 4	Interpret ecological factors in the habitat with an aim to estimate economic capacity of the hunting grounds, and based on that plan the guidelines for management in the hunting ground
Learning Outcome 5	Estimate and evaluate breeding quality, exterior features and training level of dogs
Learning Outcome 6	Describe specificity in physiology of game and dogs
Learning Outcome 7	Recommend appropriate measures of game meat veterinary-sanitary inspection
Learning Outcome 8	Identify and choose cytogenetic methods for bioindication

PLANT BREEDING AND SEED PRODUCTION

2.5. Modules of major Plant Breeding and Seed Production

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Quantitative Genetics	50	5
2.	Population Genetics II	50	5
3.	Plant Breeding	50	5
4.	Methods of Seed Production	50	5

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Seed Physiology	40	4
2.	Production of Cereal Seeds	40	4
3.	Plant Genetic Resources	40	4
4.	Biometrics	40	4
5.	Seed Processing and Storage	40	4
6.	Fertilization	40	4
7.	Quarantine Pests and Diseases	40	4
8.	Marketing and Market in Seed Science	40	4
9.	Irrigation of Seed Crops	40	4
10.	Breeding of Small grain Cereal Crops	40	4
11.	Maize Breeding	40	4
12.	Breeding of Industrial Plants	40	4
13.	Breeding Forage Crops	40	4
14.	Seed Production of Industrial Plants	40	4
15.	Seed Production of Forage Crops	40	4
16.	Seed Production Technology in Horticulture	40	4
17.	Seed Production and Processing Technique	40	4
18.	Introduction to Scientific Work	40	4
19.	Biochemistry and Molecular Biology	50	5
20.	Heavy Metals in Agroecological System	50	5

2.5.1. Learning outcomes of major Plant Breeding and Seed Production

Module name	**Quantitative Genetics**	
Module coordinator	Sonja Petrović	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	5
	Lecture hours (L+E+S)	L - 30, E - 0, S - 20

Module aim
To introduce students with principles of quantitative genetics which are very important in plant breeding and seed science.

Terms of admission
Gained knowledge in genetics, population genetics, plant breeding and biometrics.

Expected learning outcomes
After completing the module, student will be able to:
1. Describe and define basic topics in quantitative genetics and unedrstand the concept of quantitative trait.
2. Follow up different types of inehritance in breeding population of plants.
3. Use statistical methods in order to analyse variability within and among genotypes and populations.
4. Based on knowing the principle and effect of plant breeding methods predict the outcome and breeding sucess.

Module content
Inheritance of quantitative traits, Effects of minor genes, phenotypic and genotypic variance analysis, heritability, inbreeding and heterosis. With help of new acknowledgments from literature students will process chapters from some areas of quantitative genetics.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students are required to prepare for seminar writing through investigation and study of appropriate literature. Student are obligated to prepare an oral presentation of written seminar by PowerPoint presentation in duration of max. 15 minutes. Lectures consists also of utilization of statistical data analysis by SAS and NTSYS and interpretation. After presented and evaluated seminar student will write final exam with an oral explanation of solved problems. Students are advised to prepare for exam using required and recommended literature.

Literature

Required reading:

1. Lectures (presentations).
2. Falconer, D. S., Mackay, Trudy, C. C. (1996): Introduction to quantitative genetics, fourth edition, Longman group Ltd. Edinburgh.
3. Borojević, S. (1981): Principi i metodi oplemenjivanja bilja, Novi Sad.
4. Kearsey, M. J. , Pooni, H. S. (1996). The Genetical Analysis of Quantitative Traits. London: Chapman & Hall.
5. Selection of 5 review scientific papers.

Recommended literature:

1. Liu, B. H. (1998). Statistical genomics: linkage, mapping, and QTL analysis. Boca Raton: CRC Press.4.
2. Hill, J., Becker, H. C., Tigerstedt, P. M. A. (1998). Quantitative and Ecological Aspects of Plant Breeding. London: Chapman & Hall.
3. Journals: TAG, Plant breeding, JAG, Crop Science, Euphytica itd.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	1.2	1-4	Literature and assigment problemsstudy	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.8	1-4	Lliterature study, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	3	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral and written)
Total	5			

The way of calculating ECTS credits for certain activities:

Module carries 5 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
5 ECTS credits = 125 hours of module loads
30 teaching hours (lectures) = 1.2 ECTS (30 teaching hours/125 hours of total load x 100 = 24% from total of 5 ECTS)
Seminar paper = 0.8 ECTS (20 hours/125 hours of total load x 100 = 16% from total of 5 ECTS)
Final exam = 3 ECTS (75 hours of preparation/125 hours of total load x 100 = 60% from total of 5 ECTS)

Module quality assessment

Valuation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Population Genetics II**	
Module coordinator	Georg Drezner	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	5
	Lecture hours (L+E+S)	L - 30, E - 0, S -20

Module aim

Population Genetics II aims to provide postgraduate students with fundamental knowledge for understanding plant breeding and seed production.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify and distinguish between populations of self-pollinated and cross-pollinated plants.
2. Discover, demonstrate and interpret differences of populations that are and are not in H-W equilibrium.
3. Differentiate and analyze changes in population (migration, mutation, selection, random drift).
4. Undestand the differences and trends in a large or a small population, depending on the system of fertilization.
5. Assess the genetic variability in the population.
6. Apply the acquired knowledge in the possible creation of clean lines, inbred lines and hybrids.

Module content

Fertilization options. Population species.Genes in population. Hardy-Weinberg law of equilibrium. Sex-linked genes in a population. Multiple alleles in a population. Genetic variation in a population. Changes in gene's frequencies and genotypes in the population affected by the mutation, migration and selection. The balance between mutation and selection. Small population. Growing in the family line or inbreeding. Creating clean lines, inbred lines or hybrids.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to complete a seminar by studying the literature. Lectures and classes in the field will help students diversify between a large from a small population, a self-pollinated and a cross- pollinated plant population, clean lines inbred lines and hybrids, as well as variety of imbalance causes in a population. Upon a completion of the seminar and studied literature, the students will be able to take the final oral exam.

Literature

Required reading:

1. Wallace, B. (1981): Basic Population Genetics,Columbia University, New York.
2. Borojević, K. (1991): Geni populacija,drugo prošireno izdanje, Forum, Novi Sad.
3.Hartl, D. I., Clark, A. G. (1997): Principles of Population Genetics (2.ed) Sinauer Ass.,Inc., Sunderland.

Recommended literature:

1. Falconer D. S., Mackay, T. F. C. (1996): Introduction to Quantitative Genetics (4.ed) Longman Group Ltd., Essex.
2. Bernardo, P. (2002): Breeding for Quantitative Traits in Plants, Stemma Press, Woodbury, Minnesota.
3. Journals: Theoretical and Applied Genetics, Euphytica, Crop Science, Plant Breeding.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.20	1-6	Studying literature, an active learning on examples and working in a field	Checking students' progress through conversations and activities
Seminar	0.80	1-6	Studying literature, wokring on presentations and completing the seminar	Grading seminar based on the required criteria
Final exam	3	1-6	Studying required andrecommended literature for the final exam	Exam
Total	5.00			

The way of calculating ECTS credits for certain activities:

Module carries 5 ECTS points
1 ECTS point=25 load hours (student work hours)
5 ECTS= 125 load module hours
30 lecture hours = 1.20 ECTS (30 lecture hours/125 complete load hours x 00=24.00% from the total of 5 ECTS points)
Seminar = 0.80 ECTS (20 hours/125 complete load hours x 100= 16.00% from the total of 5 ECTS points)
Final exam = 3.00 ECTS (75 preparation hours/125 complete load hours x 100 = 60.00% from the total of 5 ECTS points)

Module quality assessment

The evaluation of the professor's work and quality of the above modules via anonymus student surveyes.

Module name	**Plant Breeding**	
Module coordinator	Sonja Vila	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	5
	Lecture hours (L+E+S)	L - 10, E - 10, S - 30

Module aim

To educate participants about concepts in plant breeding, methods of selection for self-pollinated and cross-pollinated crop and to teach who to make breeding plans and conduct breeding trials.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Plan breeding program for important field crops.
2. Choose appropriate methods for selection process.
3. Rank selection methods according to their efficacy.
4. Recommend aims for breeding programs of important field crops.
5. Design steps for improvement of breeding process.

Module content

Methods of breeding and selection for self-pollinated crops, methods of breeding and selection for cross-pollinated crops, recurrent selection, hybrid selection, selection of synthetic cultivars and clonally propagated crops. Visit to the institutes and private breeding companies. Demonstration of the plant breeder's field work. Use of genetic resources and creation of germ-plasma collection.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and lectures using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students have a final exam. Students are advised to prepare exams from require
d literature list.

Literature

Required reading:

1. Martinčić J., Kozumplik, V. (1996): Oplemenjivanje bilja. Zagreb.
2. Poehlman, M. J., Sleper, D. A. (1995): Breeding Field Crops. Iowa State Press.
3. Acquaah, G. (2012) Principles of Plant Genetics and Breeding, Second Edition, John Wiley & Sons, Ltd, Chichester, UK. doi: 10.1002/9781118313718.

Recommended literature:

For seminar work students will use newest scientific papers published in international scientific journals.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	1.2	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	3	1-5	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	5			

The way of calculating ECTS credits for certain activities:

Module carries 5 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
5 ECTS credits = 125 hours of module loads
20 teaching hours (lectures + exercises) = 0.8 ECTS (20 teaching hours/125 hours of total load x 100 = 16% from total of 5 ECTS)
Seminar paper = 1.2 ECTS (30 hours/125 hours of total load x 100 = 24% from total of 5 ECTS)
Final exam = 3 ECTS (75 hours of preparation/125 hours of total load x 100 = 60 % from total of 5 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Methods of Seed Production**	
Module coordinator	Vlado Guberac	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	5
	Lecture hours (L+E+S)	L - 20, E - 0, S - 30

Module aim

To educate participants about methods and principles of seed production in selfpollinated and cross-pollinated crops and to teach them about legal legislation for seed production in Croatia and EU.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Organise and conduct seed production of important cultivated plants.
2. Choose methods for laboratory seed analysies.
3. Recommend the relevant method for seed production.
4. Conduct the process of inspection during field seed production.

Module content

Cultivar purity preservation, seed quality, laboratory analysis of seed quality, OECD seed categories, methods for seed production, isolation, legislation in seed production, processing and seed market in Croatia and EU.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars and lectures using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Guberac, V. (2000): Sjemenarstvo ratarskih kulktura. Poljoprivredni fakultet u Osijeku, pg 83.
2. Fenner, M. (1992): SEEDS (The Ecology of Regeneration in Plant Communities). CAB International, Wallingford, 373 pages.
3. Basta, A. (2006): Handbook of Seed Science and Technology. CRC Press, Taylor & Francis Group.

4. Skender, A., Knežević, M., Đurkić, M., Martinčić, J., Guberac, V., Kristek, A., Stjepanović, M., Bukvić, G., Matotan, Z., Šilješ, I., Ivezić, M., Raspudić, E., Horvat, D., Jurković, D., Kalinović, I. Šamota, D. (1998): Sjemenje i plodovi poljoprivrednih kultura i korova na području Hrvatske. Udžbenik. Sveučilište u Osijeku, Osijek, pg 224.
5. Babasaheb, B. Desai (2004): Seeds Handbook. Marcel Dekker, Inc.
6. Zakon o sjemenu, sadnom materijalu i priznavanju sorti poljoprivrednog bilja. NN 140/05, 35/08, 55/11, 14/14.

Recommended literature:

For seminar work students will use newest scientific papers published in international scientific journals

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	1.2	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	3	1-4	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	5			

The way of calculating ECTS credits for certain activities:
Module carries 5 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
5 ECTS credits = 125 hours of module loads
20 teaching hours (lectures) = 0.8 ECTS (20 teaching hours/125 hours of total load x 100 = 16% from total of 5 ECTS)
Seminar paper = 1.2 ECTS (30 hours/125 hours of total load x 100 = 24% from total of 5 ECTS)
Final exam = 3 ECTS (75 hours of preparation/125 hours of total load x 100 = 60 % from total of 5 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Seed Physiology**	
Module coordinator	Tihana Teklić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E -15, S - 15

Module aim

PhD students should get knowledge on the importance of physiological processes in the seed, environmental factors influences on these processes as well as on the seed vigour testing methods.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Recognise the impact of environmental factors on physiological processes during plant generative growth and development.
2. Understand seed metabolism and seed quality through the analysis of specific indicators and scientific literature usage.
3. Setup and perform the research of germinability, vigor and chemical analyses of seed independently.

Module content

The physiology of flowering, fertilization, fruit and seed maturation, postharvest seed physiology, seed dormancy, impact of stress conditions in the seed production and storage on seed vigour, standard and recommendable germination testing methods. Seminar works in the area of seed physiology and thematic discussions about contemporary research results published in scientific journals. Laboratory evaluation of the intensity and course of seed metabolic activity: α-amylase activity, seed respiration intensity in dormancy and germination and the influence of inhibitors, seedling growth intensity and phototropism, seed electrical conductivity and other vigour testing methods.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminar and exercises using particular literature. An active participation in laboratory exercises and experimental work with seed material required for seminar is expected, as well as data analyses and oral presentation of the results. Final exam is a writen knowledge evaluation.

Literature

Required reading:

1. Teklić, T. (2012): Fiziologija bilja. (skripta s predavanjima).
2. Milošević, M.; Kobiljski, B. (2011): Semenarstvo. Monografija, Svezak I, Institut za ratarstvo i povrtarstvo, Novi Sad.
3. Kastori, R (1984): Fiziologija semena. Novi Sad.
4. Pevalek-Kozlina, B. (2003): Fiziologija bilja. Profil International. Zagreb.
5. Kastori, R.; Maksimović, I. (2008): Ishrana biljaka. Vojvođanska akademija nauka i umetnosti. Novi Sad.
6. Lisjak, M., Špoljarević, M., Agić, D., Andrić, L. (2009): Praktikum iz fiziologije bilja. Poljoprivredni fakultet Osijek.

Recommended literature:

1. Fenner, M. (ed.) (2000): Seeds – The ecology of regeneration in plant communities. 2nd edition, CABI Publishing.
2. Reiss, C. (1994): Experiments in plant physiology. Prentice Hall.
3. Roger, M. J. R. (ed.) (2001): Handbook of plant ecophysiology techniques. Kluwer Academic Publishers.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1	1-3	Literature studying, assignment work	Checking student activity in a laboratory, discussion of the obtained results
Seminar	0.6	1-3	Literature studying, seminar preparation and presentation	Seminar evaluation
Final exam	2.4	1-3	Preparing for exam by studying required and recommended literature	Exam
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
25 teaching hours (lectures + exercises) = 1 ECTS (25 teaching hours/100 hours of total load x 100 = 25% from total of 4 ECTS)
Seminar paper = 0.6 ECTS (15 hours/100 hours of total load x 100 = 15% from total of 4 ECTS)
Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Production of Ceral Seeds**	
Module coordinator	Vlado Guberac	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S - 0

Module aim

To educate participants about management practices and supervision of cereal seed growing with emphasis on les favorable environment

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Estimate the importance of cereal seed production.
2. Rank the importance of seed production of different cereals.
3. Organise cereal seed production.
4. Estimate the conditions for seed production in certain area.
5. Compare and choose appropriate method for seed production.

Module content

Importance of seed production for management; areas and degree of cereals production in Worls and Republic of Croatia (RC); degree of production of seeds of cereals in RC; Agroecological needs of cereals with empasis on seed production and inclusion of environmental conditions (soil, climate) of RC in these needs. Management practice of sereal seeds production: choice of plot, soil tillage, fertilization, sowing, protection against weeds, diseases and insects; harvesting, storage. Seed processing of small grains – wheat, berley, ray, oats. Seed processing of maize hybrids.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for lectures using recommended reading literature.

Literature

Required reading:

1. Milošević, M., Malešević, M. (2004): Semenarstvo I i II. Monografija. Naučni institut za ratarstvo i povrtarstvo, Novi Sad.
2. Milošević, M., Kobiljski, B. (2011): Semenarstvo I-III. Monografija. Institut za ratarstvo i povrtarstvo. Novi Sad.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.6	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	2.4	1-5	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

40 teaching hours (lectures + exercises) = 1.6 ECTS (40 teaching hours/100 hours of total load x 100 = 40% from total of 4 ECTS)

Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Plant Genetic Resources**	
Module coordinator	Sonja Vila	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 15, E - =, S - 25

Module aim
To educate participants about importance of genetic resources and their use in plant breeding.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Evaluate the importance of plant genetic resources.
2. Organise actions for collecting, grading and keeping of plant genetic resources.
3. Choose methods for assessment and conservation of plant genetic resources.
4. Estimate need for conservation of genetic resources for different plant varieties.
5. Plan the use of genetic resources in plant breeding process.

Module content
Evolution, centres of genetic diversity, domestication of cultivated crops, sources of genetic diversity. Collection, evaluation and conservation of plant material. Methods for conservation of plant genetic resources, use of molecular techniques in estimations of genetic diversity. Bio-diversity in Croatia. Legislation for use of plant resources. Gene-banks. Use of plant genetic resources in plant breeding. Genetic resources and sustainable development. Socio-economical aspects of protection and use of plant genetic resources.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and lectures using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Brown, A. H. (1989): The Use of Plant Genetic Resources. Cambridge Univ. Press.
2. Elsevier's Dicitionary of Plant Genetic Resources (1991).
3. Engels, J. (2002): Managing Plant Genetic Diversity. CAB International.

4. Lesser, W. (1998): Sustainable Use of Genetic Resources Under the Convention on Biological Diversity: Exploring Access and Benefit Sharing Issues. CAB International.

Recommended literature:

For seminar work students will use newest scientific papers published in international scientific journals

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.6	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	1	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-5	Preparing for exam by studying required andrecommended literature	Written exam
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
15 teaching hours (lectures) = 0.6 ECTS (15 teaching hours/100 hours of total load x 100 = 15% from total of 4 ECTS)
Seminar paper = 1 ECTS (25 hours/100 hours of total load x100 = 25% from total of 4 ECTS)
Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Biometrics**	
Module coordinator	Dražen Horvat	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S – 0

Module aim

Aim of course gets to know the student with methods of the experimental labour and biometric analysis of the data collected in research in the plants breeding and the seed production.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Plan and organise the experiment. Recognise possible experimental issues.
2. Set the scientific hypothesis and use the scientific methodology.
3. Execute the correct choice of test methods (design of experiment) and choose the appropriate statistical tests for the data analysis.
4. Know with the technique of data processing using statistical computer programs (SAS, Statistica).
5. To Interpret the results of statistical analysis and bring correct scientific conclusions.
6. Identify and explain statistical parameters and graphics in various publications.
7. Correctly present the results of research on scientifically-professional meetings.

Module content

Elaboration of specific problems in research in the plant breeding and the seed production. Combined experiments in the more environment (space and the time). Modified or custom plans. Interaction genotype × environment. Factorial experiments. Plans divided plots. Measure the central tendency and measure the variation. Null hypothesis and testing statistical significance. Analysis of variance and prerequisites for its implementation. Data transformation. Single and multiple linear and non-linear correlation and regression. Analysis of covariance. Non-parametric tests. Graphical presentation of data. "Reading" and the understanding of statistical parameters. The statistical inference. Preparation of research results for the announcement and the presentation.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required attend lectures (consultation) and on them actively participate. Desirable is the advance preparation for the discussion in the form of general and targeted subject in the domain of genetics, plant breeding and seed production with accent on the planning, organization and technique of conducting experiments. Doctorates are obligatory appear written exam part tests and after his successful realizations and the verbal part. Assessment determines on the basis of cumulative teaching activities or average performance with the examiner on the module.

Literature

Required reading:

1. Horvat, D., Ivezić, M. (2005): Biometrika u poljoprivredi. Poljoprivredni fakultet u Osijeku.
2. Vasilj, Đ. (2000): Biometrika i eksperimentiranje u bilinogojstvu. Hrvatsko agronomsko društvo, Zagreb.

Recommended literature:

1. Cochran W. G., Cox, G. M. (1957): Experimental Designs. John Wiley & Sons.
2. Mead, R., Curnow, R. N., Hasted, A. M. (1993): Statistical Methods in Agriculture and Experimental Biology. Chapman & Hall.
3. Sokal, R. R., Rohlf, F. J. (1994.): Biometry: The Principles and Practice of Statistics in Biological Research. W H Freeman & Co.
4. Steel R. G. D., Torrie, J. H., Dickey, D. A. (1996): Principles and Procedures of Statistics: A Biometrical Approach. McGraw- Hill Higher Education.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.6	1-7	Prepares for the lecture, studing, communication with the teacher throughthe previously prepared and developed issues.	Checking performed activities through the oral conversation andthe submission and the examination independently made tasks.
Final exam	2.4	1-7	Preparation for the exam by studying mandatory andrecommended literature, and numerous scientific and professional publications published on the internet. Solving tasks offered - the statistical data processing.	Written exam and the oral exam.
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

40 teaching hours (lectures) = 1.6 ECTS (40 teaching hours/100 hours of total load x 100 = 40% from total of 4 ECTS)

Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Seed Processing and Storage**	
Module coordinator	Darko Kiš	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 0, S -10

Module aim
Education students at the doctoral studies on the conservation of qualitative properties of seeds of cereals, industrial and forage crops.

Terms of admission
No

Expected learning outcomes
After completing the module, student will be able to:
1. Explain the seed quality parameters and factors affecting them.
2. Choose the seed processing methods according to the crop species.
3. Consider and recognize factor affecting the seed quality during the seed processing.
4. Propose the types of storage facilities adequate for seeds according to the plant species.
5. Explain the factors affecting the stored seed viability.
6. Adapt the seed processing and storing to current regulations.

Module content
Factors affecting the seed quality and viability. Primary seed processing. Secondary seed processing and application of seed health protection agents. Seed storing, storage conditions, duration of storing. packageing and labeling the seed. Current regulations in seed processing and storing. Importance of seed quality traits for the crop production. New technologies in seed processing and treatment of cereals, industrial crops and fodder crops.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Countinous and active attendance and participation (in discussions) during the teaching. After the completion of lectures students take an examination.

Literature
Required reading:

1. Kolak, I. (1994): Sjemenarstvo ratarskih i krmnih kultura. Priručnik. Zagreb.
2. Ritz, J. (1988): Osnovi uskladištenja ratarskih proizvoda. II izdanje. Sveučilište u Zagrebu, Fakultet poljoprivrednih znanosti, Zagreb.

3. Stjepanović, M., Zimmer, R., Tucak, M., Bukvić, G., Popović, S., Štafa, Z. (2009): Lucerna. Sveučilište J. J. Strossmayera u Osijeku, Poljoprivredni fakultet. Osijek, Hrvatska.
4. Stjepanović, M., Štafa, Z., Bukvić, G. (2008): Trave za proizvodnju krme i sjemena. Hrvatska mljekarska udruga. Zagreb, Hrvatska.
5. Katić, Z. (1992): Sušenje i sušare u poljoprivredi. Udžbenik, Zagreb.

Recommended literature:

1. Cooke, D. A., Scott, R. K. (1993): The sugar beet crop. Chapman & Hall. London.
2. Kristek, A., Liović, I., Vujević, M., Zdravčević, J. (1991): Važnost sorte i kvalitete sjemena u proizvodnji šećerne repe. Poljoprivredne aktualnosti, vol. 38., br 1-2, str. 175-182.
3. Kristek, A., Magud, Z., Vujević, M.(1990): Utjecaj krupnoće i dorade na svojstva sjemena šećerne repe. Znanost i praksa u poljop. Tehnologiji 20(1-2) 178-197.
4. Škorić, D.(1998): Suncokret. Nolit. Beograd.
5. Butorac, I., Bolf, M. (2000): Proizvodnja krumpira. Hrvatski zadružni savez. Zagreb.
6. Čulje, M.: Biotehničke karakteristike zrna žiterica i uljarica. Skripta. Osijek

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lessons an dexercises	1.2	1-6	Studing the literature.	Conversation anddiscussion with students.
Seminar	0.4	1-6	Literature studying, seminar preparation and presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	2.4	1-6	Studing the required reading and recommended literature	Exam (oral or in-written)
Total	4			

The way of calculating ECTS credits for certain activities:

Total sum of ECTS is 4 points.
1 ECTS point = 25 hours of students work
4 ECTS points = 100 hours of students work
30 hours of teaching (lessons) = 1.2 ECTS points (30 hours of teaching / 100 hours of total work x 100% = 30% of the total of 4 ECTS)
Seminar paper = 0.4 ECTS (10 hours/100 hours of total load x 100 = 10% from total of 4 ECTS)
Final exam = 2.4 ECTS points (60 hours of preparation / 100 hours of total work x 100% = 60% of the total 4 ECTS)

Module quality assessment

Lecturer and the module will be eavaluated by anonimous questionnaire to students.

Module name	**Fertilization**	
Module coordinator	Boris Đurđević	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 0, S - 10

Module aim

Modul aim is to, highlight and explain the impact of fertilization on production and application of mineral and organic
fertilizers, theirs influence on yield quantity and quality as well as influence on enviroment.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:
1. Explain and compare different types of organic fertilizers.
2. Explain and compare technological processes of production, physical and chemical features of different mineral fertilizers (nitrogen, potassum and phosphorus fertilizers, composit mineral fertilizers, micro fertilizers, liquid fertilizers).
3. Describe soil conditioners and explain the processes of soil conditioning.
4. Analyze and explain the ferzilizer recommendation results and to choose optimal formulations and quantities of fertilizer.
5. Analyze and apply advanced methods of determining fertilizer needs by using analytical and other plant species, soil, climate, agrotechnic etc. dana.
6. Define and explain chemical methods for analyzing soil and plant tissue and results of soil and plant tissue analysis.

Module content

Origin and tehnology of organic fertilizers production, Composition and fertilizers effect oforganic fertilizers. Fertilizers for soil improvement, their origin, composition, influence and application. Single mineral fertilizers, mixed fertilizers and complete fertilizers. Technologies of mineral fertilizers production. Metodology of plant nutrient determination for crop fertilization.Parametars of soil fertility and metodes for their determinations. System of fertility control and legislative in Croatia. Metodology of fertilizers recommendation. A seminar work in the field of fertilization practice.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☒ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to continuously attend lectures or consultations and to activly participate in discussions and in solving presented task.All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance.After this, students will be obliged to take the final exam. Students are advised to prepare exams from required literature.

Literature

Required reading:

1. Vukadinović, V., Vukadinović, V. (2011): Ishrana bilja. Poljoprivredni fakultet u Osijeku. Osijek.
2. FAO (2003): Assessment of soil nutrient balance, Approaches and methodologies. Rome.
3. Pravilnik o dobroj poljoprivrednoj praksi u korištenju gnojiva, NN 163/03, NN 40/07.
4. Đurđević, B. (2014): Praktikum iz ishrane bilja. Poljoprivredni fakultet u Osijeku. Osijek.
5. Vukadinović, V., Bertić, B. (2013): Filozofija gnojidbe.
6. Marschner, H. (1995): Mineral nutrition of higher plants, Academic Press.
7. Butorac, A. (1999): Opća agronomija. Školska knjiga Zagreb.

Recommended literature:

1. Finck, A. (1982): Fertilizers and Fertilization, Introduction and practical guide to crop fertilization). Verlag Chemie, Weinheim.
2. Follet, R. F. (1987): Soil Fertility and Organic Matter as critical Components of Production. System. SSSA Special Publication Number 19. Soil Science Society of America. Madison, Wisconsin, USA.
3. Pravilnik o zaštiti poljoprivrednog zemljišta od onečišćenja, NN 152/08.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.2	1-6	Studing from requiredand recommended literature, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.4	1-6	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	2.4	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

30 teaching hours (lectures + exercises) = 1.2 ECTS (30 teaching hours/100 hours of total load x100 = 30% from total of 4 ECTS)

Seminar paper = 0.4 ECTS (10 hours/100 hours of total load x 100 = 10% from total of 4 ECTS)

Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Quarantine Pests and Diseases**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L -40 , E - 0, S - 0

Module aim
Students would get acquainted to the list of quarantine pests.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Identify the most important quarantine pests or diseases.
2. Identify economically important pests and diseases of field crops.
3. Identify hazards spread of quarantine pests and diseases in our country.
4. Describe the methods of transmission of quarantine pests and diseases.
5. Collect legislation relating to quarantine pests ii pathogens.

Module content
Economics important pests of field crops and the quarantine pests. Diseases transmitted by seed crops, diseases of general importance for seed production. The quarantine pathogens (fungi, bacteria, viruses).

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students will prepare for exam using recommended reading literature.

Literature
Required reading:

1. Quarantine Pests for Europe (1997): CABI and EPPO for the EU. CAB International p.1425.
2. Pedigo, L. P. (2002): Entomology & Pest Manegement. Fourt Edition. Prentice Hall. New Jersey. p.742.
3. Champion, R. (1999): Erkennen und Bestimmen samenübertragbarer Pilze. Bayer AG, Leverkusen.
4. Hutchins, J. D., Reeves, J. C. (1997): Seed health testing: Progress towards the 21st century. CAB International.
5. Zakon o zaštiti bilja, NN.
6. EPPO Bulletin.

Recommended literature:

Journals and scientific papers relevant to quarantine pests.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.6	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	2.4	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:

Module has 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

40 teaching hours (lectures) = 1.6 ECTS (40 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)

Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Marketing and Market in Seed Science**	
Module coordinator	Zdravko Tolušić	
Study programme	Postgraduate university study of Agricultural sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

To inform postgraduate students with news in the science of marketing and market in seed science.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Describe the specifics of the agricultural products' market.
2. Notice problems occuring in the agro-industrial markets.
3. Clarify effects of marketing activities (planning, organizing and controlling).
4. Compare performance of individual subjects of supply and demand on market (to point out the advantages/disadvantages).
5. Demonstrate the importance of the marketing mix, especially promotion for entry and or retention in a particular market.
6. Use market research methods to solve problems and gathering data / information on the selected market segment.
7. Decide possible marketing strategies.
8. Present chosen strategy for market performance of seed products.

Module content

Theoretical approach to marketing. Needs as a starting point of marketing. Market of agroindustrial products. Factors of supply and demand of agroindustrial products.. Specifics of agroindustrial marketing. Unique fields of agroindustrial marketing. Organizational problems of agroindustrial marketing. Supply and demand of seed products.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☒ mentoring
- ☒ other

Student requirements

All students are required to attend minimum 50% of the classes. Students should be prepared for discussion and solving practical tasks using relevant literature. Students should write mandatory seminar. Seminars will be presented orally, with Power Point program and its duration should not be longer than 20 minutes. Schedule of oral presentations will be agreed in advance. Seminar is precondition for attending oral exams.

Literature

Required reading:

1. Tolušić, Z. (2011): Tržište i distribucija poljoprivredno prehrambenih proizvoda, Grafika Osijek, Osijek.
2. Leko-Šimić, M. (2002): Marketing hrane Sveučilište J.J.Strosmayera , Ekonomski fakultet Osijek,Osijek.
3. Meler, M. (1992): Marketing komuniciranje, Sveučilište J.J.Strosmayera , Ekonomski fakultet Osijek, Osijek.
4. Baban, Lj. (2001): Tržište, Školska knjiga Zagreb, Zagreb.

Recommended literature:

1. Kaynak, E.,Ghauri, P.N. (1994): Euromarketing: Effective Strategies for International Trade and Export, International Business Pres, Binghanton.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Participation in the debate and expressing opinions	Attendance of the classes frequency and involvementinto discussion
Seminar	0.8	5-8	Literature studying, seminarpreparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam (oral)	2.4	1-8	Preparing for exam bystudying required and recommended literature	Exam- presenting facts, argumenting, analysing case studies
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.8 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.8 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Oral exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Irrigation of Seed Crops**	
Module coordinator	Jasna Šoštarić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S - 0

Module aim

Important of irrigation in crop production - specially in seed production.Specially review on irrigation: time and ratio of application.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Arrange of seed cropsaccordint to crop water requirement.
2. Determine and select system and method for irrigation of seed crops.
3. Recommend a system and method of irrigation.
4. Apply of irrigation in seed production.
5. Invent ekonomical and sustainable irrigation.
6. Create a system of irrigation according to relief, kind of crop and crop production.

Module content

Manner of irrigation of seed production: surface, subsurface, sprinkler irrigation, and drip irrigation. Irrigation for frost protection. Equipement for irrigation - system and facilities for supply of water, pumps and pipe line

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally using PowerPoint presentation.

Literature

Required reading:

1. Madjar, S. Šoštarić, J. (2009): Navodnjavanje. Sveučilište J. J. Strossmayer u Osijeku, Poljoprivredni fakultet Osijek. Osječko-baranjska županija.

Recommended literature:

1. Mađar, S. (1986): odovodnja i navodnjavanje u poljoprivredi. NIO; zadrugar Sarajevo.
2. Tomić, F. (1988): Navodnjavanje, Zagreb.
3. Vučić, N. (1976): Navodnjavanje poljoprivrednih kultura, Novi Sad 1976.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.6	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	2.4	1-6	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
40 teaching hours (lectures) = 1.6 ECTS (40 teaching hours/100 hours of total load x 100 = 40% from total of 4 ECTS)
Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Breeding of Small Grain Cereal Crops**	
Module coordinator	Sonja Vila	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Understanding of objectives and methods of breeding and seed production of small grain cereal crops, and application of this knowledge in the scientific, teaching, creative and expert work.

Terms of admission

Previous knowledge of biology, especially of genetics, and previous knowledge of plant breeding, agricultural engineering of small grain cereal crops, phytopatology, entomology and biometrics.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand and apply recent breeding methods of small grain cereal crops in order to improve agronomic traits which are based on genetic gains.
2. Incorporate knowledge of origin, systematics, taxonomy and morfology of wheat, barley, rye, oat and triticosecale (triticale) in relation to breeding objectives and methods.
3. Understand genetic basis and molecular markers of different species of small grain cereal crops and develop ideas for rational application of breeding in purpose of improvement of useful agronomical traits (yield, quality, tolerance to deseases, pests and environmental stress conditions.)
4. Understand interaction genotyp x environment and an importance of the adaptability for breeding of small grain cereal crops and critically rewiev and interpret results of multienvironmental trials (years and locations) in lower and larger areals.
5. Understand genetic basis of physiological response of small grain cereal crops to stressful conditions and recognize the possible application of those insights in relation to genetic gain for grain yield and quality of different small grain cereal crops.
6. Compare efficiency of different breeding methods for wheat, barley, oat and triticale in relation to breeding objectives.

Module content

Chosen chapters from systematics, taxonomy and morfology of wheat, barley, rye, oat and triticosecale (triticale); The comparation among different methods and objectives of breeding of small grain cereal crops; Genetic basis of small grain cereal crops breeding for grain yield and quality; Physiological changes and genotype reaction associated with sowing densities; Molecular markers in the breeding for useful agronomic traits of small grain crops; Genotype by environment interaction and adaptation in small grain cereal crops; Genetic basis of physiological response to stressful conditions and physiological change in relation to genetics gain for grain yield and quality of different small grain cereal crops species.

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☒ field work	☐ other

Student requirements

Students make individual seminar work using required and recommended literature as well as literature which they select themselves from recent national and world scientific publications according to the theme of seminar. Student is obligated to introduce other students who enrolled elected the module "Breeding of small grain cereal crops" with his seminar work by e-mail. Positive evaluation of student's seminar work is prerequisite for the final exam which they prepare from required literature list.

Literature

Required reading:

1. Martinčić, J., Kozumplik, V. (1996) : Oplemenjivanje bilja, Zagreb, s. 1-420.
2. Kozumplik, V., Pejić, I. (Urednici) (2012): Oplemenjivanje poljoprivrednog bilja u Hrvatskoj, Zagreb, s. 1-198.
3. Lamkey, K. R., Lee, M. (Editors) (2006): Plant Breeding: The Arnel R. Hallauer International Symposium; First edition, Blackwell Publishing.

Recommended literature:

1. Slafer, G. A., Molina-Cano, J. L. , Roxana Savin, J. L., Araus, I. Romagosa (Editors) (2002): Barley science – Recent Advances from Molecular Biology to Agronomy of Yield and Quality. Food Products Press (An Imprint of The Haworth Press, Inc.), New York – London – Oxford, p. 1-551.
2. Vollmann, J., Grausgruber, H., Ruckenbauer, P. (Editors) (2004): Genetic Variation for Plant Breeding – Proceedings of the 17th EUCARPIA General Congress, Tulln-Austria, p. 1-511.
3. Basra, A. S., Randbawa, L. S. (Editors) (2002): Quality Improvement in Field Crops. Food Products Press (An Imprint of The Haworth Press, Inc.) New York – London – Oxford, p. 1-415.
4. Kang, M. S. (Editor) (2002): Crop Improvement – Challenges in the Twenty-First Century Food Products Press (An Imprint of The Haworth Press, Inc.) New York – London – Oxford, p. 1-365.
5. Araus, J. L., Slafer, G. A., Royo, C., Serret, M. D. (2008): Breeding for yield potential and stress adaptation in cereals. Critical Reviews in Plant Science 27: 377-412.
6. Reynolds, M. P., Acevedo, E., Sayre, K. D., Fischer, R. A. (1994): Yield potential in modem wheat varieties: its association with a less competitive ideotype. Field Crops Res., 37: 149-160.
7. Reynolds, M. P., Saint Pierre, C., Saad, A. S. I., Vargas, M., Condon, A. G. (2007): Evaluating potential genetic gains in wheat associated with stress-adaptive trait expression in elite genetic resources under drought and heat stress. Crop Science 47: 172-189.
8. Journals: Theoretical and Applied Genetics, Nature, Euphytica, Crop Science, Plant Breeding, Poljoprivreda, Poljoprivredna znanstvena smotra, Sjemenarstvo, Agronomski glasnik, Cereal research communications.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-6	Literature studying, assignment work, discusion	Checking on the bases of conversations and reviewing of student's work and assignments
Seminar	0.8	1-6	Literature studying, seminar preparation, consultations and discusion	Examination and evaluation of seminar accordingto the established criteria
Final exam	2.4	1-6	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 workload hours per module

20 teaching hours (lectures and exercises) = 0.80 ECTS (20 teaching hours/100 total workload hours per module x 100 = 20% from total of 4 ECTS)

Seminar paper = 0.80 ECTS (20 hours/100 total workload hours per module x 100 = 20% from total of 4 ECTS)

Final exam = 2.4 ECTS (60 hours of preparation/100 total workload hours per module x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of the module quality and lecturers through anonymous student surveys.

Module name	**Maize Breeding**	
Module coordinator	Sonja Vila	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S - 0

Module aim

Get students acquainted with methods of plan breeding and methods of germplasm improvement for maize. Discussion about heterosys, heterotical groups and interaction genotype x environment.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Plan and organise maize selection program.
2. Choose selection direction and germplasm for maize selection.
3. Predict market demands and future directions in maize breeding.
4. Evaluate maize germplasm and its breeding potential.
5. Estimate the need for combination of classic and molecular maize breeding in selection process.

Module content

Methods of inbred lines creation (pedigree selection, back-crossing, special technics, classical examples, conversion). Development of inbred lines.Correlations between inbred lines and hybrids for the most important properties. Testers and testings, Breedings sources, Types of hybrids, Maintenance of inbred lines. Introduction in teory of maize breeding, Methods of recurrent selection. Results of recurrent selection: intrapopulation selection (mass selection, selection of F1 progeny, growing in halfrelationship half sib, growing in full relationship, Iowa Stiff Stalk Synthetic), interpopulation selection (reciprocal recurrent selection), selection of germplasm. Theories of heterosis. Heterosis and hetrotical groups of maize. Molecular technics in maize breeding.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for lectures using recommended reading literature.

Literature

Required reading:

1. Wusirika, R., Bohn, M., Lai, J. , Kole, C. (2014): Genetics, Genomics and Breeding of Maize. CRC Press, Taylor & Francis Group.

2. Mandal, B. C. (2014): Maize Breeding and Seed Production Manual. Food and Agriculture Organization of the United Nations Office of the Food and Agriculture Organization.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.6	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Final exam	2.4	1-5	Preparing for exam bystudying required andrecommended literature	Written exam
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

40 teaching hours (lectures) = 1.6 ECTS (40 teaching hours/100 hours of total load x 100 = 40% from total of 4 ECTS)

Final exam = 2.4 ECTS (60 hours of preparation/100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Breeding of Industrial Plants**	
Module coordinator	Manda Antunović	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Indicate different breeding method, breeding objectives and genetic of certain characteristic, methods and achievements in sugar beet, sunflower, soybean, rapeseed, potato and tobacco breeding.

Terms of admission

There are no terms of admission.

Expected learning outcomes

After completing the module, student will be able to:

1. To identify the importance, morphological and biological characteristics and botanical systematics of sugar beet, sunflower, soybean, rapeseed, potatoes and tobacco.
2. Define the main goals of industrial plants breeding programs, according to the current requirements of farmers and producers.
3. Count the breeding methods of sugar beet, sunflower, soybean, rapeseed, potatoes and tobacco.
4. Perform procedure of detecting and selection of plants sterile by pollen for sugar beet and sunflower.
5. Select the breeding program and application of genetic markers in breeding of industrial plants.
6. Argumented and critique interpret methods and goals of industrial plant breeding.

Module content

The growth and development of sugar beet. Morphological and biological characteristic, flower morphology, different seed forms. Advances and improvements in sugar beet selection and genetic. Main breeding goals. Sugar beet breeding for individual properties (root yield, sugar content, disease resistance, botling resistance, monogerm beets varieties and male sterility). Methods of selection and creation of sugar beet hybrids. The representatives and botanical systematic of sunflower, soybean and rapeseed. Morphological and biological characteristic. Main objectives in sunflower, soybean and rapeseed breeding. Methods of breeding and reproduction. Male sterility and restoration of sterility in sunflower. Application of molecular markers in sunflower and soybean. Methods of selection and creation of sunflower hybrids. Origin, systematics and methods of reproduction in tobacco and potatoe. The goals of breeding and genetics. The development of genetic variability. Breeding methods. Production elit seed of tobacco and potato.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are recommended to attend classes and there are expected their active involvement in tasks during lectures. Students, reading related relevant literature have obligation to write seminar paper. Seminar paper should be present orally for about 20 minutes with a Power Point Presentation. Schedule of presentation will be arranged in advance. After that, students write a final exam, which they prepare from required literature.

Literature

Required reading:

1. Martinčić, J., Kozumplik, V. (1996): Oplemenjivanje bilja, str. 259-286, Kristek, A., Martinčić, J.; Šećerna repa . Poljoprivredni fakultet Osijek i Agronomski fakultet Zagreb.
2. Cooke, D.A.,Scott, R. K. (1993): The sugar beet crop, 66-112,Bosemark, N. O.: Genetics and breedng. Chapman & Hall. London.
3. Spasić, P., Tošić, M. (1992): Šećerna repa, str. 67-89, Kovačev, L.: Genetika šećerne repe. Jugošećer, Beograd.
4. Spasić, P., Tošić, M. (1992): Šećerna repa, str. 107-137, Dokić, P. i sur.: Oplemenjivanje šećerne repe, Jugošećer, Beograd.
5. Martinčić, J., Kozumplik, V. (1996): Oplemenjivanje bilja, str.309-334, Krizmanić, M., Martinčić, J.,: Suncokret. Poljoprivredni fakultet Osijek i Agronomski fakultet Zagreb.
6. Vratarić, M. (2004.): Suncokret, str. 69-163, Vratarić, M., Sudarić, A.: Oplemenjivanje i genetika suncokreta. Poljoprivredni institut Osijek.
7. Martinčić, J., Kozumplik, V. (1996): Oplemenjivanje bilja, str. 287-334, Vratarić, M., Henneberg, R.: Soja. Poljoprivredni fakultet Osijek i Agronomski fakultet Zagreb.
8. Vratarić, M., Sudarić,A. (2008): Soja, str. 55-127. Oplemenjivanje i genetika soje. Poljoprivredni institut Osijek.
9. Martinčić, J., Kozumplik, V. (1996): Oplemenjivanje bilja, str. 335-354, Hrust, V., Kozumplik, V.: Uljana repica. Poljoprivredni fakultet Osijek i Agronomski fakultet Zagreb.
10. Martinčić, J., Kozumplik, V. (1996): Oplemenjivanje bilja, str. 245-258,Salopek,I., Kozumplik, V. Krumpir. Poljoprivredni fakultet Osijek i Agronomski fakultet Zagreb.
11. Martinčić, J., Kozumplik, V. (1996): Oplemenjivanje bilja, str. 355-369, Kozumplik, V.: Duhan, Poljoprivredni fakultet Osijek i Agronomski fakultet Zagreb.
12. Kozumplik, V., Devčić,K. (1991): Suvremeni ciljevi i metode oplemenjivanja duhana tipa Virginia i Burley. Poljoprivredna znanstvena smotra, 56(1-2), str. 169-180. Zagreb.

Recommended literature:

1. Škorić, D. (1998): Suncokret, Nolit, Beograd.
2. Kristek, A. (1993): Dostignuća i perspektive oplemenjivanja šećerne repe u našoj zemlji. Sjemenarstvo 10 (93)3-4.
3. Kristek, A., Kristek, S., Antunović, M. (2003): Propizvodne vrijednosti linija šećerne repe i njihovih križanaca ovisno o ploidnosti. Poljoprivreda, 9(2): 38-44.
4. Kristek, A., Magud, Z., Antunović, M., Kristek, S. (2003): Produktivnost monogermnih linija šećerne repe u zavisnosti od osjetljivosti na cerkosporu (Cercospora beticola Sacc.). Poljoprivreda, 9(1): 31-36.
5. Uzunoski, M. (1987): Proizvodnja duvana, str. 274-289, Selekcija duvana. Prosveta, Niš.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	0.8	1-6	Reading reqired literature, tasks solving	The problems solving through conversation andmake tasks on time.
Seminar	0.8	1-6	The study of literature,writing and presentation of seminar paper	Review and evaluation of seminar paper according to pre-defined criteria
Final exam	2.4	1-6	Exam preparation through studying therequired and recommended literature	Written and oral examinations
Total	4			

The way of calculating ECTS credits for certain activities:

Module has a 4 ECTS credits

1 ECTS credit = 25 workload hours (hours of student work)

4 credits = 100 workload hours

20 lecture hours = 0.8 ECTS (20 lectures hours / 100 workload houers x 100 = 20.0% of total 4 ECTS credits)

Seminar paper = 0.8 ECTS (20 hours / 100 workload hours x 100 = 20.0% of the total 4 ECTS credits)

Final exam = 2.40 ECTS (60 hours of preparation / 100 hours of total work hours x 100 = 60.0% of the total of 4 ECTS)

Module quality assessment

The evaluation of lecturer and module quality through anonymous surveys.

Module name	**Breeding Forage Crops**	
Module coordinator	Gordana Bukvić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S - 0

Module aim
To educate participants (students) about breeding methods for anual and perenial forage legumes and grasses improvement.

Terms of admission
No

Expected learning outcomes
After completing the module, student will be able to:
1. Set the breeding goals in line with the end-users needs.
2. Choose breeding methods.
3. Collect initial collection of genotypes and continously add elite varieties, heirloom varieties, ecotypes, wild relatives, mutants and other exotic germplasm.
4. Plan the creation of new genetic variability by conventional methods (crossing) and come to know about biotechnological methods (doubling chromosomes, dihaploidization, mutagenesis, transgene technology).
5. Plan the selection over breeding population.
6. Plan the production of new cultivar candidates.

Module content
Morphological properties. Breeding goals. Breeding methods. Breeding processes. Obtaining tetraploid clovers. breeding for particular traits.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
Countinous and active attendance and participation (in discussions) during the teaching. After the completion of lectures students take an oral examination.

Literature
Required reading:

1. Fairey, D.T., Hampton J.G. (1988): Forage seed production CAB International.
2. Frame, J., Charlton, J.F.L., Laidlaw, A.S. (1998):Temperate forage legumes CAB International.
3. Hanson, A.A. et al. (1988) Afalfa and Alfalfa Improvement, Madison, Wiscsin USA.

4. Taylor, N. L., Quesenberry, K. H. (1996): Red Clover Science, Kluwer Academic Publishers Boston, London.
5. Borojević, S. (1981): Principi i metodi oplemenjivanja bilja, Novi Sad.
6. Casey, R., Davies, D. R. (1993): Peas: Genetics, Molecular biology and Biotechnplogy. CAB InternationalWallingford UK.

Recommended literature:

1. Boller, B., Posselt, U. K., Veronesi, F. (2010): Handbook of Plant Breeding (vol.5) – Fodder Crops and Amenity Grasses. Springer Science+Business Media LLC. New York, USA.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.6	1-6	Studing the literature.	Conversation anddiscussion with students.
Final exam	2.4	1-6	Studing the required reading and recommended literature.	Oral or in-written examination.
Total	4			

The way of calculating ECTS credits for certain activities:

Total sum of ECTS is 4 points.
1 ECTS point = 25 hours of students work
4 ECTS points = 100 hours of students work
40 hours of teaching (lessons) = 1.6 ECTS points (40 hours of teaching / 100 hours of total work x 100% = 40% of the total of 4 ECTS)
Final exam = 2.4 ECTS points (60 hours of preparation / 100 hours of total work x 100% = 60% of the total 4 ECTS)

Module quality assessment

Lecturer and the module will be eavaluated by anonimous questionnaire to students.

Module name	**Seed Production of Industrial Plants**	
Module coordinator	Manda Antunović	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 30, E - 0, S - 10

Module aim

Indicate different methods of sugar beet, sunflower, soybean, rape seed, potato and tobacco seed production as a relation to environment conditions, genetics and agrotechnical measures.

Terms of admission

There are no terms of admission.

Expected learning outcomes

After completing the module, student will be able to:

1. Show the importance of sugar beet, sunflower, soybean, rape seed, tobacco and potato seed production and required
   amounts of land for seed production.
2. Define the categories of seeds and planting materials and methods (procedures) gene protection and multiplication.
3. Indicate optimal land and weather conditions for producing quality seeds of sugar beet, sunflower, soybean, rape seed
   tobacco and potatoes.
4. Define the importance of isolation, crop rotation and pre-crop in seed production.
5. Show the impact of agricultural practices on yield and quality of produced seeds or seedlings.
6. Specify the necessary controlling measures in seed production and planting material.

Module content

The two-year method of sugar beet seed production. Indirectly seedlings production. The importance of agroecological conditions in the of sugarbeet seed production. The importance of crop rotation and pre-crop. Agrotechnics in one year sugar beet seed production with and without transplantation. Seedlings in winter period. Measures for improve early growth. Harvesting and seed processing. Production of hybrid sunflower seeds. Seed production of parent lines. Choice of soil for planting. Agricultural production of sunflower seeds. Harvest, storage and processing of sunflower seed. Agrotechnic in soybean seed production. Monitoring of seed crop in the field. Categories of seed. Processing and storage of seeds. Characteristics of oilseed rape cultivars and space isolation in seed production. Production technology. Harvesting, drying and seed processing. Production of tobacco seed. Cultivars and elite seed production. Monitoring of seed production. Storage and tobacco seed processing. Protecting of cultivars. Conditions of production, isolation and crop rotation in potato seed production. Agrotechnic and approbation. Harvesting, processing and tubers storage.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students are recommended to attend classes and there are expected their active involvement in tasks during lectures. Students, reading related relevant literature have obligation to write seminar paper. Seminar paper should be present orally for about 20 minutes with a Power Point Presentation. Schedule of presentation will be arranged in advance. After that, students write a final exam, which they prepare from required literature.

Literature

Required reading:

1. Kristek, A. (1992): Proizvodnja sjemena šećerne repe. Agronomski fakultet Zagreb.
2. Cooke, D. A., Scott, R. K. (1993): The sugar beet crop, 120-152, Bornscheuer, K. et al.: Seed production and qualiti. Chapman & Hall. London.
3. Vratarić, M. (2004): Suncokret, str. 163-186, Vratarić, M.. Sjemenarstvo suncokreta. Poljoprivredni institut Osijek.
4. Vratarić, M., Sudarić, A. (2008): Soja, str. 129-156. Sjemenarstvo soje. Poljoprivredni institut Osijek.
5. Kolak, I. (1994): Sjemenarstvo ratarskih i krmnih kultura. Globus, Zagreb.
6. Uzunoski, M. (1987): Proizvodnja duvana, str. 290-297. Proizvodnja duvanskog semena. Prosveta, Niš.

Recommended literature:

1. Kristek, A., Matić, I. (1984): Utjecaj gustoće usjeva i termina žetve na prinos i kvalitetu sjemena šećerne repe. Agronomski glasnik, br. 2(3-4) str. 259-369.
2. Kristek, A.(1990): Aktualna problematika u proizvodnji sjemena šećerne repe. Poljoprivredne aktualnosti, vol. 35, br. 1-2, str. 185-191.
3. Kristek, A., Magud, Z., Vujević, M. (1990): Utjecaj krupnoće i dorade na svojstva sjemena šećerne repe. Znan. prak.poljopr. tehnol., 20 (1-2) 178-197. Osijek.
4. Butorac, I., Bolf, M. (2000): Proizvodnja krumpira. Hrvatski zadružni savez. Zagreb.
5. Škorić, D. (1988): Suncokret. Nolit, Beograd.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	1.2	1-6	Reading reqired literature, tasks solving	The problems solving through conversation and make tasks on time.
Seminar	0.4	1-6	The study of literature, writing and presentation of seminar paper	Review and evaluation of seminar paper according to pre-defined criteria
Final exam	2.4	1-6	Exam preparation through studying the required and recommended literature	Exam (written or oral)
Total	4			

The way of calculating ECTS credits for certain activities:
Module has a 4 ECTS credits
1 ECTS credit = 25 workload hours (hours of student work)
4 credits = 100 workload hours
30 lecture hours = 1.2 ECTS (30 lectures hours / 100 workload houers x 100 = 30.0% of total 4 ECTS credits)
Seminar paper = 0.4 ECTS (10 hours / 100 workload hours x 100 = 10.0% of the total 4 ECTS credits)
Final exam = 2.4 ECTS (60 hours of preparation / 100 hours of total work hours x 100 = 60.0% of the total of 4 ECTS)

Module quality assessment
The evaluation of lecturer and module quality through anonymous surveys.

Module name	**Seed Production of Forage Crops**	
Module coordinator	Gordana Bukvić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S - 0

Module aim

To educate students about seed crop agronomy and inspection. To introduce a scientific approach in problem-solving during the seed crop production to achieve the targeted market value of seeds.

Terms of admission

No

Expected learning outcomes

After completing the module, student will be able to:

1. Inter-relate the seed production, inspection and certification in line with current regulation upon seed crop production.
2. Plan the establishment, care and harvest of forage seed crops accordingly to forage species, type of cultivar, environemntal conditions, current regulations, available resources and market conditions.
3. Organize the seed production in line with the plan and real production conditions.
4. Plan and organize seed processing and storing.

Module content

Importance and the state of forage seed production in national economy. Choice of parcel and area for the seed production. Agronomy for the seed crops of forages. Timing of seed harvest. Preparation of forage seed crops for the harvest. Adaptation of harvesting machines. Preparation of seed crops for the next year. Seed production in the irrigation conditions. Importance of natural seed cleannes for the loses during seed processing. Current regulations in forage seed production.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Countinous and active attendance and participation (in discussions) during the teaching. After the completion of lectures students take an oral examination.

Literature

Required reading:

1. Stjepanović, M., Štafa, Z., Bukvić, G. (2008): Trave za proizvodnju krme i sjemena. Hrvatska mljekarska udruga. Zagreb, Hrvatska.
2. Stjepanović, M., Zimmer, R., Tucak, M., Bukvić, G., Popović, S., Štafa, Z. (2009): Lucerna. Sveučilište J. J. Strossmayera u Osijeku, Poljoprivredni fakultet. Osijek, Hrvatska.
3. Website of the Ministry of Agriculture of the Republic of Croatian published with the legislation in force of the fodder plant seed production: http://www.mps.hr/default.aspx?id=2068.

Recommended literature:

1. Fairey, D. T., Hampton, J. G. (1997): Forage Seed Production. CAB International. Wallingford, Oxon, UK.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lessons an dexercises	1.6	1-4	Studing the literature.	Conversation anddiscussion with students.
Final exam	2.4	1-4	Studing the required reading and recommended literature	Oral or in-written examination
Total	4			

The way of calculating ECTS credits for certain activities:

Total sum of ECTS is 4 points.
1 ECTS point = 25 hours of students work
4 ECTS points = 100 hours of students work
40 hours of teaching (lessons) = 1.6 ECTS points (40 hours of teaching / 100 hours of total work x 100% = 40% of the total of 4 ECTS)
Final exam = 2.4 ECTS points (60 hours of preparation / 100 hours of total work x 100% = 60% of the total 4 ECTS)

Module quality assessment

Lecturer and the module will be eavaluated by anonimous questionnaire to students.

Module name	**Seed Production Technology in Horticulture**	
Module coordinator	Tomislav Vinković	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E - 10, S - 20

Module aim

Get students acquainted with technique of conducting field and laboratory experiments as well as supply them with knowledge of vegetable and flower seed production technologies.

Terms of admission

Passed modules from first semester.

Expected learning outcomes

After completing the module, student will be able to:

1. Define vegetables and flowers production areas.
2. Describe and differentiate breeding and selection of vegetables and flowers as weel as varieties of vegetables and flowers.
3. Explain agricultural coditions of vegetables and flowers seed production.
4. Differentiate production techologies.
5. Disscus and determine professional and health control of seeds.
6. Critically assess and justify the monitoring of experiments in the practicum, greenhouse and in the open field.
7. Predict and review influence of light on seed unifomity and maturation.
8. Evaluate and valorize growth of vegetable and flowers seedlings.
9. Predict and determine possible diseas and pest occurrence in vegetable and flowers seed production.
10. Connect importance and role of scientific research in vegetable and flower production technology.

Module content

Basic traits of vegetable growing as an economic branch, primary prerequisites of vegetable production, breeding –selection activity and vegetable assortment, agricultural conditions of vegetable seed production (cabbage, onion and leek, tomato and paprika, peas and bens, carrot, red beet and spinach, lattuce and endive), production technology, professional and health observation.

Get students acquainted with basics of flower production. Technological phases of flower growing aiming to produce seed (annual and biannual species). Diseases and pests in flower seed production. Significance of research work in technology of flower seed production. Computer application in flower seed production.

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. For laboratory work, students need emergency protective laboratory clothing (lab coat). Final exam is oral. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. George, A. T. Raymond (2009): Vegetable Seed Production. CAB International.
2. Lešić R., Pavlek, P., i Cvjetković (1993) Proizvodnja povrtnog sjemena, Agronomski fakultet Zagreb.
3. Matotan, Z.(1994) Proizvodnja povrća, Globus, Zagreb.
4. McDonald, M. B., Kwong, F. Y. (2005): Flower seeds biology and technology. CAB International.
5. Parađiković, N. (2009): Opće i specijalno povrćarstvo, sveučilišni udžbenik, Poljoprivredni fakultet Osijek.
6. Parađiković, N. (2014): Opće i specijalno povrćarstvo – online skripta, Poljoprivredni fakultet u Osijeku. (http://www.pfos.unios.hr/~dsego/ftp/Nastava/Op%C4%87e%20i%20specijalno%20povr%C4%87arstvo/).
7. Parađiković, N. (2014): Osnove florikulture – interna skripta, Poljoprivredni fakultet Osijek. http://www.pfos.unios.hr/~dsego/ftp/Nastava/Nastava%20Florikultura/.

Recommended literature:

1. Scientific and expert pappers from relevant journals and databases related to vegetable and flowers seed techology
2. Jelaska, S. (1994): Kultura biljnih stanica i tkiva. Školska knjiga. Zagreb.
3. Delaplane, K.S., Mayer, D.F. (2000): Crop pollination by bees. CABI Press, New York, NY.
4. Free, J.B. (1993): Insect pollination of crops. Academic Press, London, UK, and San Diego, CA.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1	1-10	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	1	1-10	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria

Final exam	2	1-10	Preparing for exam by studying required and recommended literature	Oral exam
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1.ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

20 teaching hours (lectures + exercises) = 1.00 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)

Seminar paper = 1.00 ECTS (20 hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)

Final exam = 2.00 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Seed Production and Processing Technique**	
Module coordinator	Darko Kiš	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim
To introduce doctorate candidates to the mechanization in seed production and processing of important field crops and fodders.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Identify and differentiate machines and tools for working the soil, planting, fertilizing and seed culture care.
2. Select the technique of irrigation in seed production.
3. Use machinery for harvesting and picking the seed production.
4. Identify and differentiate the machinery and equipment for seed processing.

Module content
Devices and tools for soil tillage, sowing, fertilization and seed care and protection. Irrigation, harvesting and picking the seed techniques. Machines and equipment for seed processing

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Zimmer, R., Banaj, Đ., Brkić, D., Košutić, S. (1997): Mehanizacija u ratarstvu, Poljoprivredni fakultet Osijek, Osijek.
2. Barčić, J. (2000): Prskalice i orošivači, Agronomski fakultet Zagreb.
3. Čuljat, M., Barčić, J. (1997): Poljoprivredni kombajni, Poljoprivredni institut Osijek, Osijek.
4. Ujević, A. (1988): Tehnologija dorade i čuvanje sjemena, Fakultet poljoprivrednih znanosti Zagreb, Zagreb.

5. Ritz, J. (1978): Osnovi uskladištenja ratarskih proizvoda, Fakultet poljoprivrednih znanosti Zagreb, Zagreb.

Recommended literature:

1. Brkić, D., Vujčić, M., Šumanovac, L. (2002): Strojevi za žetvu i berbu zrnatih plodina, Poljoprivredni fakultet Osijek.
2. Kolak, I. (1994): Sjemenarstvo ratarskih i krmnih kultura, Zagreb, «Globus».

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.8	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60,00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Introduction to Scientific Work**	
Module coordinator	Pero Mijić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E -10, S - 20

Module aim

The aim of this module is to introduce the postgraduate students to the basic principles of the scientific research, including the composition and publication procedures.

Terms of admission

No preconditions

Expected learning outcomes

After completing the module, student will be able to:

1. Apply the scientific method to the example of his own research.
2. Set scientific hypotheses and objectives of the work.
3. Conduct and write your own scientific work at the predicted structure of scientific work.
4. Own devise a current scientific topic and present a seminar paper.
5. Apply the computer in scientific research, and analyze the collected scientific papers.
6. Critically evaluate the scientific and professional work, and klasifikicirati used literature.

Module content

Significance of the scientific research, scientific workers and their professionalization, scientific methods, choosing the research topic, experimental research, publication types, structure of a scientific work, preparing the manuscript for the publication, oral presentation of the scientific results, legislation.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students prepare a seminar work that is mandatory and which will be presented orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. After that, students take part Written exam of topics Exercises. The laying of the exercises, students acquire the right exit to the oral exam from the lecture topics. Students are advised to prepare exams from the successful exam.

Literature

Required reading:

1. Knežević, I., Mijić, P. (2006): Uvod u znanstveni rad – drugo, dopunjeno i izmjenjeno izdanje. Poljoprivredni fakultet u Osijeku, Sveučilište J. J. Strossmayera u Osijeku, pg 80.
2. Knežević, I. (1988): Uvod u znanstveni rad. Poljoprivredni fakultet, Osijek, pg 54.

Recommended literature:

1. Mijić, P., Knežević, I. (2005): Uporaba Interneta u poljoprivredi. Stočarstvo, 59 (1) 71-78
2. Zelenika, R. (2000): Metodologija i tehnologija izrade znanstvenog i stručnog djela. Četvrto izdanje. Ekonomski fakultet u Rijeci.
3. Baban, Lj., Ivić, K., Jelinić, S., Lamza-Maronić, M., Šundalić, A. (2000): Primjena metodologije stručnog i znanstvenog istraživanja. Ekonomski fakultet u Osijeku, Osijek.
4. Zelenika, R. (1991): Kako nastaje recenzija znanstvenog i stručnog rada. Zavod za istraživanja i razvoj sigurnosti, Zagreb.
5. Silobrčić, V. (1989): Kako sastaviti i objaviti znanstveno djelo. Drugo izdanje. JUMENA, Zagreb.
6. Žugaj, M. (1989): Osnovi znanstvenog i stručnog rada. «Zagreb» r. o. za grafičku djelatnost, Samobor.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture and exercise	0.80	1-6	Studying literature, assignments	Checking the activities carried out through oral conversation, delivery and review assignments made
Seminar	0.80	1-6	The study of literature, preparation, and presentation of seminars	Review and evaluation of the seminar work according to pre-established criteria
Final exam	2.40	1-6	Preparation for the exam by studying recommended literature	Oral examination
Total	4.00			

The way of calculating ECTS credits for certain activities:

The module has 4 ECTS credits
1 ECTS point = 25 hours of workload (hours of student work)
4 ECTS = 100 hours of load modules
20 hours of instruction (lectures and practice) = 0.80 ECTS (20 teaching hours / 100 hours total load x 100 = 20% of the total 4 ECTS)
Seminar = 0.80 ECTS (20 hours / 100 hours total load x 100 = 20% of the total 4 ECTS)
Final exam = 2.40 ECTS (60 hours preparation / 100 hours of total work hours x 100 = 60% of the total 4 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Biochemistry and Molecular Biology**	
Module coordinator	Drago Bešlo	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	5
	Lecture hours (L+E+S)	L - 50, E - 0, S - 0

Module aim

Complete show catabolic and anabolic aspect of metabolic processes in plant cells, which will include topics: membrane structure and transport through membranes, diffusion and transport in plants, nitrogen fixation and assimilation of sulfur, biosynthesis of secondary metabolites and hormones, the reception and transmission of information and transmission of signals and growth regulation.

Terms of admission

No conditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Analyse and explain the catabolic and anabolic reactions in plant cell.
2. Monitor energy changes in cellular metabolic processes.
3. Connect the metabolism of carbohydrates and lipids in plants.
4. Show the primary metabolism of nitrogen and sulfate assimilation in plants.
5. Interpret basic mechanisms of transfer of molecules and ions across biological membranes.
6. Clarify the role of secondary metabolites of plants.
7. Generate basic mechanisms of transfer of molecules and ions across biological membranes.
8. The judgment role of plant hormones and explain the mechanisms of transmission of hormonal messages.
9. Explain DNA replication and transmission and translation of genetic messages.

Module content

A complete view of catabolic and anabolic aspects of metabolic processes with a focus on the molecular basis of metabolism in plants. Xylem and phloem transport, fixation and reduction of nitrogen assimilation and reduction of sulfur, synthesis of hormones and secondary metabolites, including material information molecules, their synthesis and methods of action and complex regulation of gene expression, the formation of gametes, development and maturation of flower, aging and programmed cell death (apoptosis).

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to attend lectures. Come to class prepared, where the processed material studied to pray equally participate in the discussions.

Literature

Required reading:

1. Berg, M. J., Tymoczko, L. J., Stryer, L. (2013): Biokemija, prijevod 6. izdanja engleskog, 1. hrvatsko, Školska knjiga, Zagreb.
2. Bešlo, D. (2014): Praktikum iz biokemije, Poljoprivredni fakultetu u Osijeku.
3. McMurry, J., Castellion, M. (2003): Fundamentals General, Organic, and Biological Chemistry, Four Edition, Pentice hall, UK.
4. Buchanon, B., Gruissem, W., Jones, R. (2000): Biochemistry and Molecular biology of Plants, American Society of Plant Biologist, USA.
5. Voet, J. D., Voet, J G., Pratt, W. C. (2008): Principles of biochemistry, Wiley & Sons, Inc.

Recommended literature:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, D. J. (1994): Molecular biology of the cell, Thrid Edition, Garland Publishing, Inc New York@London.
2. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2004): Essential cell biology, Second Edition, Garland Science, UK.
3. Elliott, H. W. (2004): Biochemistry and molecular biology. Oxford University Press.
4. Berg, M. J., Tymoczko, L. J., Stryer, L. (2002): Biochemistry, Fifth Edition, W. H. Freeman and Company, UK.
5. Lodish, H., Berk, A., Lawrence Zipursky, S., Matsudaira, P., Baltimore, D., Darnell, J. (2000): Molecular cell biology, Fourth Edition, W. H. Freeman and Company, UK.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture sand repetition	2	1-9	The study of literature andprepares questions	Checking renewed activity through oral discussion and explanation prepared questions.
Final exam	3	1-9	Preparation for the exam by studying compulsory and recommended literature	Exam (written and oral)
Total	5			

The way of calculating ECTS credits for certain activities:

The module has 5 ECTS
1 credit = 25 hours of workload (hours of student work)
5 ECTS credits = 125 hours of load modules
50 teaching hours (lectures) = 2 ECTS (50 teaching hours / 125 hours of total work hours x 100 = 40,00% of the total
Final exam = 3 (75 hours of preparation / 125 hours of total work hours x 100 = 60.00% of total 5 ECTS)

Module quality assessment

Evaluation of teachers and the quality of the following module via anonymous student surveys.

Module name	**Heavy Metals in Agroecological System**	
Module coordinator	Zdenko Lončarić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Breeding and Seed Production	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	5
	Lecture hours (L+E+S)	L - 40, E - 0, S - 10

Module aim

Aim of the module it to integrate knowledge about heavy metals and trace elements from ecological and physiological aspects, to analyse and emphasise potential and impact of plant breeding and biofortification on selective heavy metals accumulation and quality of food from vegetative origin. Students will acquire latest scientific facts from the field of ecology, physiology and biofortification regarding selective transport of heavy metals in food chain. Students will be prepared for interdisciplinary scientific research work in the fields of ecophysiology, ecology and plant breeding.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Integrate knowledge about heavy metals from ecological, physiological and breeding aspects.
2. Estimate bioavailability of heavy metals in agroecological system.
3. Evaluate potential and impact of plant breeding and biofortification on quality of food from vegetative origin.
4. Compare different methods of agronomical and genetic biofortification of plants.
5. Select adequate method of classical or molecular biofortification.

Module content

Bioavailability and fractions of heavy metals in soil, ways of uptake, transport, allocation, distribution and accumulation of heavy metals in plant tissue, physiological mechanism in heavy metals cycles, particularities of plant species and organs in transfer of heavy metals in food chain, genetic variability of heavy metal accumulation, inheritance – QTLs for heavy metals accumulation in plants, particularities of heavy metals accumulations inheritance in major crops (wheat, rice, maize, potato), biofortification – importance, projects in the world, conduction methods, trends for the future.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and lectures using recommended reading literature. Students make individual seminar works, which they present orally in a fifteen-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Lončarić, Z. (2012): Teški metali u agroekosustavu. Poljoprivredni fakultet u Osijeku. (interna skripta-predavanja).
2. Lončarić, Z. (2012): Koncentracije i odnosi teških metala u poljoprivrednim proizvodima. Poljoprivredni fakultet u Osijeku. (interna skripta-predavanja).
3. Marić, S. (2012): Biofortifikacija - oplemenjivanje za dodanu nutritivnu vrijednost (interna skripta - predavanja).
4. Official Journals of the EC, ISO standardi, EN norme, HRN norme, Zakoni i Pravilnici.

Recommended literature:

1. Hooda, Peter (2010): Trace elements in soils. Blackwell Publishing Ltd. West Sussex. United Kingdom.
2. Ivarsson, K. et al. (2002): Cadmium from Plough to Plate. SLU. Swedish university of agricultural science. 34 p.
3. Reynolds, M. P., Ortiz-Monasterio, J.I., McNab, A. (2001): Application of physiology in wheat breeding.CIMMYT, Meksiko.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.6	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.4	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	3	1-4	Preparing for exam bystudying required andrecommended literature	Oral exam
Total	5			

The way of calculating ECTS credits for certain activities:

Module carries 5 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

5 ECTS credits = 125 hours of module loads

40 teaching hours (lectures) = 1.6 ECTS (40 teaching hours/125 hours of total load x 100 = 32% from total of 5 ECTS)

Seminar paper = 0.4 ECTS (10 hours/125 hours of total load x 100 = 8% from total of 5 ECTS)

Final exam = 3 ECTS (75 hours of preparation/125 hours of total load x 100 = 60 % from total of 5 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

After completing the major Plant Breeding and Seed Production, student will be able to:

Learning Outcome 1	Plan breeding programs of major cultivated plant species
Learning Outcome 2	Lead the selection process of major cultivated plant species
Learning Outcome 3	Design the improvement of existing selection methods
Learning Outcome 4	Foresee the future movements and demands for improved cultivars and hybrids
Learning Outcome 5	Organise seed production of major cultivated species
Learning Outcome 6	Manage the laboratory for seed quality testing
Learning Outcome 7	Develop new methods for testing of seed quality

ANIMAL BREEDING

2.6. Modules of major Animal Breeding:

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Biochemistry – Selected Chapters	30	3
2.	Physiology – Selected Chapters	30	3
3.	Introduction to Scientific Work	30	3
4.	Biometrics in Zootechnics	30	3

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Current Procedures in Animal Selection	30	3
2.	Animal Health Protection and Animal Welfare	30	3
3.	Methods for Breeding Value Estimation	30	3
4.	Endocrinology and Reproduction of Domestic Animals	30	3
5.	Cattle Production – Selected Chapters	30	3
6.	Pig Breeding – Selected Chapters	30	3
7.	Poultry Breeding – Selected Chapters	30	3
8.	Sheep and Goat Breeding – Selected Chapters	30	3
9.	Horse breeding – Selected Chapters	30	3
10.	Quality of Animal Products (Meat and Milk)	30	3
11.	Growth and Development of Domestic Animals	30	3
12.	Molecular Methods in Animal Science	30	3
13.	Food Quality and Safety Management	20	2
14.	Animal Products in Human Nutrition	20	2
15.	Farm Animal Ethology	30	3

2.6.1. Learning outcomes of major Animal Breeding

Module name	**Biochemistry – Selected Chapters**	
Module coordinator	Drago Bešlo	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 29, E - 0, S - 1

Module aim

Link metabolic processes of various organs and their way of regulation. Then explain the interaction of metabolic pathways in the example of the flow of molecules through three key metabolic crossroads. These glucose-6-phosphate, pyruvate and acetyl-CoA. Then follows a discussion of the major hormonal regulators of energy metabolism as well as the storage, transfer of information and the regulation of gene expression.

Terms of admission

No condisions.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand catabolism and anabolism linked macromolecules.
2. Analyse the processes in organs and their regulation.
3. Interpret the hormonal regulation of metabolism.
4. Connecting signaling of glucose levels and understand the role of coordination of hormones in different tissues.
5. Determine how the entered excess food is stored as glycogen or triacylglycerols.
6. Analyze and interpret the knowledge gained in biochemistry with knowledge obtained in other areas to determine the proper animal nutrition.
7. Analyse and describe the mechanisms that regulate gene transcription and regulation of metabolism, explain the coordinated regulation synthesis of enzymes at the level of gene transcription and postsynthetic regulation and enzyme activity in cells and energy charge needs of certain metabolites.
8. Qualify PhD student to interpret data from the literature and their application.

Module content

A complete view of catabolic and anabolic aspects of metabolic processes with a focus on the molecular basis of metabolism, including material information molecules, their synthesis and methods of action and complex regulation of gene expression.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

PhD students are required to attend lectures and laboratory exercises. Come to classes prepared where the processed reading materials and laboratory exercises to be able to equally participate in the discussions.

Literature

Required reading:

1. Berg, M. J., Tymoczko, J. L., Stryer, L. (2013): Biochemistry, 6th edition England, 1st edition Croatia, School book, Zagreb.
2. Bešlo, D. (2014): Practicum of boichemistry. Faculty of Agriculture in Osijek.
3. Devlin, T. M. (2008): Textbook of Biochemistry with Clinical Correlation. Seventh Edition, John Wiley @Sons.
4. Voet, D., Voet, J. G., Pratt, C. W. (2008): Principles of Biochemistry. Third Edition, John Wiley@Sons.
5. Karlson, P. (2003): Biochemistry. School book.

Recommended literature:

1. Voet, D., Voet, J. G., Pratt, C. W. (2006): Fundamentals of Biochemistry. Life at the molecular level, John Wiley@Sons.
2. Albert, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J. D. (1994): Molecular biology of the cell. Third Edition, Garland Publishing, Inc. New York@London.
3. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2004): Essential cell biology. Second Edition, Garlad Science, Taylor Francis Group.
4. Boyer, R. F. (1993): Modern experimental biochemistry, Second Edition, The Benjamin/cumming Publishing Company, Inc.
5. Nelson, D. L., Cox, M.M. (2000): Lehninger Principles of Biochemistry. Worth Publishers.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and laboratory exercises	1.16	1-8	The study of literature and prepares questions.	Checking renewed activity through oral discussion andexplanation prepared questions.
Writing reports from laboratory exercises	0.04	1-8	Processing the resultsobtained by the implementation of experiments in the laboratory.	Review and evaluationobtained and analyzedresults.

Final exam	1.80	1-8	Preparation for the exam by studying compulsory and recommended literature.	Exam (written and oral).
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1 ECTS credit = 25 workload hours (student' working hours)

3 ECTS credits = 75 hours of module loads

29 hours of lectures = 1.16 ECTS (29 hours / 75 hours of total work hours x 100 = 38.67% from total of 3 ECTS)

1 hour of seminar = 0.04 ECTS (1 hour/ 75 hours of total work hours x 100 =1.33% from total of 3 ECTS)

Final exam = 1.80 ECTS (45 hours preparation / 75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teachers and the quality of the following imodule via anonymous student surveys.

Module name	**Physiology – Selected Chapters**	
Module coordinator	Mislav Đidara	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S - 5

Module aim

Adopting theoretical knowledge of mammal organism functioning. Form and function of the cells. Students will be able to explain tissue composition, metabolic processes, centres of gene expression and regulation. They will be able to define defence mechanisms from pathogens and stressors. They will be introduced with action of nutritive and biologically active substances on modification of immune cell response. Students will be able to prepare seminar using up to date scientific literature.

Terms of admission

No prerequisite.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand the organization of animal cells.
2. Connect the peculiarities of structure of cell membranes with the ways of communication of animal cells.
3. Count holders and functions of the immune system.
4. Understand role of the endocrine system in the metabolic processes.
5. Evaluate indicators of clinical evaluation in the light of production tasks.

Module content

Membrane structure, intracellular departments, programmed cell death, receptors. From DNA to proteins.Elements of specific and nonspecific defence. Diffuse and organised gut lymphoid tissue. Influence of feed composition, additives and gut microflora in disease protection. Hormones. Endocrine glands. Functions of growth hormone, steroid hormones, insulin, glucagon and gastrointestinal hormones. Determination of metabolic and haematological parameters with laboratory procedures.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Participate in the teaching process, prepare literature

Literature

Required reading:

1. Bruce, A., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2007): Molecular biology of the cell. 5th edition, Garland Science, Taylor and Francis Group, New York, USA.
2. Cooper, G. M., Hausman, R.E. (2004): Stanica, molekularni pristup. Medicinska naklada, Zagreb.
3. Squires, E. J. (2003): Applied Animal Endocrinology. CABi Publishing International.
4. D'Mello, J. P. F. (2000): Farm Animal Metabolism and Nutrition. CABi Publishing.
5. Griffin, J. E., Ojeda, S. R. (2004): Textbook of Endocrine Physiology. Oxford University Press.
6. Doppenberg, J., van der Aar, P. (2010): Dynamics in animal nutrition. Wageningen Academic Publishers.
7. Tyzard, I. (2013): Veterinary Immunology. Saunders company. Ninht edition.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.0	1-4	Studying the literature	Verification activities
Seminar	0.2	1-4	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.8	1-5	Preparing for exam by studying required literature	Exam (oral)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Modul carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
25 teaching hours (lectures + exercises)= 1 ECTS (25 hours/75 total load x 100 = 33.33% from total 3 ECTS)
5 seminar hours= 0.2 ECTS (5 hours/75 total load x 100 = 6.67% from total 3 ECTS)
Final exam= 1.8 ECTS (45 hours/75 total load hours x 100 = 60.00% from total 3 ECTS

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Introduction to Scientific Work**	
Module coordinator	Pero Mijić	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

The aim of this module is to introduce the postgraduate students to the basic principles of the scientific research, including the composition and publication procedures.

Terms of admission

No preconditions

Expected learning outcomes

After completing the module, student will be able to:

1. Apply the scientific method to the example of his own research.
2. Set scientific hypotheses and objectives of the work.
3. Conduct and write your own scientific work at the predicted structure of scientific work.
4. Own devise a current scientific topic and present a seminar paper.
5. Apply the computer in scientific research, and analyze the collected scientific papers.
6. Critically evaluate the scientific and professional work, and klasifikicirati used literature.

Module content

The module combines recognising, treatment and prophylaxis of the most important farm animal diseases with recognising the aspects of welfare. Students will gain necessary theoretical knowledge as an addition to knowledge from graduate studies, accompanied with seminar work and visiting an animal husbandry together with self estimation of the aspects of health protection and animal welfare.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students prepare a seminar work that is mandatory and which will be presented orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. After that, students take part Written exam of topics Exercises. The laying of the exercises, students acquire the right exit to the oral exam from the lecture topics. Students are advised to prepare exams from the successful exam.

Literature

Required reading:

1. Knežević, I., Mijić, P. (2006): Uvod u znanstveni rad – drugo, dopunjeno i izmjenjeno izdanje. Poljoprivredni fakultet u Osijeku, Sveučilište J. J. Strossmayera u Osijeku.
2. Knežević, I. (1988): Uvod u znanstveni rad. Poljoprivredni fakultet, Osijek. Str. 54.

Recommended literature:

1. Mijić, P., Knežević, I. (2005): Uporaba Interneta u poljoprivredi. Stočarstvo, 59 (1): 71-78.
2. Zelenika, R. (2000): Metodologija i tehnologija izrade znanstvenog i stručnog djela. Četvrto izdanje. Ekonomski fakultet u Rijeci.
3. Baban, Lj., Ivić, K., Jelinić, S., Lamza-Maronić, M., Šundalić, A. (2000): Primjena metodologije stručnog i znanstvenog istraživanja. Ekonomski fakultet u Osijeku, Osijek.
4. Zelenika, R. (1991): Kako nastaje recenzija znanstvenog i stručnog rada. Zavod za istraživanja i razvoj sigurnosti, Zagreb.
5. Silobrčić, V. (1989): Kako sastaviti i objaviti znanstveno djelo. Drugo izdanje. JUMENA, Zagreb.
6. Žugaj, M. (1989): Osnovi znanstvenog i stručnog rada. «Zagreb» r. o. za grafičku djelatnost, Samobor.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture and exercise	0.80	1-6	Studying literature, assignments	Checking the activities carried out through oral conversation, delivery and review assignments made
Seminar	0.40	1-6	The study of literature, preparation, and presentation of seminars	Review and evaluation of theseminar work according to pre-established criteria
Final exam	1.80	1-6	Preparation for the exam by studying recommended literature	Oral examination
Total	3.00			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1 ECTS point = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
20 hours of instruction (lectures and practice) = 0.80 ECTS (20 teaching hours / 75 hours total load x 100 = 26.67% of the total 3 ECTS)
Seminar = 0.40 ECTS (10 hours / 75 hours total load x 100 = 13.33% of the total 3 ECTS)
Final exam = 1.80 ECTS (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Biometrics in Zootechnics**	
Module coordinator	Gordana Kralik	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 10, S - 0

Module aim

To introduce students of doctoral studies with basic statistical methods, specificities of setting up experiments in zootechniques and data processing. The aim is to enable students to independently perform scientific work and to analyze results.

Terms of admission

None

Expected learning outcomes

After completing the module, student will be able to:

1. Describe statistical methods used in the zootechnical.
2. Select statistical method depending on the set problem.
3. Use advanced statistical packages when working with a computer.
4. Comment the results of statistical calculations.
5. Interpret the results for statistical hypothesis testing.
6. Justify why certain applied the statistical method in certain calculations.
7. To select the most appropriate statistical method for data processing.

Module content

Adopting theoretical knowledge of mammal organism functioning. Form and function of the cells. Students will be able to explain tissue composition, metabolic processes, centres of gene expression and regulation. They will be able to define defence mechanisms from pathogens and stressors. They will be introduced with action of nutritive and biologically active substances on modification of immune cell response. Students will be able to prepare seminar using up to date scientific literature.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Participation in teaching and solving the problem. Students will solve tasks with the help of some of the recognized statistical package (Statistica, SAS, SPSS). Lectures will take place with the help of power point presentation to students easily understand the course content. During the semester is scheduled for the final exam, which includes one task from three areas: 1st. distribution, hypothesis testing and determine the sample size; 2nd. ANOVA and MANOVA; 3rd Regression and correlation analysis.The final exam consists of written part (five tasks, of which

two dealt exclusively with the aid of computers) and oral (interpretation of results).Due to the complexity of formulas to calculate assignments students can use all the available literature, lecture notes and presentations in Power Point 2013. Students are advised to conduct lecture notes.The entire teaching material for students will be available in electronic form.

Literature

Required reading:

1. Kralik, G., Škrtić, Z., Kralik Z. (2012): Biometrika u zootehnici. Grafika, Osijek.
2. Horvat, D., Ivezić, M. (2005.): Biometrika u poljoprivredi. Grafika, Osijek.
3. Kaps, M., Lamberson, W. R. (2004): Biostatistics for animal science. CABI Publishing, CAB International, Wallingford, UK.
4. Šošić, I. (2004.): Primijenjena statistika. Školska knjiga, Zagreb.
5. Gogala, Z. (2001.): Osnove statistike. Nakladništvo Sinergija d.o.o.
6. Šošić J., Serdar V. (2000): Uvod u statistiku. Školska knjiga, Zagreb.

Recommended literature:

Manuals for the statistical programs use.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.20	1-7	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	1.80	1-7	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
30 teaching hours (lectures + exercises) = 1.20 ECTS (30 teaching hours/ and exercises/75 hours of total load x 100 = 40.00% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Current Procedures in Animal Selection**	
Module coordinator	Vesna Gantner	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	30
	Lecture hours (L+E+S)	L - 20, E - 0, S - 10

Module aim

Introduce students with methods of the traditional selection or phenotypic selection. Introduce them with impact of molecular techniques in detecting genetic variability in the population and it's influence on development and application of marker assistent selection in animal breeding.

Terms of admission

Passed exam - Quantitative Genetics and Selection of Animals.

Expected learning outcomes

After completing the module, student will be able to:
1. Define and describe important population and quantitative genetic concepts such as: natural selection, genetic drift, inbreeding, heritability, breeding value, genetic markers, quantitative trait loci (QTL).
2. Apply these population and quantitative genetic concepts to problems related to the genetic dynamics of natural, captive and artificially selected populations.
3. Apply population and quantitative genetic concepts to problems related to the erosion of genetic diversity and methods for genetic conservation of populations.
4. Apply current knowledge and understandings with the aim of animal breeding and improving of breeding programmes.
5. Create a breeding programme for modern breeds intended for intensive farming as well as endangered breeds intended for extensive and sustainable farming.

Module content

Aplication of population and quantitative genetics in farm animals breeding; selection based on the phenotype/genotype of the individual and / or phenotype/genotype of relatives. Expected and realized impact of phenotypic selection. Factors that influence the effect of selection. The importance of molecular markers in detecting genetic variation in populations. Marker assisted selection. Genomic selection.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students have to be prepared for lectures and seminars using recommended reading literature. Students will make individual seminar works in accordance with the module coordinator, which they present orally in a fifteen-minute period using PowerPoint or Prezi presentation. Schedule of presentations will be arranged in advance. After succesful seminar presentation, students write a final exam. Students are advised to prepare exams from required as well as Recommended literature list.

Literature

Required reading:

1. Dekkers, J. C. M., Van der Verf, J. (2007): Strategies, limitation and opportunities for marker-assisted selection in livestock. Marker Assisted Selection. Current status and future perspectives in crops, livestock, forestry and fish. FAO and Agriculture organization of United Nations, Rome.
2. Falconer, D. S., Mackay, Trudy, F.C. (1996): Introduction to quantitative genetics. Fourth edition. Longman Group LTD, Edinburgh.
3. Jovanovac, S. (2005): Populacijska genetika domaćih životinja. Poljoprivredni fakultet u Osijeku.
4. Lunch, B., Walsh, B. (1997): Genetic and Analysis of Quantitative traits. Sinauer Associates, Inc.

Recommended literature:

1. Meuwissen, T. H. E, Goddard, M. E. (1996): The use of marker haplotypes in animal breeding schemes. Genetic Selection Evolution 28: 161-176.
2. Goddard, M. E., Hayes, B. J. (2000). Genomic selection. Journal of Animal Breeding and Genetics. 124: 323-330.
3. Weller; J. (2009): Quantitative Trait Loci Analysis in Animals. 2nd edition. CAB International.
4. Montaldo, H., Meza_Herrera, A. (1998): Use of molecular markers and major genes on the improvement of livestock. EJB Eletronic Journal of Animal Biotechnology 1(2): 1-12.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.4	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.8	1-5	Preparing for exam using required and recommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

20 hours of lectures = 0.8 ECTS (20 teaching hours/75 hours of total load x 100 = 26.67% from total of 3 ECTS)

Seminar paper = 0.4 ECTS (10 hours/75 hours of total load x 100 = 13.33% from total of 3 ECTS)

Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Animal Health Protection and Animal Welfare**	
Module coordinator	Mislav Đidara	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 5, S – 5

Module aim

Introduce students to the methods of diagnosis, treatment and prophylaxis of certain diseases of domestic animals, and with aspects of the welfare of farm animals as an important determinant in the modern approach to breeding of domestic animals.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate the significance of certain diseases in domestic animals.
2. Assess and evaluate the necessary aspects of well-being which are applied in animal husbandry.
3. Rank and compare the diseases of domestic animals according to their zoonotic potential or economic importance.
4. Identify and choose the newer methods and procedures in assessing the welfare of farm animals.
5. Evaluate the aspects of the welfare compared to the economy.
6. Recommend measures for improving the status of health and welfare of farm animals.

Module content

The module combines the recognition, treatment and prophylaxis of major diseases of domestic animals by identifying aspects of well-being. In lectures students acquire the necessary theoretical knowledge as a complement to prior knowledge with graduate studies, which are supplemented by seminar work and practical visiting the farm with an independent assessment of health care and welfare.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Rupić, V. (2010): Zaštita zdravlja domaćih životinja. Intergrafika TTŽ, Zagreb.
2. Ponašanje domaćih životinja (Pavičić, Ž., K. Matković, ur.), Veterinarski fakultet Sveučilišta u Zagrebu, Zagreb, 2014. (prema 2. engleskom izdanju Per Jensen: The Ethology of Domestic Animals: An Introductory Text (Modular Texts).
3. Zakon o zaštiti životinja ("Narodne novine", broj 135/06, 37/13 i 125/13 - Zakon o provedbi uredbi Europske unije o zaštiti životinja).
4. Zakon o dobrobiti životinja ("Narodne novine", broj 19/99).

Recommended literature:

1. Fraser A.F. i D.M. Broom (1998): Farm Animal Behaviour and Welfare. Cab International, UK.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.0	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.2	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.8	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
25 teaching hours (lectures + exercises) = 1.00 ECTS (25 teaching hours/75 hours of total load x 100 = 33.33% from total of 3 ECTS)
Seminar paper = 0.20 ECTS (5 hours/75 hours of total load x 100 = 6.66% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Methods for Breeding Value Estimation**	
Module coordinator	Nikola Raguž	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 0, S - 10

Module aim

Introduce students with the concept and importance of animal selection based on breeding values. Instruct them in the ways of breeding value estimation, depending on the nature of the properties, sources of information and criteria to indicate the accuracy of predicted breeding values. Present the basic principles for evaluation of animals using the best linear estimate model (BLUP) and selection index. To show how information obtained from molecular DNA markers may contribute to the accuracy of estimates of breeding values and explain the concept of genomic breeding values.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Clarify the concept of breeding value and describe the methods developed for breeding value estimation through the past
2. Specify and explain factors that affect the accuracy of breeding value estimation of individuals for quantitative traits, as well as select optimal method to estimate breeding values.
3. Describe the concept of genomic prediction of breeding values (GEBV) and explain the meaning of DNA markers use in the prediction of phenotype.
4. Analyse the implementation possibilities of genomic selection in the national scheme of evaluation and breeding programs.
5. Compare different methods and models for breeding value estimation.
6. Evaluate advantages and disadvantages of the methodology of calculation the breeding values based on the information of molecular markers in comparison to traditional methods based on phenotypic information.

Module content

The concept of breeding value. Historical overview of the development in methodologies of genetic evaluation for individuals who are candidates for selection. Influence of heritability and type of information on the accuracy for breeding value estimation. Factors influencing the choice of models for the prediction of breeding values. BLUP and selection index in breeding value estimation. Using of molecular markers in genetic evaluation of individuals.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students have to be prepared for lectures and seminars using recommended reading literature. Students will make individual seminar works in accordance with the module coordinator, which they present orally in a fifteen-minute period using PowerPoint or Prezi presentation. Schedule of presentations will be arranged in advance. After succesful seminar presentation, students write a final exam. Students are advised to prepare exams from required as well as recommended literature list.

Literature

Required reading:

1. Cameron, D. (1997): Selection indices and prediction of genetic merit in animal breeding. CAB International.
2. Falconer, D. S., Mackay, T. (1996): Introduction to quantitative genetics. Longman Group LTD. Edinburgh.
3. Mrode, R. A. Thompson, R.(1995): Linear models for the Prediction of Animal Breeding Values. CAB International.
4. Henderson, C. R. (1973): Sire evaluation and genetic trends. In Proc. Anim. Breed. Genet. Symp. In Honor of dr. J. L. Lush. ASAS and ADSA, Champaign, Illinois, 10-14.

Recommended literature:

1. Dempfle, L. (1977): Comparison of several sire estimation methods in dairy cattle breeding. Livestock production Science 4, 129-139.
2. Weller, J. 2009): Quantitative Trait Loci Analysis in Animals. CAB International.
3. Hayes, B. J., Bowman, P. J., Chamberlain, A. J., Goddard, M. E. (2009): Invitet review: Genomic selection in dairy cattle. Progress and challenges. Journal of dairy Scinece 92, 433-443.
4. Goddard, M. E., Hayes, B. J. (2007): Genomic selection. Journal of Animal Breeding and Genetics 124, 323-330.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	1.0	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria

Final exam	1.2	1-6	Preparing for exam using required and recommended literature	Exam (oral or written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures) = 0.8 ECTS (20 teaching hours/75 hours of total load x 100 = 26.67% from total of 3 ECTS)
Seminar paper = 1.0 ECTS (25 hours/75 hours of total load x 100 = 33.33% from total of 3 ECTS)
Final exam = 1.2 ECTS (30 hours of preparation/75 hours of total load x 100 = 40.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Endocrinology and Reproduction of Domestic Animals**	
Module coordinator	Marcela Šperanda	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 20, E - 0, S - 10

Module aim
Introduce students with hormonal regulation, oestrus cycle in domestic animals, gravidity, partus and lactation. To explain students pathology of gravidity, partus and puerperium.

Terms of admission
No prerequisite.

Expected learning outcomes
After completing the module, student will be able to:
1. Describe communications of the animal cell.
2. Enumerate hormons which regulate reproductive cycle and distingush hormons' acting.
3. Interpreters of differences sexual cycle in different species of domestic animals.
4. Understand irregularities and bad conditions of labor animals.
5. Enumerate pathological conditions of the puerperium and diseases of the mammary gland.

Module content
Introduction with hormones that regulate oestrus cycle. Defining and recognizing external signs of heat and oestrus cycle. Physiology and pathology of partus. Physiology of lactation. Pathology of udder and problems with lactation.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
Participate in the teaching process, prepare literature.

Literature
Required reading:

1. Cooper, G., Hausman, M., Robert, E. (2004): Stanica. Molekularni pristup. Medicinska naklada, Zagreb, treće izdanje.
2. Griffin, J.E., Ojeda, S.R. (2000): Textbook of Endocrine Physiology. Oxford University Press, New York.
3. Rupić, V. (2010): Zaštita zdravlja domaćih životinja. 3. Fiziologija i patologija reprodukcije. Intergrafika TTŽ, Zagreb.
4. Liker, B. (2005): Spolni sustav. Interna skripta.
5. Reece, W. O. (1999): Physiology of Domestic Animals, Williams& Wilkins, Baltimore, Philadelphia.

6. Rupić, V. (2010): Zaštita zdravlja domaćih životinja. 3. Fiziologija i patologija reprodukcije. Intergrafika TTŽ, Zagreb.
7. Hafez, B., Hafez, E. S. E. (2000): Reproduction in farm animals. Lippincott, Williams & Wilkins.
8. Bearden, H. J., Fuguay, J. W. (1999): Applied Animal Reproduction. Prentice Hall, USA.
9. Havranek, J., Rupić, V. (2003): Mlijeko od farme do mljekare. Hrvatska mljekarska udruga, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Studying the literature	Verification activities
Seminar	0.4	3, 4, 5	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.8	1-5	Preparing for exam by studying required literature	Exam (oral)
Total	3.0			

The way of calculating ECTS credits for certain activities:

Modul carries 3 ECTS credits
1 ECTS credit = 25 hours
3 ECTS credits = 75 hours
20 hours of lectures= 0.8 ECTS (20 hours/75 total load x 100 = 26.67% from total 3 ECTS)
Seminar= 0.4 ECTS (10 hours/75 total load x 100 = 13.33% from total 3 ECTS)
Final exam= 1.8 ECTS (45 hours/75 total load hours x 100 = 60.00% from total 3 ECTS

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Cattle Production – Selected Chapters**	
Module coordinator	Pero Mijić	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 5, S - 10

Module aim

Becoming friendly with methods of diagnostics, healing and prophylaxis of certain domestic animals' diseases, and animal welfare, as well, as an important factor in up-to-date approach in animal husbandry.

Terms of admission

No preconditions

Expected learning outcomes

After completing the module, student will be able to:

1. Envision and propose appropriate modern technology regarding the direction of cattle production.
2. Develop the concept of posture and build a modern dairy farms.
3. Provide procedures behavior of cattle on the basis of individual production and reproduction cycles.
4. Organize production in accordance with the legislation the welfare of cattle.
5. To design and evaluate modern methods and selection procedures cattle breeding program.
6. Organize and manage environmentally friendly family estate.

Module content

The module combines recognising, treatment and prophylaxis of the most important farm animal diseases with recognising the aspects of welfare. Students will gain necessary theoretical knowledge as an addition to knowledge from graduate studies, accompanied with seminar work and visiting an animal husbandry together with self estimation of the aspects of health protection and animal welfare.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students prepare a seminar work that is mandatory and which will be presented orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. After that, students take part Written exam of topics Exercises. The laying of the exercises, students acquire the right exit to the oral exam from the lecture topics. Students are advised to prepare exams from the successful exam.

Literature

Required reading:

1. Uremović, Z. (2004.): Govedarstvo. Hrvatska mljekarska udruga, Zagreb.
2. Havranek, J., Rupić, Z. (2003): Mlijeko - od farme do mljekare. Hrvatska mljekarska udruga, Zagreb. Zagreb.

Recommended literature:

1. Kralik, G., Adamek, Z., Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D., Kralik, I., Margeta, V., Pavličević, J. (2011.): Zootehnika. Sveučilišni udžbenik, Poljoprivredni fakultet u Osijeku, Osijek.
2. Caput, P. (1996): Govedarstvo. Celeber, Zagreb.
3. Huth, F. W. (1995): Die Laktation des Rindes, Analyse, Einfluss, Korrektur. Verlag Eugen Ulmer, Stuttgart.
4. Beneder, I. (1993): Handbuch Offenstallhaltung – Planung, Stallbau, Weidenutzung. BI.
5. Hampel, G. (1993): Fleischrinder in Mutterkuhhaltung. BI.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture and exercise	0.80	1-6	Studying literature, assignments	Checking the activities carried out through oral conversation, delivery and review assignments made
Seminar	0.40	1-6	The study of literature, preparation, and presentation of seminars	Review and evaluation of the seminar work according to pre-established criteria
Final exam	1.80	1-6	Preparation for the exam by studying recommended literature	Oral examination
Total	3.00			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1 ECTS credit = 25 hours of workload (hours of student work)
3 ECTS credits = 75 hours of load modules
20 hours of instruction (lectures and exercises) = 0.80 ECTS (20 teaching hours / 75 hours total load x 100 = 26.67% of the total 3 ECTS)
Seminar = 0.40 ECTS (10 hours / 75 hours total load x 100 = 13.33% of the total 3 ECTS)
Final exam = 1.80 ECTS (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Pig Breeding – Selected Chapters**	
Module coordinator	Gordana Kralik	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 5, S - 10

Module aim

Introduce the students with the latest knowledge modules of selection and breeding of pigs and technological processes in the production of pigs and pork.

Terms of admission

There are no prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1.Describe breeding objectives and characteristics of modern breeds, types and hybrids.

2.Define norms relating to the well-being and health of pigs, and environmental protection.

3.Recognize trends and attitudes of consumers towards the production and consumption of pork products.

4.Detgermine similarities and differences between conventional and alternative ways of breeding pigs.

5.Estimate indicators of quality of pork and pork products, and point out the differences between industrial and traditional pork products.

6. Designed recipes and production-technological parameters for the production of pork products with added value.

7. Comment (arguments and critical) assigned topics related to pig production.

Module content

The module is designed in such a way that each student after the completion of lectures and exercises as well as successfully passing the exam can independently manage technological and organizational procedures on the pig farm. Also, the module is covered and scientific section relating to the selection and feeding practices, and research quality of pork and pork products, which provides students independently design and preparation of the dissertation. Topics module are: Breeding and selection procedures and evaluation of breeding values of pigs by using techniques that are consistent with the biological characteristics of pigs (BLUP, genetic evaluation). Breeding program in pig production. Establishing appropriate selection criteria and selection of pigs. Modern processes in the pig reproduction (artificial insemination, embryo transfer). Ethology pigs. The application of molecular methods in breeding, selection and propagation of pigs, processing of the latest scientific and technical papers related to a specific area of pig production published in international journals reference. Practical laboratory work related to the topic of the study and application of computer software in data processing.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☒ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are expected to be present and actively participate in the implementation of the module (consultation, preparation for laboratory exercises and seminars). The obligation of the student's writing seminar paper in the form of review papers on a given subject, which is required to publicly present (PowerPoint presentation for 15 minutes). Also, the student is required to attend the anticipated laboratory practice, where shall respect the rules regarding work in the laboratory (equipment, house rules). During the performance of teaching a student is required to take notes and exam preparation to implement the set of references.

Literature

Required reading:

1. Kralik, G., Adamek, Z., Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D., Kralik, I., Margeta, V., Pavličević, J. (2011): Zootehnika. Sveučilišni udžbenik, Grafika d.o.o. Osijek.
2. Kralik, G., Kušec, G., Kralik, D., Margeta, V. (2007): Svinjogojstvo – biološki i zootehnički principi. Sveučilišni udžbenik, Grafika d.o.o. Osijek
3. Holden, P.J., Ensminger, M.E. (2006): Swine Science. 7th edition, Pearson Education, Inc. Upper Saddle Rover, NJ.
4. Wiseman, J., Varley, M.A., Kemp, B. (2003): Perspective in Pig Science. Nottingham University Press.
5. Rotschild, M.F., Ruvinsky, A. (2004.): The Genetic of the Pigs. Oxon, UK: CABI Press.

Recommended literature:

1. Falconer, D. S., Mackay, T. F. C. (1996): Introduction to Quantitative Genetics. Ed 4. Longmans Green, Harlow, Essex, UK.
2. Glodek, P. (1992): Schweinezucht. Verlag Eugen Ulmer Stuttgart.
3.„Pig International“, „Feed international“ and other international journals.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-7	Studying literature, laboratory work.	Checking the activities carried outthrough the oral interview and a review of laboratory diary.
Seminar	0.40	1-7	The study of literature, preparation and presentation of seminars.	Review and evaluation of the seminar work according to pre-established criteria.
Final exam	1.80	1-7	Preparation for the exam by studying the successful exam.	Oral examination.
Total	3.00			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits

1 ECTS credit = 25 hours of workload (hours of student work)

3 ECTS credits= 75 hours of load modules

20 hours of instruction (lectures and practice) = 0.80 ECTS (20 teaching hours / 75 hours of total work hours x 100 = 26.67% of the total 3 ECTS credits)

Seminar = 0.4 ECTS credits (10 hours / 75 hours of total work hours x 100 = 13.33% of the total 3 ECTS credits)

Final exam = 1.80 ECTS credits (45 hours of preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS credits).

Module quality assessment

Evaluation of quality performance modules and teachers' work will be evaluated by an anonymous student surveys.

Module name	**Poultry Breeding – Selected Chapters**	
Module coordinator	Gordana Kralik	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E - 5, S - 10

Module aim

To introduce students with up-to-date achievements in selection, poultry breeding, as well as technologies of poultry meat and egg production.

Terms of admission

None

Expected learning outcomes

After completing the module, student will be able to:

1. Describe breeding objectives and characteristics of modern hybrids in poultry production.
2. List recommendations of selection companies for breeding hybrids.
3. Synthesize norms relating to poultry welfare and environmental protection.
4. Identify trends and consumers' attitudes towards the production and consumption of poultry products.
5. Differentiate similarities and differences in poultry production (conventional compared to alternative methods of breeding).
6. Compare and evaluate quality indicators of meat and eggs, and define differences between conventional and enriched products.
7. Recommend (design) mixtures for production of enriched poultry products.
8. Discuss with suitable arguments, different topics related to poultry production.

Module content

The module is conceptualized that each candidate can independently manage chicken farms after the completion of hours and worked exercises, and successfully passing the exam. Furthermore, the module is included a scientific research related to the quality of poultry products, which allows candidates independently design and preparing of the doctoral dissertation.

Topics of module are: Breeding goals in poultry production. Characteristics of modern poultry hybrids. Recommendation of selection companies for breeding of hybrids of domesticated poultry. Interaction of poultry genotypes and external factors (microclimate, feeding, Health protection). Conventional poultry breeding and production of commercial eggs. Protection of environment and poultry in intensive breeding systems. Specificities, characteristics and standards referring to poultry bred in alternative manner (ecological production, “free-range”, laying hens kept on floor, extended fattening).Trends in consumers’ attitudes towards poultry production and products.Evaluation of poultry carcass and meat quality. Differences in products produced alternatively and conventionally. Modification of nutritive contents in meat and eggs. Quality of fresh and commercial eggs. To introduce students with recent scientific achievements in poultry breeding (overview of topics in referential journals and publications from international meetings). Advanced usage of data available on Internet. Preparation of seminar papers (topic selection and overview of recent scientific achievements). Search of available literature needed

for selection of doctoral dissertation topic.Determination of poultry meat quality, as well as quality and freshness of eggs.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students are expected to actively participate during class (consultations). All students are obliged to prepare for seminars and laboratory exercises. Writing a seminar work is obligatory. A seminar work is a review article on a given topic which the student will present in a given period in the duration of 15 minutes using a Power Point presentation. Attending laboratory exercises is obligatory. For laboratory work, students are obliged to wear protective laboratory clothing (coat). Students are advised to take notes during classes (consultations) and laboratory exercises, as well as to prepare for exam by studying the recommended mandatory literature. During lectures, Power Point presentations will be used to explain the contents that are being discussed and debated during class.

Literature

Required reading:

1. Kralik G., Adamek, Z., Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D.,Kralik, I., Margeta, V., Pavličević, J. (2011): Zootehnika. Sveučilišni udžbenik, Grafika d.o.o. Osijek.
2. Kralik, G., Has-Schon, E., Kralik, D., Šperanda, M. (2008): Peradarstvo - biološki i zootehnički principi. Sveučilišni udžbenik, Grafika, Osijek.
3. Sim, J. S., Sunwoo, H. H. (2006): The amazing egg. University of Alberta, Canada.
4. Bell, D., Weawer W. D. (2001): Commercial chicken Meat and Egg Production. Kluwer Academic Publisher. Norwell, USA.
5. Leeson, S., Summers, J. D. (1997): Commercial Poultry Nutrition. Second Edition. University Books, Guelph, Canada
6. Rose, S. P. (1997): Principles of Poultry Science. CAB Publishing.

Recommended literature:

“Poultry Science”, “British Poultry Science”, “Meat Science”, “Archiv fuer Gefluegelkunde”, “Journal of Poultry Science”, Proceedings of international scientific congresses.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.80	1-8	Literature studying, laboratory work	Checking the activities was carried out throughthe oral conversation and checking laboratory diary.

Seminar	0.40	1-8	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.80	1-8	Preparing for exam by studying required and recommended literature	Oral exam
Total	3.00			

The way of calculating ECTS credits for certain activities:
Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/75 hours of total load x 100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x 100 = 13.33% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment
Evaluation of quality performance modules and teachers' work will be evaluated by an anonymous student surveys

Module name	**Sheep and Goat Breeding – Selected Chapters**	
Module coordinator	Zvonko Antunović	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 15, E – 5, S - 10

Module aim

Selection and application of procedures for breed-selection work in sheep and goat production, establishing and organizing modern technological procedures in sheep and goat production.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1 Synthesize, apply and evaluate modern methods and selection procedures in the assessment of the genetic value of sheep and goats.

2 To assess and evaluate the phenotypic and genetic characteristics of sheep and goats and the major genes in sheep and goat breeding

3 Rank and compare quality indicators of sheep and goat products.

4 Identify and choose contemporary methods and procedures in sheep and goat reproduction.

5 Evaluate the ecological and conventional sheep and goat breeding.

6 Recommend nutritional aspects of productivity modelling productivity and quality of sheep and goat products, to choose a healthy meal and feed mixtures for different sheep and goat categories.

Module content

Application of modern methods in value estimation of sheep and goat breeding. Norwegian circle method and French method of goat progeny test. New methods in sheep and goat selection, with an emphasis on phenotypic and genetic characteristics – genes for increased muscularity and sheep fecundity (Callipyge gene, FecB.). Goat products quality (medical and ecological benefit). Organic sheep and goat breeding. Modern methods of sheep and goat reproduction. Microbial ecology of the rumen of sheep and goats. Feeding modelling of sheep and goat productivity and metabolic profile. Selection index calculation, assessment of physical condition, and preparing meals and feed mixtures for different categories of sheep and goats. Students will be given suggestions of seminar paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for their paper writing, according to scientific interest of participants.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Mioč, B., Pavić, V. (2002): Kozarstvo. Hrvatska mljekarska udruga. Zagreb.
2. Mioč, B., Pavić, V., Sušić, V. (2007): Ovčarstvo. Hrvatska mljekarska udruga. Zagreb.
3. Freer, M., Dove, H. (2002): Sheep Nutrition. Cabi Publishing and CSIRO Publishing.
4. Cannas, A., Pulina, G. (2008): Dairy goats feeding and nutrition. CAB International.
5. Piper, L., Ruvinsky, A. (1997): The genetics of sheep. CAB International.
6. Senčić, Đ., Antunović, Z., Mijić, P., Baban, M., Puškadija, Z. (2011): Ekološka zootehnika. Poljoprivredni fakultet u Osijeku, Osijek.
7. Domaćinović, M., Antunović, Z., Džomba, E., Opačak, A., Baban, M. Mužic, S. (2015): Specijalna hranidba domaćih životinja. Poljoprivredni fakultet u Osijeku, Osijek.
8. NRC- Nutrient requirements of small ruminants (2007): The National Academy Press.Washington DC, USA.

Recommended literature:

1. Mahgoub, O., Kadim, T., Webb, E. (2012): Goat meat production and quality. CAB International.
2. Court, J., Webb, W.J., Hides, S. (2010): Sheep farming for meat and wool. CSIRO Publishing.Gordon, J. (1997): Controlled reproduction in sheep and goats. CAB International.
3. Paulina, G., Bencini, R. (2004): Dairy sheep nutrition. CAB Publishing.
4. Petrović, M. P. (2001): Genetika i oplemenjivanje ovaca. ITP Naučna, Beograd.
5. Samardžija, M., Đuričić, D., Dobranić, T., Herak, M., Vince, S (2010): Rasplođivanje ovaca i koza. Veterinarski fakultet Sveučilišta u Zagrebu.
6. Gordon, J. (1997): Controlled reproduction in sheep and goats. CAB International.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.8	1-6	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.4	1-6	Literature studying, seminarpreparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.8	1-6	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits

1ECTS credit = 25 workload hours (student's working hours)

3 ECTS credits = 75 hours of module loads

20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)

Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)

Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Horse Breeding – Sselected Chapters**	
Module coordinator	Mirjana Baban	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

Acquiring theoretical knowledge of selective horse breeding. Testing working ability of horses with the aim of different ways of using horses.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
1 Synthesize, apply and evaluate modern methods and selection procedures in the assessment of the genetic value of horses.
2 Assess and evaluate the phenotypic and genetic characteristics of horses.
3 Rank and compare quality indicators of horse breeding.
4 Identify and choose contemporary methods and procedures in horse reproduction.
5 Evaluate pure-bred and inadequate horse breeding.
6 Recommend methods in the evaluation of the working ability of the horse.

Module content

Applying modern methods in evaluating the breeding value of horses according to their usage value. Conducting the horse selection. Breeding methods and their use with the aim of setting breeding programs. Equine Locomotion. Evaluation of work ability of horses.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar papers, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Ivanković, A. (2004): Konjogojstvo. Hrvatsko agronomsko društvo. Zagreb.
2. Kralik G., Adamek, Z., Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D., Kralik, I., Margeta, V., Pavličević, J. (2011): Zootehnika. Sveučilišni udžbenik, Grafika d.o.o. Osijek.

3. Bowling, A. T., Ruvinsky, A. (2000): The Genetics of the Horse. CAB International CABI Publishing, Wallingford, UK.
4. Back, W., Clayton, H. (2001): Equine Locomotion. W. B. Sauders. Harcourt Publishers Limited.

Recommended literature:

1. Barrey, E. (2001): Inter-limb Coordination. (In: Back, W., Clayton, H.: Equine Locomotion.) W. B. Sauders. Harcourt Publishers Limited.
2. Brem, G. (2011): Der Lipizzaner im Spiegel der Wissenschaft. Verlag der Österreichischen Akademie der Wissenschaften, Wien.
3. Grilz-Seger, G., Druml, T. (2011): Lipizzaner Hengststämme. Vehling Medienservice und Verlag GmbH. Graz. (knjiga).
4. Morel, M. D. (2005): Breeding horses. Blackwell Publishing Ltd.
5. Senčić, Đ., Antunović, Z., Mijić, P., Baban, M., Puškadija, Z. (2011): Ekološka zootehnika. Poljoprivredni fakultet u Osijeku.
6. Sponenberg, P., Beaver, V.B. (2001): Horse color. Breakthrough. 15-117.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.40	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.80	1-6	Preparing for exam by studying required and recommended literature	Exam
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/75 hours of total load x 100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x 100 = 13.33% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and the quality of the module by anonymous student questionnaires.

Module name	**Quality of Animal Products (Meat and Milk)**	
Module coordinator	Goran Kušec	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 16, E - 6, S - 8

Module aim
To expand the knowledge on meat and milk quality traits, as well as their products.

Terms of admission
Biochemisty-selected chapters
Physiology-selected chapters
Biometrics in zootehnics

Expected learning outcomes
After completing the module, student will be able to:
1. Describe post-mortem changes in meat.
2. Specify meat quality traits and factors that affect meat quality.
3. Asses quality of animal products based on determined quality parameters.
4. Implement analyses for quality evaluation of meat and milk.

Module content
Postmortem changes in meat (ripening); meat quality traits; factors influencing meat quality traits; chemical composition of meat; handling milk after milking; milk quality analyses.

Types of teaching

☒lectures	☐ individual tasks
☒seminars and workshops	☐ multimedia and network
☒exercises	☒laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students are advised to prepare for lectures by studying required and recommended literature. In agreement with the lecturer student chooses the seminar theme and prepares the seminar, which has to be presented in the form of Power Point presentation. For laboratory work, students need protective laboratory clothing (lab coat). Students are advised to prepare the exam from required literature.

Literature
Required reading:

1. Mann, J., Trusswel, A.S. (2007): Esentials of human ntrition. Oxford University press Inc.
2. Kovačević, D. (2001): Kemija i tehnologija mesa i ribe. Prehrambeno tehnološki fakultet, Osijek.
3. Lawrie, R. A. (1985): meat science, Pergamon press.
4. Rahelić, S. (1978): Osnove tehnologije mesa, Školska knjiga, Zagreb.
5. Uremović, Z. (2004): Govedarstvo. Hrvatska mljekarska udruga. Zagreb.

6. Havranek, J., Rupić, Z. (2003): Mlijeko - od farme do mljekare. Hrvatska mljekarska udruga. Zagreb.
7. Tratnik, Lj. (1998): Mlijeko - tehnologija, biokemija i mikrobiologija. Hrvatska mljekarska udruga, Zagreb.
8. Sabadoš, D. (1996): Kontrola i ocjenjivanje kakvoće mlieka i mliječnih proizvoda. Hrvatsko mljekarsko društvo, Zagreb.
9. Pravilnik o kakvoći svinjskih trupova i polovica.
10. Pravilnik o kakvoći goveđih trupova i polovica.
11. Pravilnik o kakvoći ovčjih trupova i polovica.

Recommended literature:

1. Reference journals which publish scientific and professional papers related to quality of meat and milk.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecures and exercises	0.88	1-4	Literature studying, assignment work, researching the literature; quality assesment at the laboratory	Checking student activity orally (conversation), reviewing student's work and assignments, succesfuly obtained and interprated result of exercises
Seminar	0.32	1-4	Researching the literature; preparing and presentation of seminar	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.80	1-4	Preparing for exam by studying required and recommended literature	Exam (oral)
Total	3.00			

The way of calculating ECTS credits for certain activities:
Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
22 teaching hours (lectures+exercises) = 0.88 ECTS (22 teaching hours/75 hours of total load x 100 = 29.33% from total of 3 ECTS)
Seminar paper = 0.32 ECTS (8 hours/75 hours of total load x 100 = 10.67% from total of 5 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality through anonymous student surveys.

Module name	**Growth and Development of Domestic Animals**	
Module coordinator	Goran Kušec	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

Introduce the students with the principles of growth of domestic animals, one of the fundamental principles in the livestock production.

Terms of admission

Biometrics, Anathomy and physiology of animals

Expected learning outcomes

After completing the module, student will be able to:

1. Apply appropriate statistical and mathematical models of growth.
2. Predict the optimal age and weight of animals for slaughter.
3. Apply acquired knowledge of animal nutrition in order to achieve the desired growth and development.
4. Estimate the effects of quantitative trait loci on growth and development as well as on the carcasses quality.

Module content

General aspects of growth (prenatal and postnatal growth; hyperplasia and hypertrophy); cellular growth, protein synthesis and genetic code; the growth of the most important tissues (muscle, adipose, bones); genetic and environmental influences on growth; measuring growth (destructive and non-invasive methods); growth of animals and carcass quality; statistical and mathematical models of growth; biometrical principles of growth description in domestic animals; technical devices for growth measurements (ultrasound, TOBEC, VIA; CT, MRT, etc.); modeling growth (dynamic and relative models of growth).

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to prepare for lectures, exercises and seminars by studying the literature. Upon seminar completion, students are obliged to present it orally using the PowerPoint presentation. After fulfilling all of their obligations, students should pass their final exam as prepared using the obligatory literature.

Literature

Required reading:

1. Lawrece, T. L. J., Fowler, V.R. (1997): Growth of farm animals, CAB International.
2. Swatland, H. J. (1994): Structure and development of meat animals, Technomic pub. Co., Lancaster, Pa. USA.
3. Lawrie, R. A. (1991): Meat Science, Pergamon press.
4. Pfeiffer, H., von Lengerken, G., Gebhardt, G. (1984): Wachstum und Schachtkörperqualität – Schweine. VEB Deutscher Landwirtschaftsverlag.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-4	Literature research, working on assignments	Assessing student activity (conversation), reviewing student's work and assignments, overviewing the completed tasks and obtained results
Seminar	0.4	1-4	Literature research, preparing and presenting the results	Seminar evaluation according the given criteria
Final exam	1.8	1-4	Preparation for the exam by studying therecommended literature	Exam (written and oral)
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures+exercises) = 0.8 ECTS (20 hours/75 hours of total load x 100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.4 ECTS (10 hours/75 hours of total load x 100 = 13.33%% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

The evaluation of teaching quality using anonymous student surveys.

Module name	**Molecular Methods in Animal Science**	
Module coordinator	Ivona Djurkin Kusec	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

To introduce the students to the methods of Molecular genetics and Animal biotechnology and their application in Animal science, as well as to the possibilities of their combination with classical methods of population and quantitative genetics with the aim of improvement of breeding programs.

Terms of admission

Biochemistry and Physiology of Animals, Quantitative Genetics and Selection of Animals

Expected learning outcomes

After completing the module, student will be able to:

1. Understand and differentiate molecular methods of gene and gene products analysis.
2. Identify and describe genetic markers and genetic maps.
3. Define Marker Assisted Selection.
4. Apply different PCR methods of DNA analysis.
5. Design own investigation based on application of DNA technologies.

Module content

Methods of molecular analyses of genes and their products; polymorphisms and criptopolymorphisms; gene mapping: linkage and physical gene maps; genetic markers; identification of quantitative trait loci (QTL); candidate and major genes; marker assisted selection (MAS). The seminar themes will be suggested to students, as well as peer reviewed journals associated with application of molecular methods in different areas of zootechnics according to student's interests.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are required to prepare for laboratory exercises and seminars by studying required literature, as well as recommended journal papers. In agreement with the lecturer student chooses the seminar theme and prepares the seminar, which has to be presented in the form of Power Point presentation. For the laboratory exercises students are required to bring their own laboratory coats and shoes, while laboratory masks and gloves will be provided by the laboratory during the exercises. Students are advised to prepare the exam from required literature.

Literature

Required reading:

1. Meneely, P. (2009): Advanced genetic analysis, Oxford University press Inc. New York.
2. Kinghorn, B., Van der Werf, J. (2000): Identifying and incorporating genetic markers and major genes in animal breeding programs. Belo Horizonte.
3. Cox, T. M., Sinclair, J. (2000): Molekularna biologija u medicini, Medicinska naklada.
4. Falconer, D. S., Mackay, T.F. (1996): Introduction to quantitative genetics, Logmann Group Ltd.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexcercises	0.80	1-5	Studying the literature,exercises according to prepared plan of exercises	Checking of activity through conversation, succesfuly obtained result of exercises
Seminar	0.40	1-5	Studying the literature,making and presentation of seminar	Review and evaluation according to thepre-established criteria
Final exam	1.80	1-5	Preparing for exams by studying required and recommended literature	Preliminary exam and oral exam
Total	3.0			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures+exercises) = 0.8 ECTS (20 hours/75 hours of total load x 100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.4 ECTS (10 hours/75 hours of total load x 100 = 13.33%% from total of 3 ECTS)
Final exam = 1.8 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of lecturer's work and evaluation of module's quality through anonymous student surveys.

Module name	**Food Quality and Safety Management**	
Module coordinator	Mislav Đidara	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 15, E – 0, S - 5

Module aim

The aim of the module is to introduce students to the principles, methodology and legislative bases of safe and quality food. Students are trained to evaluate the existing system of food safety and quality, and to take measures for improvement.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate the concept of quality and development in the field of quality, norms and principles of quality management.
2. Assess and evaluate food quality, authenticity, legislation.
3. Rank and compare the system of accreditation.
4. Identify and choose the newer methods and procedures in the assessment of food safety - monitoring, legislative aspects.
5. Evaluate the principles and application assurance of food safety.
6. Recommend measures to improve food safety management system.

Module content

Quality management-principles, tools, standards. The quality and health safety of food- and legislative requirements. Standards of food safety management.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Havranek, J. et al. (2014): Sigurnost hrane od polja do stola. Naknada Lijevak.
2. Koprivnjak, O. (2014): Kvaliteta, sigurnost i konzerviranje hrane. Sveučilište u Rijeci.

3. Norme (ISO 9000, ISO 22000, IFS, BRC, CA…): Zakoni, pravilnici , Regulations, Directive.

Recommended literature:

1. Luning, P. A., Devlieghere, F., Verhe, R. S. (2006): Safety in the agri-food chain, Wageningen Academic Publichers.
2. Baert, K., Devlieghere, F., Jacxsens, L., Debevere, J. (2005): Quality management systems in food industry. Ghent University.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.6	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.2	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.2	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	2.0			

The way of calculating ECTS credits for certain activities:
Module carries 2 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
15 teaching hours (lectures) = 0.60 ECTS (15 teaching hours/50 hours of total load x 100 = 30.00% from total of 2 ECTS)
Seminar paper = 0.20 ECTS (5 hours/50 hours of total load x 100 = 10.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Animal Products in Human Nutrition**	
Module coordinator	Daniela Čačić Kenjerić	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 16, E - 4, S - 0

Module aim

The course introduces students with the basic principles of human health as well as the role of animal products in human nutrition.

Terms of admission

None defined

Expected learning outcomes

After completing the module, student will be able to:

1. Present the role of animal products in human nutrition.
2. Present the dietary value of various animal products.
3. Advisage the risks of animal products consumption.
4. Clasiffy individuals based on their nourishment status.
5. Estimate the value of selected animal product in individual´s nutrition.

Module content

Principles of human nutrition; Energy requirements; Animal products; Foodborne diseases caused by animal products; Diet and state of nourishment

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☒ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

To participate in planned programme (lectures/consultations/exercises); to study the literature and based on the up to date information present the advantages and shortcommings of selected animal product used in human nutrition.

Literature

Required reading:

1. Krešić, G. (2012): Trendovi u prehrani, Fakultet za menadžment u turizmu i ugostiteljstvu, Opatija.
2. Mandić, M. L. (2007): Znanost o prehrani: Hrana i prehrana u očuvanju zdravlja, Prehrambeno-tehnološki fakultet, Osijek. http://www.ptfos.hr/index.php/hr/nastavni-materijali (authorisation credentials will be provided by the module coordinator)

Recommended literature:

Selection of books and scientific papers from the specific field of interest.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures/consultations/exercises	0.8	1-5	Literatur e studying, exercises	Disscussion, evaluation ofthe results obtained by measurement
Final exam	1.2	1-5	Literature studying	Oral exam
Total	2.0			

The way of calculating ECTS credits for certain activities:

By completion of module student acquires 2 ECTS credits.
1 ECTS credit = 25 hours of students workload
2 ECTS credits = 50 hours workload for module
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/50 hours of total module load x 100 = 40.00 % from the total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total module load x 100 = 60.00 % from the total of 2 ECTS)

Module quality assessment

Evaluation of teacher´s work and evaluation of module´s quality by anonimous student survey.

Module name	**Farm Animal Ethology**	
Module coordinator	Pero Mijić	
Study programme	Postgraduate university study of Agricultural Sciences, major Animal Breeding	
Module status	Elective module	
Year of studies	Second	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim

Get students acquainted with the theoretical basis of the mechanism for the control of domestic animals behavior in functional processes. Make them qualified for observing of the behavior of animals with different levels of domestification and breed. The possibility of applying the method of animal behavior evaluation in practice, their keeping and use.

Terms of admission

No preconditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Distinguish physiological mechanisms and the ecological behavior of domestic animals for the purpose of improving production and welfare.
2. Identify errors in the treatment of animals, and more beneficial to devise acceptable concepts of production.
3. Choosing the optimal technology option acceptable for animal regard to its behavior during feeding, watering, defecation, urination, rest, rumination, sleep, play and reproductions.
4. Anticipate possible behavioral domestic animals depending on the particular production system of domestic animal breeding.
5. Rank patterns of behavior in domestic animals respect to environmental and genetic influences.
6. From the seminar paper critically evaluate the latest scientific and professional literature knowledge, and make certain conclusions.

Module content

Physiological and ethological mechanisms of livestock behavior, description of behavior types in functional processes, ability of learning and adaptation for the realization of behavior types, errors in treating animals, application of pharmaceutical means in the livestock behavior. Behavior of cattle, pig, sheep, goat, horse, poultry, rabbit, dog and cat at feed intake, water intake, defecation, urinating, resting, rumination, sleeping, playing, and reproduction. Orientation in space and time, sequence rank forming, welfare of animals, transportation of animals.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students prepare a seminar work that is mandatory and which will be presented orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. After that, students take part Written exam of topics Exercises. The laying of the exercises, students acquire the right exit to the oral exam from the lecture topics. Students are advised to prepare exams from the successful exam.

Literature

Required reading:

1. Jensen, P. (2014): Ponašanje domaćih životinja – prema 2. engleskom izdanju, Uvodni tekst. Ur. Pavičić, Ž., Matković, K. Veterinarski fakultet Sveučilišta u Zagrebu, Zagreb.
2. Knierim, U. (2002): Grundsätzliche ethologische Überlegungen zur Beurteilung der Tiergerechtheit bei Nutztieren. Dtsch. tierärztl. Wschr. 109, 261-266.
3. Keeling, L. J., H. W. Gonyou (2001): Social Behavior in Farm Animals. CABI Publishing.
4. Fraser, A. F., Broom, D. M. (1998): Farm animal behaviour and welfare. Third edition. CAB International, Oxon, New York.

Recommended literature:

1. During the preparation of the seminar papers published in refereed journals will be studied.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture and exercise	0.80	1-6	Studying literature, assignments	Checking the activities carried out through oral conversation, delivery and review assignments made
Seminar	0.40	1-6	The study of literature, preparation, and presentation of seminars	Review and evaluation of the seminar work according to pre-established criteria
Final exam	1.80	1-6	Preparation for the exam bystudying recommended literature	Oral examination
Total	3.00			

The way of calculating ECTS credits for certain activities:

The module has 3 ECTS credits
1 ECTS point = 25 hours of workload (hours of student work)
3 ECTS = 75 hours of load modules
20 hours of instruction (lectures and practice) = 0.80 ECTS (20 teaching hours / 75 hours total load x 100 = 26.67% of the total 3 ECTS)
Seminar = 0.40 ECTS (10 hours / 75 hours total load x 100 = 13.33% of the total 3 ECTS)
Final exam = 1.80 ECTS (45 hours preparation / 75 hours of total work hours x 100 = 60.00% of the total 3 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student surveys.

After completing the major Animal Breeding, student will be able to:

Learning Outcome 1	Apply contemporary knowledge and skills in the field of livestock breeding and for breeding programs improvement; describe the concept of breeding values and the importance of genetic markers in predicting phenotypes; select, of optimal growth, a model for domestic animals in order to assess the optimal age and weight of animals for slaughter
Learning Outcome 2	Explain the functions during the food intake and explain the principles of weight gain and its relation with genetic regulation
Learning Outcome 3	Explain the morphological and functional properties of animal cells and interpret the association of endocrine regulation of metabolic processes with increased or decreased immune response
Learning Outcome 4	Predict and evaluate all necessary aspects of welfare and prophylaxis of the diseases of domestic animals; synthesize the knowledge on the animal behaviour and harmonize the behavioural patterns with sustainable and cost-effective production
Learning Outcome 5	Manage the farms using modern farming systems for livestock species such as cattle, pigs, poultry, sheep, goats and horses while considering their breeds, ways of keeping and nutrition
Learning Outcome 6	Analyse and evaluate factors that affect milk and meat quality, and their products; teach students to perform independent scientific research and publish the results
Learning Outcome 7	Identify and select optimal methods and procedures for the quality and food safety management systems, based on the public health and economic aspects and present the advantages and disadvantages of animal products in human nutrition

TECHNICAL SYSTEMS IN AGRICULTURE

2.7. Modules of major Technical Systems in Agriculture

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Methods of Scientific Research Technical Systems in Agriculture	60	6
2.	Technical Systems in Agroecological Environment	60	6

Elective modules:

	Module name	teaching hours	ECTS credits
1.	Strategies of Maintaining Technical Systems in Agriculture	40	4
2.	Technological Design of Workshops	40	4
3.	Technical Systems in Preparing Feed	40	4
4.	Theory of Operation of Agricultural Machinery	40	4
5.	Theory of Reliability of Technical Systems in Agriculture	40	4
6.	Machines and Devices for Fertilizing, Nursing and Crop Protection	40	4
7.	Technical Systems for Crop Harvesting	40	4
8.	Livestock Husbandry Processes Management	40	4
9.	Facilities and Air-Condition in Livestock Husbandry	40	4
10.	Operations Research of Technical Systems in Agriculture	40	4
11.	The Effectiveness of Technical Systems in the Function of Preserving the Soil	40	4
12.	Ergonomic Principles in the Construction of Agricultural Machinery	40	4
13.	Technical Systems in Horticulture, Orchards and Vineyards	40	4
14.	Technical Systems of Transport in Agriculture	40	4
15.	Geographic Information Systems in Agriculture	40	4
16.	Tribology of Technical Systems in Agriculture	40	4
17.	Alternative Energy Resources in Agriculture	40	4
18.	Technical Systems in Milk Production	40	4
19.	Design and Development of Agricultural Machines and Equipment	40	4
20.	Systems of Artificial Drying and Preservation of Agricultural Products	40	4
21.	Quality of Agricultural Products and Drying Media	40	4
22.	Robots and Manipulators in Agriculture	40	4

2.7.1. Learning outcomes of major Technical Systems in Agriculture

Module name	**Methods of Scientific Research Technical Systems in Agriculture**	
Module coordinator	Mladen Jurišić	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 25, E - 0, S - 35

Module aim

Gaining knowledge of modern methods of any research and experimentation of technical systems (machinery, plant production, animal husbandry) in Agriculture, with special emphasis on technical systems. The candidate this module should master writing scientific and technical papers, theses, and modern presentation of the same. Furthermore, he met the planning and execution of experiments and statistical treatment of the data obtained.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate contemporary methods and procedures during the study of the technical systems in agriculture.
2. Set the hypothesis in scientific work and her research results relevant to confirm or reject.
3. Create, evaluate and conclude research results concerning technical systems in agriculture.
4. Write and present scientific and professional work.
5. Critically evaluate and judge other professional and scientific works.
6. Organize, set up and run an experiment related to the research of technical systems in agriculture.

Module content

Introduction to science and scientific work. Scientific articles and categorization. Scientific style - structure of scientific work. Writing original science paper. Writing articles and other scientific hypothesis. Contemporary interpretations and supplies. Academics and training. Methods of scientific work and research of technical systems in the mechanization of agriculture, crop production and animal husbandry (experimental, statistical and historical). Experimental work (planning and carrying out the experiment and relevant Statistically processing of the results).

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☒ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a 30 minute period using presentation. Schedule of presentations will be arranged in advance. After that, students take oral exams of theoretical basis in scientific research methods of technical systems in agriculture.

Literature

Required reading:

1. Jurišić, M., Plaščak, I., Barač Ž., Zimmer, D., Petrović, D. (2015): Metode znanstvenog istraživanja tehničkih sustava u poljoprivredi, Praktikum - interna skripta, Poljoprivredni fakultet, Osijek.
2. Knežević, I., Mijić, P. (2006): Uvod u znanstveni rad, Poljoprivredni fakultet u Osijeku, Osijek. priručnik za metodologiju istraživačkog rada.
3. Tkalac Verčić, A., Sinčić Ćorić, D., Pološki Vokić, N. (2010): Priručnik za metodologiju istraživačkog rada - Kako osmisliti, provesti i opisatii znanstveno i stručno istraživanje, M.E.P. d. o. o. Zagreb.

Recommended literature:

1. Silobrčić, V. (1989): Znanstveno djelo, Jumena-Jugoslavensko-medicinska naklada.
2. Simonić, A. (2000): Znanost-najveća avantura i izazov ljudskog roda, Sveučilište u Rijeci, Vitograf d.o.o., Rijeka.
3. Banaj, Đ., Šmrčković, P. (2003): Upravljanje poljoprivrednom tehnikom, Poljoprivredni fakultet u Osijeku, Osijek.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	1	1-5	Studying literature, assignments	Studying literature, assignments
Seminar	1.4	1-6	The study of literature,preparation, and presentation of seminars	Pregled i vrednovanje seminarskog radaprema unaprijed utvrđenim kriterijima
Final exam	3.6	1-6	Preparation for the exam by studying recommended literature	Ispit (usmeni)
Total	6.0			

The way of calculating ECTS credits for certain activities:
The module has 6 ECTS
1 ECTS point = 25 hours of workload (hours of student work)
6 ECTS credits = 150 hours of load modules
25 hours of instruction (lectures) = 1 ECTS (25 hours / 150 hours total load x 100 = 16.67% of total 6 ECTS)
Seminar = 1.4 ECTS (35 hours / 150 hours total load x 100 = 23.33% of total 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation / 150 hours of total work hours x 100 = 60.00% of total 6 ECTS)

Module quality assessment
The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Technical Systems in Agroecological Environment**	
Module coordinator	Tomislav Jurić	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 25, S - 35, E - 0

Module aim

Objective of this module is to gain theoretical and practical knowledge on the use and proper maintenance of technical systems (machines, tools and appliances) in crop and livestock production in regard to the agroecological environment

Terms of admission

No preconditions

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the impact of measures to maintain the quality on the engine and the permitted parameters of exhaust gases.
2. Apply legal requirements regarding disposal of used oil and waste recycling technology
3. Describe the problem of soil compaction in the wheel-soil interaction.
4. Assess the impact of technical systems in the processing of the physical and chemical characteristics of the soil.
5. Describe the sowing of major field crops in the fallow ground called. no-till sowing
6. Explain the impact of technical systems in fertilization and plant protection on the possible consequences of the agroecological environment.
7. Select machines for harvesting and picking and extracting tuberous yields.
8. Describe the machines used for silage in the AG-BAG hose and horizontal silos.
9. Explain the disposa techniquel of manure, slurry and industrial waste water with increased concentrations of detergents and their effect on the environment.

Module content

The use of machinery, tools and appliances in crop and livestock production in regard to the agroecological environment. The impact of maintaining the engine quality and the permitted parameters of exhaust gases. Disposal of waste oil and waste recycling technological waste. Soil compaction in the interaction wheel-ground. The impact of technical systems in the processing of the change in the physical and chemical properties of soil. Sowing of major field crops in the rough ground (so calle no-till seeders). The impact of technical systems in fertilization and plant protection on the possible consequences of the agroecological environment when changing the embedded potential. Choice of machinery for harvesting and picking, and extraction of tuberous yields. Machines and appliances used for saving silage in the AG-BAG bowel and horizontal silos. Technique used for the disposal of manure and slurry, and its impact on the environment.

Types of teaching	☒ lectures	☐ individual tasks
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratory
	☐ distance education	☐ mentoring
	☐ field work	☐ other

Student requirements

Classes are conducted via combined lectures or consultations and assigning seminary work in which student on
concrete research assigment deals with teaching units from a lecture or consultation to the extent of the required research paper. Method of monitoring and measuring performance of individual technical systems in crop and livestock production
obtained data is processed, and a seminar paper is written with a critical review. Monitoring of the seminar work is
continuous, as well as verification of the acquired knowledge, which concludes by publicly defending the seminar papers.

Literature

Required reading:

1. Emert R., Jurić T., Filipović D., Štefanek E. (1996): Održavanje traktora i poljoprivrednih strojeva, Sveučilišni udžbenik, Poljoprivredni fakultet u Osijeku.
2. Brkić D., Vujčić M., Šumanovac L., Lukač P., Kiš D., Jurić T., Knežević D. (2005): Eksploatacija poljoprivrednih strojeva, sveučilišni udžbenik, Poljoprivredni fakultet Osijek.
3. Klein, W., König, K., Grabler, W. (2005): Sachkundig im Pflanzenschutz, 11. Auflage, Verlag Eugen Ulmer GmbH& Co., Stuttgart (Hohenheim).
4. Znaor, D. (1996): Ekološka poljoprivreda, Nakladni zavod Globus, Zagreb.
5. Barčić, J. (2000): Prskalice i orošivači, Agronomski fakultet Zagreb.
6. Banaj, Đ., Šmrčković, P. (2003): Upravljanje poljoprivrednom tehnikom, Poljoprivredni fakultet Osijek.
7. Čuljat, M., Barčić, J. (1997): Poljoprivredni kombajni, Poljoprivredni institut Osijek, Osijek.
8. Zimmer, R., Banaj, Đ., Brkić, D., Košutić, S. (1997): Mehanizacija u ratarstvu, Poljoprivredni fakultet Osijek,Osijek.
9. Tanevski D. (2000): Mehanizacija u stočarstvu, Poljoprivredni fakultet Skopje, Skopje.
10. Zakon o otpadu N.N. 178/04.

Recommended literature:

1. Zbornici radova «Aktualni zadaci mehanizacije poljoprivrede», Opatija 1997-2015.
2. Ronai Đ.M.(1998): Zbijanje zemljišta kao posledica kretanja točka, udžbenik Univerziteta u Novom Sadu, Novi Sad.
3. Brčić, J., i sur. (1995): Mehanizacija rada voćarstva i vinogradarstva, Agronomski fakultet u Zagrebu, Zagreb.
4. Sommer, C. (1998): Bodenbearbeitung und Bodenschutz, Kuratorium für Technik und Bauwesen in der Landwirtschaft e. V. (KTBL), Darmstadt.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Classes	1.0	1-9	Studying the literature	Checking the activities carriedout through the oral interview
Seminar	1.4	1-9	Studying the literature, making and presenting the seminar	Review and evaluation of theseminar work according to pre-established criteria
Final exam	3.6	1-9	Preparation for the testby using required and recommended literature	Exam (oral or written)
Total	6			

The way of calculating ECTS credits for certain activities:

The module has 6 ECTS points
1ECTS point = 25 hours of workload (hours of student work)
6 points = 150 hours of load modules
25 hours of instruction (lectures) = 1.0 ECTS (25 hours / 150 hours total load x100 = 16.67% of total 6 ECTS)
Seminar = 1.4 ECTS (35 hours / 150 hours total load x100 = 23.33% of total 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation / 150 hours of total work hours x 100 = 60.00% of total 6 ECTS)

Module quality assessment

By evaluating the teachers and the quality of this module via anonymous student surveys

Module name	**Strategies of Maintaining Technical Systems in Agriculture**	
Module coordinator	Željko Barač	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

The purpose and goal is the optimization of the structure, scope and technological features of the basic steps Strategies maintenance of technical systems in agriculture, and the measures and procedures in order to increase economic effectiveness of those systems in operation..

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
1. Describe the most important components of technical systems.
2. Understand the complexity of the interaction between the components of technical systems
3. Understand procedures for assessing the reliability of technical systems
4. Describe the use and maintenance of technical systems in agriculture as a series which includes various operations and procedures that support the basic function of a technical system
5. Adopt the principles strategijei maintenance of technical systems that ensure optimal korištrnjr the position. ergonomic - economic and trehničko - technological criteria.

Module content

Course content includes knowledge of technical and technological characteristics of technical systems. The use and maintenance of technical systems, and means of work, support optimum development of the process of production, which has an important place in the production system of each company Objectives of use and maintenance of production processes point to the importance of maintaining a broad field as a process associated with the production. The importance of the use and maintenance funds for the work is estimated to development and technological viewpoint, as well as economic. and social point of view. All of the above seen in the function of preserving the resources available in the company, in line with the mandatory standards.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint

presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

Adamović, Ž., Jevtić, M. (1988): Preventivno održavanje u mašinstvu. Građevinska knjiga, Beograd.

Recommended literature:

Baldin, A., Furlanetto, L. (1980): Održavanje po stanju, OMO, Beograd.
Adamović., Ž. i sur. (2007): Menadžment industrijskog održavanja, Univerzitet u Novom Sadu.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.8	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Technological Design of Workshops**	
Module coordinator	Ivan Plaščak	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim
Acquisition of knowledge in the specific selection of technology, organization and equipment as the basis for designing resources for revitalization (repair) of technical systems.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. To establish and evaluate the optimal location of revitalization workshop accommodation.
2. Select the organizational model, technology and methods of revitalization process.
3. Devise a solution of revitalization workshop technological project.
4. To recommend the equipment of revitalization workshop individual departments.

Module content
Workshop facilities and infrastructure accommodation. Types of organizational models of revitalization. The technology and methods of revitalization. Selection and sizing of departments, manipulative space and warehouse. Organizational connectivity department. Special requirements related to technology. Equipment for departments of revitalization. Specialist departments. Safety requirements and the requirements of environmental protection.

Types of teaching

☒ lectures	☒ individual tasks
☐ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☒ other

Student requirements
All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a thirty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Emert, R., Bukvić, Ž., Jurić, T., Filipović, D. (1997): Popravak poljoprivrednih strojeva, Sveučilišni udžbenik, Poljoprivredni fakultet u Osijeku.
2. Banaj, Đ., Šmrčković, P. (2003): Upravljanje poljoprivrednom tehnikom, Sveučilišni udžbenik, Poljoprivredni fakultet u Osijeku.

Recommended literature:

1. Greuter, E. (1998): Motorschladen, Wurzburg Vogel.
2. Actual tasks on agricultural engineering INTERNATIONAL SYMPOSIUM ON AGRICULTURAL ENRINEERING, Opatija 1999-2004.
3. Standardi (HRN, ISO) iz područja tehničkih sustava u poljoprivredi.
4. Tehnička i projektna dokumentacija ZIRC – Belje d.d., 1998.-2005.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.8	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Technical Systems in Preparing Feed**	
Module coordinator	Irena Rapčan	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Acquisition of theoretical and practical knowledge on the use of technical systems while preparing feed (alfalfa, clover-grass mixtures and corn silage from the field to drying facilities or horizontal silos.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate the use of machine aggregates in preparing feed.
2. To assess and evaluate the effect of various machine aggregates in preparing feed.
3. Identify and select the most appropriate hardware aggregates in preparing some feed.
4. Evaluate the quality of feed.
5. Recommendation of the most suitable feed for specific agro-ecological conditions.

Module content

The use of machine aggregates mowers, rakes, breakers / conditioner, press balers, bale press for roller with elastic chamber and permanent forms. Drying square and roller bales in the horizontal kilns with thermal aggregates. Drying feeds in vertical kilns with and without the use of waste heat. Dehydration of alfalfa in the semi-mobile and stationary dehydrators. Forage harvester with a pick-up device, serial header and universal header. The device for processing feed with inoculants. Ensiling in horizontal silos.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are obliged to prepare for seminars using literature. Students prepare a seminar work that is required. Seminar students present orally for about 20 minutes with a PowerPoint presentation as a final exam. Schedule of presentation will be arranged in advance. Students are advised to prepare the exam with required and recommended literature.

Literature

Required reading:

1. Katalinić, I., Pejaković, D., Brčić, J. (2000): Spremanje sjenaže, Hrvatski zavod za poljoprivrednu savjetodavnu službu, Zagreb.
2. Zimmer, R., Banaj, Đ., Brkić, D., Košutić, S. (1997): Mehanizacija u ratarstvu, Poljoprivredni fakultet u Osijeku, Osijek.
3. Stjepanović, M. (1998): Lucerna, Nova Zemlja, Osijek.
4. Stjepanović, M., Steiner, Z., Domačinović, M., Bukvić, G. (2002): Konzerviranje i korištenje krme, Agroekološko društvo u Osijeku, Osijek.

Recommended literature:

1. Čuljat, M. (2003): Uskladištenje krme u crijeva AG-BAG prešom, PUP, 4, Osijek.
2. Ćuljat, M. (2003): Silaža u crijevima od folije s AG-BAG prešama, PUP, 2, Osijek.
3. Gagro, M. (1998): Ratarstvo obiteljskog gospodarstva: Industrijsko i krmno bilje, Hrvatsko agronomsko društvo, Zagreb.
4. Vratarić, M., Sudarić, A. (2000): Soja, Poljoprivredni institut Osijek, Osijek.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.8	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments.
Seminar	0.8	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.4	1-5	Preparing for exam by studying required and recommended literature	Public seminar paper.
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 20 workload hours (student's working hours)
4 ECTS credits = 40 hours of module loads
20 teaching hours (lectures) = 2 ECTS (20 teaching hours/40 hours of total load x100 = 50% from total of 4 ECTS)
Seminar paper = 2 ECTS (20 hours/40 hours of total load x100 = 50% from total of 4 ECTS)
Final exam = public seminar paper that is attendant independently developed under the guidance of mentors and collaborators of doctoral studies.

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Theory of Operation of Agricultural Machinery**	
Module coordinator	Goran Heffer	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Objective of this module is the knowledge of the mechanical analysis of the work process of major agricultural machinery and tools of plant production, and vibration phenomena in the work of agricultural machinery and ways of protection from vibration which will allow students the scientific approach to the research process and technical systems in crop production.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Analyze workloads in the work of agricultural machinery.
2. Analyze the transmission of motion in the work of agricultural machinery.
3. Analyze the work, power and energy in the work of agricultural machinery.
4. Analyze the vibration motion in the work of agricultural machinery.

Module content

Classification and mechanical features of machines in agriculture. Physical and technological properties of soil and plants. Analysis of mechanics working wedge in the soil. The forces on the plow body. Drawbar pull the plow. Mechanics work tiller. Mechanical performance of fertilization. Theory of mechanical and pneumatic seed drill. Kinematics and dynamic analysis of machines for cutting. Mechanical analysis of work processes work winches combine theory cutting, theory drum threshing machines, straw walkers theory, theory griddles. The theory of operation sugar beet harvester beet. Vibrations in the work of agricultural machinery and protect people from vibration and machines.

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Brkić, D., Vujčić, M., Šumanovac, L. (2002): Strojevi za žetvu i berbu zrnatih plodina, Poljoprivredni fakultet u Osijeku, Vinkovci.
2. Brkić, D., Vujčić, M., Šumanovac, L., Jurišić, M. (2000): Strojevi i uređaji za spremanje silaže, Poljoprivredni fakultet u Osijeku, Vinkovci.
3. Stegić, M. (1996): Teorija vibracija linearnih diskretnih mehaničkih sustava, FSB, Zagreb.
4. Srivastava, A. K., Goering, E. C., Rohrbach, P. R. (1996): Engineering Principles of Agricultural Machines, The American Society of Agricultural Engineers (ASAE), Michigan, USA.

Recommended literature:

1. Listopad, G. E. (red.) (1986): Sel'skohozjajstveninnye i meliorativnye mašiny, Agropromizdat, Moskva.
2. Soucek, R., Pippig, G. (1990): Machinen und Gerate für Bodenbearbeitung, Dungung und Aussaat, Verlag Technik, Berlin.
3. Christianson, L. L., Rohrbach, R. P. (1986): Design in Agricultural Engineering, ASAE Publication, St. Joseph. MI.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.8	1-4	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.8	1-4	Literature studying, seminarpreparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.4	1-4	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	Theory of Reliability of Technical Systems in Agriculture	
Module coordinator	Goran Heffer	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L -20, S-20, E-

Module aim

Objective of this module is to acquire knowledge in the field of reliability theory, which provide students with a scientific approach to the research process and problems of reliability, durability and maintenance of technical systems in agriculture.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. analyze the reliability of elements and systems of technical systems in agriculture
2. calculate indicators of reliability elements and assemblies of technical systems in agriculture
3. analyze the processes of failure occurrence in the work of the technical systems in agriculture
4. propose ways to increase the reliability of technical systems in agriculture

Module content

Basic concepts of technical systems in agriculture; facility reliability parameters of functioning and ability to work, fired and time proper operation, limit state building and working life. Reliability index; indicators of proper operation, sustainability indicators, indicators of technical maintenance, economic indicators of reliability. Models of cancellation; Classification of cancellation, models distributed proper operation, failure rate models. Assessment of the basic indicators of proper operation. System reliability; models for system reliability. Physical-chemical base occurrence of cancellation; causes of the outages, the classification process of cancellation, the process of destruction due to exceeding the static strength, fatigue and wear and tear. Methods to increase the reliability of technical systems in agriculture

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Vujčić, M. (2002): Teorija pouzdanosti tehničkih sustava u poljoprivredei, nastavni materijal, Poljoprivredni fakultet Osijek.
2. Rao, S. S. (1992): Reliability-Based Design, McGraw-Hill, Inc., New York.
3. Ermolov, L. S. (1987): Povyšenie nadežnosti sel'skohozjajstveninnoj tehniki, Kolos, Moskva.

Recommended literature:

1. Kececioglu, D. (1991): Reliability Engineering Handbook, Vol. 1 and 2, PTR Prentice Hall, New York.
2. Sebastijanović, S. (2002): Osnove održavanja strojarskih konstrukcija, Strojarski fakultet, Slavonski Brod.
3. Lewis, E. E. (1996): Introduction to Reliability Engineering, John Wiley & Sons, New York.
4. Zelenović, D., Todorović, J. (1990): Efektivnost sistema u mašinstvu, naučna knjiga, Beograd.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.8	1-4	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.8	1-4	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.4	1-4	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Modul name	**Machines and Devices for Fertilizing, Nursing and Crop Protection**	
Module leader	Vjekoslav Tadić	
Program degree	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective	
Year	Second	
ECTS value and teaching methods	ECTS value of student workload	4
	Number of hours (L+E+S)	L - 20, E - 0, S - 20

Objectives of the module

To introduce participants with the basic lows at pesticides and fertilizer distribution, new machines and technical solutions in fertilizing, nursing and crop protection. To introduce participants with basic methods for use of pesticides in agriculture.

Conditions for module entry

No precontitions

The expected learning outcomes for the module

After successfully completing the module the student will be able to:
1. Independently perform adjustment of machines for fertilizing, nursing and crop protection.
2. Select test methods and write reports about machine testing.
3. Describe the current situation and propose development directions for machines for fertilizing, nursing and crop protection.

Module content

Importance and quality distribution of mineral fertilizer, new constructed machines for distribution and their impact on environment protection. Methods for pesticides application, technical specification for arable sprayers, choose and nozzle application, sprayer testing according to ENTAM, leaf area coverage with pesticides, distribution of pesticides. Sprayers, mistblowers, foggers and planes in crop protection. Technics and organization for using of pesticides in crop prodiction, fruit growing, viticulture and vegetable production.

Teaching methods

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ education on distance
- ☐ field teaching
- ☒ indenpendent tasks
- ☐ multimedia and the internet
- ☐ laboratory
- ☐ mentoring
- ☐ other

Obligations of students

Choosing a seminar paper on a real student research project deals with teaching units and lectures in the range given in specific research paper. Monitoring of the seminar work, as well as verification of acquired knowledge, is continuous. Public defense of a seminar paper using a PowerPoint presentation ends with the knowledge testing.

Literature

Required literature:

1. Banaj, Đ., Šmrčković P. (2003): Upravljanje poljoprivrednom tehnikom, Poljoprivredni fakultet, Osijek.
2. Vujčić, M., Emert, R., Jurić, T., Heffer, G., Baličević, P., Pandurović, T., Plašćkak, I. (2011): Osnove poljoprivrednog strojarstva, udžbenik, Poljoprivredni fakultet, Osijek.
3. Maceljski, M. (1992): Metode i aparati za primjenu pesticida, udžbenik, Agronomski fakultet, Zagreb.

Recommended literature:

1. Srivastava, A.E., Goering, C.E., Rohrbach, R.P. (1996): Engineering Principles of Agricultural Machines, ASAE Publication, St. Joseph. MI.

Linking learning outcomes with teaching methods

Teaching activity	ECTS value	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-4	Literature research, task creation	Checking the activities carried outthrough oral conversation, delivery and review of assignments
Seminars	0.80	1-4	Literature research, preparation and presentation of seminars	Review and evaluation of theseminar work according to pre-established criteria
Final exam	2.40	1-4	Preparation for the exam by studying recommended literature	Oral examination
Total	4.00			

The method of calculation of ECTS value for certain activitiesi:

Modul has 4 ECTS points
1 ECTS point = 25 loud hours (student working hours)
4 ECTS point = 100 hours of module loud.
20 hours of lectures = 0.80 ECTS (20 hours of lectures/100 hours of module loud x 100 = 20% of total 4 ECTS)
Seminar work = 0.80 ECTS (20 hours/100 hours of module load x 100 = 20% of total 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of module load x 100 = 60.00% of total 4 ECTS)

Quality assessment

The evaluation of teachers and the quality of the above module via anonymous student surveys.

Module name	**Technical Systems for Crop Harvesting**	
Module coordinator	Đuro Banaj	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	Second	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

To familiarize the students with the new machines for harvesting agricultural crops. Compare the technical characteristics of individual systems from various manufacturers, and to select the best system for the selected area of work. At the same time introduce candidates to the expected directions of development of machines for crop harvesting.

Terms of admission

No precontitions.

Expected learning outcomes

After completing the module, student will be able to:

1. Independently perform adjustment of machines for crop harvesting of several different cultures.
2. Choose the methodology of testing for specific machine.
3. Propose development directions for machines for crop harvesting.
4. Analyze the current situation in the manufacture of machinery for harvesting crops.
5. Design proposals for the development of machinery for harvesting crops.

Module content

Introduction and development of machinery and the importance of their individual technical systems in the process of crop harvesting. Comparison of technical characteristics and ways of dealing with certain tasks in the system of collection. Strategy of testing agricultural machinery according to the regulations of the European Union.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Choosing a seminar paper on a real student research project deals with teaching units and lectures in the range given in specific research paper. Monitoring of the seminar work, as well as verification of acquired knowledge, is continuous. Public defense of a seminar paper using a PowerPoint presentation ends with the knowledge testing.

Literature

Required reading:

1. Banaj, Đ., Šmrčković P. (2003): Upravljanje poljoprivrednom tehnikom, Poljoprivredni fakultet, Osijek.
2. Feiffer A., Feiffer P.r i drugi (2005) Getreideernte - sauber, sicher, schnell, DLG-verlag.
3. Brkić, D., Vujčić, M., Šumanovac, L. (2002): Strojevi za žetvu i berbu zrnatih plodina, Poljoprivredni fakultet u Osijeku, Vinkovci.

Recommended literature:

1. Power, H. M., Simpson, R. J. (1988); Introduction to Dinamics and Control, Mc Graw-Hill, Book Co., London.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Literature research, task creation	Checking the activities carried out through oral conversation, delivery and review of assignments
Seminar	0.8	1-5	Literature research, preparation and presentation of seminars	Review and evaluation of the seminar work accordingto pre-established criteria
Final exam	2.4	1-5	Preparation for the exam by studying recommended literature	Oral examination
Total	4.0			

The way of calculating ECTS credits for certain activities:

Modul has 4 ECTS points
1 ECTS point = 25 loud hours (student working hours)
4 ECTS point = 100 hours of module loud.
20 hours of lectures = 0.80 ECTS (20 hours of lectures/100 hours of module loud x 100 = 20% of total 4 ECTS)
Seminar work = 0.80 ECTS (20 hours/100 hours of module load x 100 = 20% of total 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of module load x 100 = 60.00% of total 4 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above module via anonymous student surveys.

Module name	**Livestock Husbandry Processes Management**	
Module coordinator	Davor Kralik	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40 E - 0, S - 0

Module aim

This module study aims to provide students with knowledge on the latest systems of automatic management and its mathematical display of the transition function for diverse livestock production types.

Terms of admission

no terms

Expected learning outcomes

After completing the module, student will be able to:

1. Synthesize, apply and evaluate modern systems to automate processes in livestock production.
2. To assess and evaluate the contribution of the application of the latest technologies in livestock production.
3. Identify and choose the most adequate technical solutions in automation processes.
4. Organization and design of process automation in livestock production.

Module content

Automatic livestock systems management : food distribution, water supply, milk production and processing, heating of facilities and spaces, monitoring of physiological values , ultra-violet radiation of animals, final processing and production of cattle feed as well as theory of mathematical modeling of livestock technological processes in non-stationary systems

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students makes a seminar that is obligatory. Students presents seminar orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. For laboratory work students need standard protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from mandatory literature.

Literature

Required reading:

1. Kralik, G., Adámek, Z.,, Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D., Kralik, I., Margeta, V., Pavličević, J. (2011.) Zootehnika.
2. Kralik, G., Has-Schön E., Kralik, D., Šperanda, M. (2009.) Peradarstvo - biološki i zootehnički principi.
3. Kralik, G., Kušec, G., Kralik, D., Margeta, V. (2007.) Svinjogojstvo - biološki i zootehnički principi.
4. Babić J., Menđušić I., Babić I.(1996): Elektrotehnika u funkciji proizvodnje poljoprivrednih proizvoda; Sveučilište J. J. Strossmayera, Osijek.
5. Emert, R., Bukvić, Ž., Jurić, T., Filipović D.: (1996.) Popravak poljoprivrednih strojeva; Sveučilište J. J. Strossmayera, Osijek.
6. Kuljača, Lj., Vukić, Z.(1985.): Automatsko upravljanje sistemima; Školska knjiga, Zagreb.
7. Tanevski, D.: (1999.): Mehanizacija na stočarskoto proizvodstvo; Uniberzitet Skoplje.

Recommended literature:

1. Power, H. M., Simpson, R. J.(1998): Introducition to Dinamics and Control, Mc Graw-Hill Book Co., London,
2. Kailath, T.(1980): Liner Systems, Prentice – Hall, Inc., Englewood Cliffs, New York
3. Journals: Journal of Agricultural Engineering Research, Animal Science, Živočišna Vyroba, Zemedelska technika, Agricultural Engineering.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and excercises	1.6	1-5	Study of literature, developmnt of tasks	Evaluation the activities carried out through oral conversation, submisson and review of assignments
Final exam	2.4	1-5	Prepeartion for exam trough study of required and recomended literature	Exam (oral or in writting)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
Lectures and excercise = 1.60 ECTS (40 hours / 100 hours of total load x100 = 40 % from total of 4 ECTS)
Final exam = 2.4 ECTS (60 hours of preparation 100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

The evaluation of teaching quality using anonymous student surveys.

Module name	**Facilities and Air-Condition in Livestock Husbandry**	
Module coordinator	Davor Kralik	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 40, E - 0, S - 0

Module aim

This module study aims to provide knowledge and get students acquainted with the latest construction –technical achievements related to organization, design and maintenance of optimum microclimatic zoo-hygienic requirements in the facilities for diverse livestock production types.

Terms of admission

No terms

Expected learning outcomes

After completing the module, student will be able to:

1. Organize and design facilities in livestock production, spatial planning, design of technology, preliminary and final project.
2. To assess and evaluate the contribution of the application of the latest technologies in livestock production.
3. Identify and choose the most favorable sanitary and technical conditions of the animals.
4. Organization and design of ventilation systems in facilities on the pig, cattle and poultry production.

Module content

Organization and designing facilities in livestock husbandry, spatial planning, developing of technological, conceptual and main project, biological-technical environment requirements: dimensioning of stable spaces, peripheral constructions and ratio between ventilation and facilities insulation; Construction –technical factors: physical construction traits of facilities in the livestock production, heat balance; hygienic-technical factors; production requirements of the animals housing, aeration and facilities ventilation types in pig, cattle and poultry production as well as heating facilities by the conventional and alternative power resources.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students makes a seminar that is obligatory. Students presents seminar orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance.

For laboratory work students need standard protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from mandatory literature.

Literature

Required reading:

1. Kralik, G., Adámek, Z.,, Baban, M., Bogut, I., Gantner, V., Ivanković, S., Katavić, I., Kralik, D., Kralik, I., Margeta, V., Pavličević, J. (2011.) Zootehnika.
2. Kralik, G., Has-Schön E., Kralik, D., Šperanda, M. (2009.) Peradarstvo - biološki i zootehnički principi.
3. Kralik, G., Kušec, G., Kralik, D., Margeta, V. (2007.) Svinjogojstvo - biološki i zootehnički principi.
4. Biglbauer, M.(1997): Poljoprivredni objekti, Osijek.
5. Senčić, Đ., Pavičić, Ž., Bukvić, Ž. (1996): Intenzivno svinjogojstvo; Nova zemlja, Osijek.
6. Tanevski, D.: (1999.): Mehanizacija na stočarskoto proizvodstvo; Uniberzitet Skoplje.
7. Šikić, D. (1980): Elementi projektiranja građevinskih firmi. Poljoprivredno graditeljstvo, Zagreb.

Recommended literature:

1. Jurnals: Journal of Agricultural Engineering Research; Animal Science, Živočišna Vyroba; Zemedelska technika.
2. Agricultural Engineering.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and excercises	1.6	1-5	Study of literature, developmnt of tasks	Evaluation the activities carried out through oral conversation, submisson and review of assignments
Final exam	2.4	1-5	Prepeartion for exam trough study of required and recomended literature	Exam (oral or in writting)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
Lectures and excercise = 1.60 ECTS (40 hours / 100 hours of total load x 100 = 40 % from total of 4 ECTS)
Final exam = 2.4 ECTS (60 hours of preparation 100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

The evaluation of teaching quality using anonymous student surveys.

Module name	**Operations Research of Technical Systems in Agriculture**	
Module coordinator	Darko Kiš	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

The aim of the module is to teach students problem analysis and setting the model optimization. The task is to train students in thinking and problem solving using some of the methods of operations research.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Create a model of rational use of technical systems in agriculture.
2. Apply second multiobjective programming and decision-making in selecting certain technical systems in operation.
3. Third Simulate the operation of technical systems in agriculture.
4. Choose and apply expert systems in agriculture.
5. Propose the criteria and conditions for the introduction of artificial intelligence in agriculture.

Module content

The concept of optimization. Model Operational Research. Objective function, constraints and conditions. Methods of Operational Research. Linear programming. Non-linear programming. Dynamic programming. Optimal provision. Heuristic programming. Game theory. Simulation models. Multiobjective programming. Artificial Intelligence. The application of operations research in agriculture.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Barković, D. (1997): Operacijska istraživanja, Ekonomski fakultet u Osijeku, Osijek.
2. Kalpić, D., Mornar, V. (1996): Opercijska istraživanja, ZEUS, Zagreb.
3. Šumanovac, L.., Sebastijanović, S., Kiš, D. (2011): Transport u poljoprivredi, Poljoprivredni fakultet u Osijeku, Osijek.

Recommended literature:

1. Majdanžić, N., Lujić, R., Matičević, G., Šimunović, G., Majdanžić, I. (2001): Upravljanje proizvodnjom, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.8	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0,80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0,80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Final exam =2,40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60,00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**The Effectiveness of Technical Systems in the Function of Preserving the Soil**	
Module coordinator	Tomislav Jurić	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Objective of this module is to introduce the principles of the use of machinery in precision agriculture, and interaction "agricultural mechanization -soil» and guidelines to improve traction and performance of agricultural machinery.

Terms of admission

No preconditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the traction theory and and soil compaction in interaction "wheel - soil".
2. Compare the pneumatics performance on tracktors traction characteristics and soil compaction.
3. Explain the methods and devices used to precisely manage mechanization.
4. Describe the methods, ways and devices for testing the quality of work of agricultural machinery.
5. Describe qualitative and quantitative methods of determining the work of agricultural machinery.
6. Give argumented and critical comments on the topic of effectiveness of technical systems in the function of preserving the soil.

Module content

The theory of traction and soil compaction in the interaction "wheels -soil"; impact of pneumatic performance on tractors traction characteristics and soil compaction; methods and devices used for precise management of mechanization; methods, ways and devices used for testing the quality of work of agricultural machinery; qualitative and quantitative methods of determining the operation of agricultural machinery.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

The exam is taken orally or in writing after successfully defending the seminar paper. The seminar paper is made by the student independently; with the expert help of his teachers. Seminar involves theoretical consideration of pulling characteristics, resistance and soil compaction, and measurement and analysis of the results obtained by the aforementoined research and the choice of resources of mechanization with the student's critical review.

Literature

Required reading:

1. Brkić, D., Vujčić, M., Šumanovac, L., Lukač, P., Kiš, D., Jurić, T., Knežević, D. (2005): Eksploatacija poljoprivrednih strojeva, Sveučilišni udžbenik, Osijek.
2. Demo, M. a kolektiv (1995): Obrábanie pôdy, Nitra.
3. Eichhorn H. (1999): Landtechnik 7. Auflage, Verlag Eugen Ulmer GmbH & Co., Stuttgart (Hohenheim).
4. Janković, D., Todorović, J. (1983): Uputstva za izradu vučnog proračuna motornih vozila, Mašinski fakultet Univerziteta u Beogradu, Beograd.
5. Lazić, V. (1983): Teorijske osnove eksploatacije poljoprivredne tehnike, udžbenik Univerziteta u Novom Sadu, Novi Sad.
6. Ricz, Z (1986): Agrikulturna mehanika tla, udžbenik Sveučilišta u Zagrebu, Zagreb.
7. Ronai, Đ. M. (1986): Teorija kretanja van tvrdih puteva, udžbenik Univerziteta u Novom sadu, Novi Sad.
8. Ronai, Đ. M. (1988): Sabijanje zemljišta kao posledica kretanja točka, udžbenik Univerziteta u Novom sadu, Novi Sad.

Recommended literature:

1. Zaimović Uzunović, N. (1997): Mjerna tehnika, udžbenik Mašinskog fakulteta u Zenici Univerziteta u
Sarajevu, Zenica.
2. *** Agricultural Engineering –Yearbook.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Classes	0.8	1-6	Studying the literature	Checking the activities carriedout through the oral interview
Seminar	0.8	1-6	Studying the literature, making and presenting the seminar	Review and evaluation of theseminar work according to pre-established criteria
Final exam	2.4	1-6	Preparation for the testby using required and recommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:
The module has 4 ECTS points
1ECTS point = 25 hours of workload (hours of student work)
4 points = 100 hours of load modules
20 hours of instruction (lectures + practice) = 0.80 ECTS (20 teaching hours / 100 hours total load x 100 = 20.00% of total 4 ECTS)
Seminar = 0.80 ECTS (20 hours / 100 hours total load x 100 = 20.00% of total 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation / 100 hours of total work hours x 100 = 60.00% of total 4 ECTS)

Module quality assessment
By evaluating the teachers and the quality of this module via anonymous student surveys.

Module name	**Ergonomic Principles in the Construction of Agricultural Machinery**	
Module coordinator	Tomislav Jurić	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E- 0, S - 20

Module aim

Objective of this module is to introduce PhD students with ergonomic requirements in regard to the occupation of the machine operator, harmful factors which he/she is exposed to during operation and possibilities of their reduction.

Terms of admission

No preconditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Describe the factors which the operator is exposed to during operation.
2. Explain the impact of each factor on the operator.
3. Describe the ergonomic requirements due to the occupation of the operator.
4. Describe the methods, ways and devices for determining the factors that expose the operator.
5. Describe construction solutions to reduce the negative impact of certain factors.
6. Propose measures to protect the operator from the negative impact of certain factors.
7. Comment, argumentative and critical, given topic from the ergonomics of agricultural machinery.

Module content

Factors which the operator is exposed during operation; the impact of those factors on the machine operator; ergonomic requirements due to the occupation of the machine operator; methods, ways and apparatus (devices) for determining the factors that the operator is exposed to; structural opportunities to reduce them.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

The exam is taken orally or in writing after successfully defending the seminar paper. The seminar paper is made by the student independently; with the expert help of his teachers. Seminar includes consideration of the origin and the influence of individual factors that influence operator during operation, measurement and analysis of the resulting data and guidelines for the improvement of working conditions of the operator.

Literature

Required reading:

1. Dupuis, H. (1981): Ergonomische Gestaltung von Schleppern und landwirtschaftlichen Arbeitsmaschinen, Köln.
2. Gohlich, H. (1987): Mensch und Maschine, Lehrbuch der Agrartechnik Band 5, Hamburg und Berlin.
3. Renius, K. T. (1987): Traktoren, München.
4. Kirchner, J. H., Baum, E. (1990): Ergonomie für Konstrukteure und Arbeitsgestalter, München.

Recommended literature:

1. Ergonomy 2001, Proceedings of 1stInternational Ergonomics Conference, Zagreb.
2.*** Agricultural Engineering –Yearbook.
3. Zbornici radova «Aktualni zadaci mehanizacije poljoprivrede», Opatija.
4. Kroemer, K. H. E., Grandjean, E. (1999): Prilagođavanje rada čovjeku –ergonomski priručnik.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Classes	0.8	1-7	Studying the literature	Checking the activities carried out through theoral interview
Seminar	0.8	1-7	Studying the literature, making and presenting the seminar	Review and evaluation of theseminar work according to pre-established criteria
Final exam	2.4	1-7	Preparation for the testby using required and recommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:

The module has 4 ECTS points
1ECTS point = 25 hours of workload (hours of student work)
4 points = 100 hours of load modules
20 hours of instruction (lectures + practice) = 0.80 ECTS (20 teaching hours / 100 hours total load x 100 = 20.00% of total 4 ECTS)
Seminar = 0.80 ECTS (20 hours / 100 hours total load x 100 = 20.00% of total 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation / 100 hours of total work hours x 100 = 60.00% of total 4 ECTS)

Module quality assessment

By evaluating the teachers and the quality of this module via anonymous student surveys.

Module name	**Technical Systems in Horticulture, Orchards and Vineyards**	
Module coordinator	Luka Šumanovac	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Introducing the participants with the most advanced technical systems in horticultural, horticulture, where will a dedicated attention given to increasing the degree of rational use, preservation of soil fertility and environmental protection, and agricultural production based on ecological principles.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. To organize and establish a modern technical systems in the horticultural, horticulture on the principles of precision farming.
2. Select the optimal technical-technological solution to perform farming operations in horticultural production and permanent crops.
3. Develop a model of optimal size droplets (particles) different methods of pesticide application.
4. Define the environmental aspects of the mechanized production of vegetables, fruits and grapes.
5. Describe the principles and specify the main working parts of the technical systems in the harvest vegetable and permanent crops.
6. Propose rationalization of costs of technical systems using a thematic map (map).

Module content

The program includes the use of modern technical systems in the planting of fruit and vine materials, systems and methods of pesticide applications, systems harvest fruit and grapes, as well as systems for the reception of fruit and grođa. During the implementation of the curriculum, participants will be introduced to the sowing and planting grain and planting seedlings under the sheets, use "green" cultivators for weed control pesticide application of measures to combat pests mechanical aspirator, application of the pesticide spraying and fogging indoors. The program includes teaching and development of a model and the optimal size of droplets and particles of dusts, technical and technological solutions techniques of plant protection, economic and environmental parameters of the system. Modern technical systems for harvesting and extraction of vegetable crops and permanent crops.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Brčić, J. (1997): Mehanizacija u povrćarstvu, FPZ Zagreb, Zagreb.
2. Eichorn, H. (1999): Landtechnik, 7. Auflage, Verlag Eugen Ulmer GmbH & Co.; Stuttgart (Hohenheim).
3. Lukač, P., Pandurović, T. (2011): Strojevi za berbu voća i grožđa, Poljoprivredni fakultet u Osijeku, Osijek.
4. Lukač, P. (2010): Strojevi i uređaji za zasnivanje, obradu i gnojidbu trajnih nasada, skripta, Poljoprivredni fakultet u Osijeku, Osijek.
5. Storck, H. (1994): Taschenbuch des Gartenbaues, 3. Auflage, Verlag Eugen Ulmer GmbH & Co., Stuttgart (Hohenheim).

Recommended literature:

1. Bajkin, A. (1994): Mehanizacija u povrtarstvu, Poljoprivredni fakultet u Novom Sadu, Novi Sad.
2. Bajkin, A., Orlović, S., Ponjičan, O., Somer, D. (2005): Mašine u hortikulturi, Poljoprivredni fakultet, Novi Sad.
3. Čuljat, M., Barčić, J. (1997): Poljoprivredni kombajni, Poljoprivredni institut Osijek, Osijek.
4. Jurišić, M., Plaščak, I. (2009): Geoinformacijske tehnologije GIS u poljoprivredi i zaštita okoliša, Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet u Osijeku, Osijek.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.8	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)

Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)

Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60,00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Technical Systems of Transport in Agriculture**	
Module coordinator	Luka Šumanovac	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

The purpose and goal is the optimization of the structure, scope and technological features of transport systems, and measures and procedures in order to increase economic effectiveness of those systems in operation.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Develop a database and optimize the number of transport means for a given production unit.
2. Creating models of planning and management of transport systems.
3. Create an algorithm transportation systems and their optimization.
4. Simulate the operation of transport systems.
5. Choose and apply expert systems in the agricultural transport.

Module content

Analysis of traffic flows and optimization of technical systems, the technical-economic analysis with a ranking of economic indicators of individual solutions. Creating a database model and the planning and management of transportation systems. Application of logistics in the process of optimization and choice of transport strategies. Algorithms transportation systems. A simulation mode of transportation systems and queues. Expert transport systems.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Brkić, D. i sur. (2005): Eksploatacija poljoprivrednih strojeva, Poljoprivredni fakultet u Osijeku, Osijek.
2. Georgijević, M.: (1995): Regalna skladišta, Fakultet tehničkih nauka u Novom Sadu, Novi Sad.
3. Šumanovac, L. (2001): Transport u poljoprivredi, skripta, Poljoprivredni fakultet u Osijeku, Osijek-Vinkovci.
4. Šumanovac, L., Sebastijanović, S., Kiš, D. (2011): Transport u poljoprivredi, Poljoprivredni fakultet u Osijeku, Osijek.

Recommended literature:

1. Eichorn, H. (1999): Landtechnik, 7. Auflage, Verlag Eugen Ulmer GmbH& Co., Stuttgart (Hohenheim).
2. Kutzbach, H. B. (1989): Lehrbuch Agrartechnik, Band 1. Allgemeine Grundlagen Ackerschlepper Fördertechnik, Verlag Paul Parey, Hamburg und Berlin.
3. Wenner, H. L. i sur. (1987): Landtechnik Bauweswn, BLV, Verlagsgesellschaft, München.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.8	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.4	1-5	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Geographic Information Systems in Agriculture**	
Module coordinator	Mladen Jurišić	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	Secound	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L -20, E - 0, S - 20

Module aim

Objective of this module is to acquire knowledge from geionformatizacije and its application in agriculture, especially in precision agriculture and agricultural engineering. The candidate this module should learn how to use GIS technology, remote sensing and GPS in agriculture and agricultural engineering. The candidates will master the use of the latest GIS tools and software, and apply them to concrete problems and tasks - the agro-technical operations (sowing, harvesting, dnojidba, pest management, systematization of the field, etc.) and navigation.

Terms of admission

No preconditions.

Expected learning outcomes

After completing the module, student will be able to:

1. Prepare and present the basic tenets of GIS technology and Global Positioning System (GPS).
2. Handle some of the basic GIS software in agriculture - agricultural engineering; Open source.
3rd Evaluate the application of remote sensing in agriculture and technology (to create folders of nutrients and yield and to evaluate methods of map production in agriculture).
4th Evaluate and recommend a system for precision agriculture in agrotechnical practices and operations.
5. Organise, set up and run systems to navigate in agriculture and applied (D) GPS systems in engineering and transport in agriculture

Module content

Introduction to geoinformation technologies. Definition and concepts. Applications of GIS technologies in the world and Croatia. History and Future of GIS technologies. GIS Software and. Remote sensing (remote sensing) in agriculture (maps nutrients, yield and methodology of the same). Precision agriculture (precision farming). Digital Cartography - satellite imagery (Landsat, Spot, Ikonos) and digital aerial photogrammetry. The process of creating a GIS. A global positioning system (GPS and DGPS). Working with GPS and navigation. The use of Global Positioning System in agriculture and agricultural engineering - navigation. GIS Presentations.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☒ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a 30 minute period using presentation. Schedule of presentations will be arranged in advance. After that, students take oral exams of theoretical basis in scientific research methods of technical systems in agriculture.

Literature

Required reading:

1. Jurišić, M., Plaščak, I. (2009) : Geoinformacijski sustavi, Poljoprivredni fakultet u Osijeku.
2. Jurišić, M. (2013): Geoinformacijski sustavi GIS u poljoprivredi i zaštiti okoliša, PRIRUČNIK, Poljoprivredni fakultet Osijek.
3. www.arkod.hr

Recommended literature:

1. Ludowicy, C., Schwaiberger, R., Leithold, P. (2002): Precision farming – Hanbuch fur die Praxis, Verlag, Frankfurt am Main, Deutschland.
2. Committee on Assesing Crop Yield (1997): Precision agriculture in 21st century, National Academy Press, Washington.
3. Burrough, P. A., McDonnell, R. A. (2006): Principles of Geographical Information Systems – Spatial Information Systems and Geostatistics, Oxford University Press., UK.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-4	Studying literature, assignments	Provjera obavljene aktivnosti kroz usmeni razgovor
Seminar	0.8	1,5	The study of literature, preparation, and presentation of seminars	Pregled i vrednovanje seminarskog rada premaunaprijed utvrđenim kriterijima
Final exam	2.4	1-5	Preparation for the exam by studying recommended literature	Exam (oral)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

The evaluation of teachers and the quality of the above modules via anonymous student surveys.

Module name	**Tribology of Technical Systems in Agriculture**	
Module coordinator	Goran Heffer	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	Secound	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

The acquisition of basic and specific knowledge in the field of tribology, which allow students to systematic scientific approach to the research process and problems of friction and wear, and the application of various measures for protection against wear of components of technical systems in agriculture.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the basic concepts in the field of tribology.
2. Identify the problems of tribological character in technical systems.
3. Understand the relationship of friction and wear of materials.
4. Define the basic wear mechanisms in the wear processes.
5. Differentiate condition of normal and abnormal wear process.
6. Determine the most important factors in the wear processes.
7. Interpret the different tribological measures to protect against wear.
8. Analyze typical wear cases of parts of technical systems in agriculture.
9. Choose the appropriate tribological measures to avoid and reduce wear of agricultural techniques.

Module content

A systematic approach to solving of tribological problems; Concept and elements of the tribological system; The relationship of friction and wear of materials; Basic mechanisms of wear of materials; Normal and abnormal processes of wear; Typical cases of wear parts of technical systems in agriculture; Tribological measures of wear protection; Fundamentals and techniques of lubrication of wear surface.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally for 20 minutes with a PowerPoint presentation. Schedule of presentations will be arranged in advance. After the

lectures, students take the final exam. Students are advised guidance notes during lectures and exam preparation from required and recommended literature.

Literature

Required reading:

1. Ivušić, V. (1998): Tribologija, Hrvatsko društvo za materijale i tribologiju, Zagreb.

Recommended literature:

1. Marušić, V. (2008): Tribologija u teoriji i praksi, Strojarski fakultet Slavonski Brod.
2. Czichos, H. (1978): Tribology – a system approach to the science and technology of friction lubrication and wear, Elsevier, Amsterdam-Oxford-New York.
3. Zum Gahr, K-H. (1987): Microstructure and Wear of Materials, Elsevier.
4. Kragelsky, I. V.; Alisin, V.V. (1981): Friction – Wear – Lubrication, Tribology Handbook, Mir Publishers, Moscow.
5. Selected papers from international journals: Wear, Tribology International, Tribology Transactions, Tribologie und Schmierungstechnik, Journal of Agricultural Engineering Research, etc.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-9	Literature studying	Checking student activities through oral conversation
Seminar	0.80	1-9	Literature studying, seminar preparationand presentation	Review and evaluation of theseminar work according to pre-established criteria
Final exam	2.40	1-9	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Alternative Energy Resources in Agriculture**	
Module coordinator	Davor Kralik	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Objective of this module is to gain knowledge of certain principles of creating alternative sources, primarily renewable energy sources (such as energy from biomass, biogas, biodiesel, solar energy, wind energy, geoterminalna energy, chemical energy-fuel cells) plants and features of plants for the production of alternative energy sources, the manner of their exploitation in agricultural production, the impact on the environment and the possibility of savings or economic gain.

Terms of admission

No terms.

Expected learning outcomes

After completing the module, student will be able to:

1. The organization and design of renewable energy sources.
2. To assess and evaluate the contribution of individual RES technologies on the environment.
3. Identify and choose the most favorable technical and technological solutions for the production of renewable energy.
4. Organization of production of raw material for biogas plants, the production of biodiesel and bioethanol.

Module content

The properties of biogas, the process of anaerobic fermentation of biomass for biogas production,biogas plants, Bioelektro-heating device (BEHD), mandatory security measures, biodiesel properties, biodiesel production, EU standards for the use of biodiesel, utilization of crop residues and forestry industry residues for energy production.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students makes a seminar that is obligatory. Students presents seminar orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. For laboratory work students need standard protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from mandatory literature.

Literature

Required reading:

1. Kralik, G., Kušec, G., Kralik, D., Margeta, V. (2007): Svinjogojstvo - biološki i zootehnički principi. Poljoprivredni fakultet u Osijeku, Osijek.
2. Baličević, I., Madžarević, P., Majstorović, V., Majger, V. (2001): Agrar energija i ekologija, 73-77.
2. Burton, C. H., Turner C. (2003): Manure Management; Silsoes Research Institute, Bedford UK.
3. Graf, W. (1994): Biogas- Historisches, Biogas für Österreich, Gefördert vom Bundesministerium für Umwelt, Jungend und Familie.
4. Đulbić, M. (1986): Biogas, dobijanje, korištenje i gradnja uređaja, Beograd.
5. WienHorst Eichhorn (1985): Landtechnik, Stuttgart.

Recommended literature:

Jurnals: Journal of Agricultural Engineering Research; Animal Science, Živočišna Vyroba; Zemedelska technika,
Agricultural Engineering

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and excercises	0.8	1-5	Study of literature, developmnt of tasks	Evaluation the activities carriedout through oral conversation, submisson and review of assignments
Seminar	0.8	1-5	Study of literature, development and presentation of seminar	Review and evaluation of the seminar work according to pre-established criteria
Final exam	2.4	1-5	Prepeartion for exam trough study of required and recomended literature	Exam (oral or in writting)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

The evaluation of teaching quality using anonymous student surveys.

Module name	**Technical Systems in Milk Production**	
Module coordinator	Davor Kralik	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S -20

Module aim

This module study is to acquire knowledge and promotion of the milking process as well as achieve higher degree of milk hygiene and quality. Possibilities of savings or economic profit.

Terms of admission

No terms.

Expected learning outcomes

After completing the module, student will be able to:

1. Organize milking.
2. Design of milking projects.
3. Assess and evaluate the contribution of a technology in the process of milking.
4. Identify and choose the most favorable technical and technological solutions for the production and storage of milk.
5. Find errors or irregularities in milking.

Module content

Elementary concepts of milk production process pointing out the latest achievements in the scope of milking and milking devices. Units comprised are as follows: physiological and anatomic requirements ,milking devices; milking technical-technological requirements due to milk hygiene and quality; errors and irregularities while milking ; classification and description of milking system, technical characteristics of milking devices segments, technical description and operation principles ; milking process automation; milking robots application; milking process and flow; milk taking , cooling and transport ; milking devices maintenance.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars and practice using recommended literature. Students makes a seminar that is obligatory. Students presents seminar orally for about 20 minutes with a PowerPoint presentation. Schedule of presentation will be arranged in advance. For laboratory work students need standard protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from mandatory literature.

Literature

Required reading:

1. Jungbluth T., Büscher W., Krause M. (2005): Technik Tiethaltung, Hohenheim.
2. Eichhorn, H. (1985): Landtechnik, Stuttgart.
3. Lobetka, J. (1980): Tehnika a mechanizácia živočišnej výroby.
4. Hall et al. (1977) Machine Milking.
5. Domaćinović, M., Antunović, Z., Mijić, P., Šperanda, M., Kralik, D., Đidara, M., Zmaić, K. (2010): Proizvodnja mlijeka. Poljoprivredni fakultet u Osijeku.

Recommended literature:

Jurnals: Journal of Agricultural Engineering Research; Animal Science, Živočišna Vyroba; Zemedelska technika, Agricultural Engineering

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and excercises	0.8	1-5	Study of literature, developmnt of tasks	Evaluation the activities carried out through oral conversation, submisson and review of assignments
Seminar	0.8	1-5	Study of literature, development and presentation of seminar	Review and evaluation of theseminar work according to pre-established criteria
Final exam	2.4	1-5	Prepeartion for exam trough study of required and recomended literature	Exam (oral or in writting)
Total	4			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Final exam =2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

The evaluation of teaching quality using anonymous student surveys.

Module name	**Design and Development of Agricultural Machines and Equipment**	
Module coordinator	Goran Heffer	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Introduction to the scientific method in the process of mechanical engineering design of machines and acquisition of knowledge about constructional features agricultural machines.

Terms of admission

Elements of Agricultural Machines.

Expected learning outcomes

After completing the module, student will be able to:

1. Create the target function of the product, based on an requirement and information about device - system.
2. Develop the target function of the product with the partial functions of the implementing components.
3. Generate and evaluate possible alternative solutions of the constructions.
4. Synthesize functional structure of the new versions of the device.
5. Optimise the design parameters and product properties.

Module content

Definining the Design Problems. Technical Product as a System. Decomposition of Mechanical System. The Value of Construction Information. Methods for generating general solutions. Goals and Design Decisions. A list of requires to the new construction. Background for Developing a Design Project. Data processing of construction. Variable Construction. Intuitive and Discursive Mental Processes. A Technique for Designing with Function. Working with functional structures. Multidisciplinary aspects of product development and innovation. Principles of creativity. Methods and approaches to innovation. Modeling, Analysing and Design Optimization. Generating and Evaluating Design Alternatives.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students independently work on a seminar assignment - project in the form of structural solution of the selected task, which is mandatory. The seminar is based on creating solutions by applying the principles and methods of the science of design. Students are required to prepare for making the seminar and for the written exam by studying the appropriate literature. The task for the

seminar is selected in accordance with the interests of the student. Students present the seminar orally during semester in about 20 min long presentation. Final examination is carried out at the written examination. Students are advised to prepare for exams from the mandatory literature.

Literature

Required reading:

1. Oberšmit, E. (1985): Osnove konstruiranja: Tehnološki ispravno konstruktivno oblikovanje strojnih dijelova. Sveučilišna naklada Liber, Zagreb.
2. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.H. (2007): Engineering Design: A Systematic Approach. Springer Verlag, London.

Recommendedg literature:

1. Budynas, R. G., Nisbett, J. K., (2011): Shigley's Mechanical Engineering Design. Mc Graw Hill, New York.
2. Clive L. Dym, Little, P. (2009): Engineering Design: A Project-Based Introduction. John Wiley & Sons, New York.
3. Ullman, D. G. (2003): The Mechanical Design Process. Mc Graw Hill, New York.
4. Otto, K., Wood, K. (2000): Product design: Techniques in Reverse Engineering and New Product Development. Prentice Hall.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.8	1-5	Literature studying	Checking student activity orally (conversation) on final exam
Seminar	0.8	1-5	Literature studying, seminarpreparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.4	1-5	Preparing for exam by studying required and recommended literature	Exam written
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
Lectures = 0.8 ECTS credits (20 teaching hours / 25 workload hours = 0.8 ECTS)
Seminar paper = 0.80 ECTS (20 working hours on seminar / 25 workload hours = 0.8 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation / 25 hworkload hours = 2.4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Systems of Artificial Drying and Preservation of Agricultural Products**	
Module coordinator	Darko Kiš	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

To introduce doctoral candidates with technical systems of artificial drying and preservation of agricultural products in order to achieve optimum in the course of drying and preservation of agricultural products.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
1. Identify and differentiate artificial drying systems of agricultural products.
2. Monitor the state of moist air during drying in the Mollier's diagram and calculate the energy necessary to evaporate one kilogram of water.
3. Identify and differentiate agricultural products conservation systems.
4. To recommend means of preservation (conservation) of agricultural products.

Module content

Technical systems of artificial drying, Mollier's – ix diagram and technical systems of preservation of agricultural products.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Katić, Z. (1997): Sušenje i sušare u poljoprivredi, Multigraf, Zagreb.
2. Brkić, M. (2002): Dorada sjemena. Akademska štampa, Beograd.
3. Kljusurić, S. (2000): Uvod u tehnologiju mljevenja pšenice. Prehrambeno tehnološki fakultet Osijek.

4. Dobričević, N. (1998.): Sušenje voća, povrća i začinskog bilja. Gospodarski list, Zagreb.
5. Lovrić, T., Piližota, V. (1994.): Konzerviranje i prerada voća i povrća. Nakladni zavod Globus, ZagrebMltet u Osijeku.
6. Babić, Lj., Babić, M. (2012): Sušenje i skladištenje, Poljoprivredni fakultet u Novom Sadu, Novi Sad.

Recommended literature:

1. Drying technology – yearbook
2. Storage technology – yearbook

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.8	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.8	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Quality of Agricultural Products and Drying Media**	
Module coordinator	Darko Kiš	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

To introduce PhD students with the working media of the technical system of artificial drying. To determine the influence of the drying media on product quality, energy consumption and environmental protection during the drying of agricultural products.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify and differentiate the working media in the system of artificial drying of agricultural products.
2. Describe the drying media effect on the quality of agricultural products.
3. Categorize drying media's influence on the environment.
4. To recommend the application of drying media considering the product quality, energy consumption and environmental impact during drying.

Module content

Influence of working drying medium on product quality, energy consumption with regard to the drying medium and environment protection.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Katić, Z. (1997): Sušenje i sušare u poljoprivredi, Multigraf, Zagreb.
2. Dobričević, N. (1998.): Sušenje voća, povrća i začinskog bilja. Gospodarski list , Zagreb.
3. Lovrić, T., Piližota, V. (1994.): Konzerviranje i prerada voća i povrća. Nakladni zavod Globus, Zagreb.
4. Babić, Lj., Babić, M. (2012): Sušenje i skladištenje, Poljoprivredni fakultet u Novom Sadu, Novi Sad.

Recommended literature:

1. Drying technology-yearbook.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.8	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.8	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.4	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.0			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

4 ECTS credits = 100 hours of module loads

20 teaching hours (lecture) = 0.80 ECTS (20 teaching hours/100 hours of total load x 100 = 20% from total of 4 ECTS)

Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x 100 = 20% from total of 4 ECTS)

Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Robots and Manipulators in Agriculture**	
Module coordinator	Tomislav Šarić	
Study programme	Postgraduate univerity study of Agricultural Sciences, major Technical Systems in Agriculture	
Module status	Elective module	
Year of studies	Third	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Objective of this module is to introduce doctoral students with advanced robotics, its development and applications in agriculture. Students should acquire the knowledge of specific areas of robotics with a deep understanding of the robot components functions, especially its structure, kinematics, dynamics and programming and also simulations of robot operations. Special attention is given to the application of robots and robotic systems in agricultural production.

Terms of admission

There are no prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. To rewiev and chose optimal robots for specific needs of agricultural production.
2. To assess the advantages and disadvantages for specific applications in agriculture and maximize the benefits and minimize the deficiencies.
3. To review and evaluate the structure of end effector for each specific application.
4. To judge and assess the necessary sensors for each specific application.
5. To predict and evaluate the program and programming of the robot to the level of industrial applications.

Module content

Introduction to Robotics. Terminology, generations, definitions, standards and laws of robotics. The principle of robot operation. Structure and types of robots. The use of robots in agriculture; storage, transportation, harvest, milking and etc. Robot kinematics and dynamics. Sensors. Artificial Intelligence. Economic Analysis. Robot programming. Robotic simulation.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students are obliged to prepare for seminars by studying recommended literature. Student crate seminar work individually with professional assistance of module coordinator.Seminar paper involves the study of existing and possible solutions for the application of robots in agricultural production. The exam is taken orally after successfully defended seminar paper.

Literature

Required reading:

1. Šurina, T., Crneković, M. (1990): Industrijski roboti, Školska knjiga, Zagreb.
2. Kovačić, Z. i dr. (2002): Osnove robotike, Graphis Zagreb.
3. Craig, J.J. (1986): Introduction to Robotics , Mechanics & Control, Addison-Wesley.
4. Vujčić, M. i dr. (1987): Robotika i njena primjena u poljoprivredi, Zbornik radova XI. savjetovanja mehanizatora Slavonije i Baranje, Vinkovci.

Recommended literature:

1. Paul, R.P. (1982): Robot Manipulators: Mathematics, Programming and Control, The MIT Press, Cambridge, England.
2. Haug, E.J. (1989): Computer Aided Kinematics and Dynamics of Mechanical Systems, Allyn and Bacon.
3. Stadler, W. (1995): Analytical Robotics and Mechatronics, McGraw-Hill.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lecture	0.8	1-5	The study of literature,and preparations for the seminar. Attending classes and consultations	The records. Verification activities performed through an oral interview
Seminar	0.8	1-5	Individual work and defense of seminars	Assessment according to predefined criteria
Oral examination	2.4	1-5	Revision of learned module content	Oral examination
Total	4			

The way of calculating ECTS credits for certain activities:

The module has 4 ECTS points
1ECTS point = 25 hours of workload (hours of student work)
4 ECTS points = 100 hours of load modules
20 teaching hours (lectures) = 0.8 ECTS (20 teaching hours / 100 hours total load x 100 = 20.0% of the total of 4 ECTS)
Seminar = 0.8 ECTS (20 hours / 100 hours total load x 100 = 20.0% of the total of 4 ECTS)
Oral examination = 2.4 ECTS (30 hours of preparation / 100 hours of total work hours x 100 = 60.0% of the total of 4 ECTS)

Module quality assessment

Anticipated evaluation by students, teachers and experts in the field of study, and if necessary, international supervision.

After completing the major Technical Systems in Agriculture, student will be able to:

Learning Outcome 1	Explain the most important principles of modern technical systems in crop and livestock production
Learning Outcome 2	Assess the impact of technical systems on the environment
Learning Outcome 3	Select the qualitative and quantitative methods for determining the operation and maintenance of technical systems in agriculture
Learning Outcome 4	Prepare and implement models of rational use of technical systems in agriculture
Learning Outcome 5	Manage the modern technical systems on the principles of precision farming
Learning Outcome 6	Analyse and suggest ways to increase the reliability of technical systems in operation
Learning Outcome 7	Identify and choose the most adequate technical solutions in automation procedures
Learning Outcome 8	To review and chose optimal robots for specific needs of agricultural production

PLANT PROTECTION

2.8. Modules of major Plant Protection:

Compulsory modules:

	Module name	teaching hours	ECTS credits
1.	Principles of Scientific Work in Plant Protection	60	6
2.	Ecology in Plant Protection	60	6

Elective modules:

	Module name	teaching hours	ECTS credits
	Group ZOOLOGY		
1.	Insect Morphology and Physiology	20	2
2.	Insect Systematic	20	2
3.	Pests of Field Crops	40	4
4.	Pests of Vegetables	40	4
5.	Pests of Fruit Trees and Grape Vines	40	4
6.	Pests in Storages	30	3
7.	Control Methods of Stored Pests	20	2
8.	Plant Resistance to Pests	20	2
9.	Urban Entomology	20	2
10.	Quarantine Pests	10	1
11.	Acarology	20	2
12.	Nematology	40	4
13.	Nematode Ecology	20	2
14.	Zoocides	40	4
	Group PHYTOPATHOLOGY		
1.	Laboratory Methods in Mycology	20	2
2.	Quarantine Diseases	10	1
3.	Seed Diseases	20	2
4.	Vegetable Protection	40	4
5.	Diseases of Arable Crops	40	4
6.	Toxicogenic Fungi and Micotoxins	20	2
7.	Diseases of Tree Fruits and Grapevine	40	4
8.	Soil Microbiology	40	4

	Group HERBOLOGY		
1.	Herbology	40	4
2.	Special Herbology	40	40
3.	Weed Control in Arable Crops	40	4
4.	Herbicides (New Cognition)	20	2
5.	Interaction Herbicide – Soil – Plant	10	1
6.	Pesticides Application and Legislative	20	2
7.	GMO in Plant Protection	20	2
8.	Orchard and Vineyard Protection Against Weeds	40	4
9.	Weed Management in Vegetable Crops	40	4
10.	Allergenic Plants: Monitoring and Control	20	2
11.	Weed Communities in Agricultural Crops	20	2
	Out of groups		
1.	Plant Protection in Organic Agriculture	40	4
2.	Toxycology and Ecotoxycology	20	2

2.8.1. Learning outcomes of major Plant Protection

Module name	**Principles of Scientific Work in Plant Protection**	
Module coordinator	Dražen Horvat	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Obligatory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 20, E – 20, S - 20

Module aim

To introduce students of doctoral study with the experimental methodology and scientific analysis of data, modes of presentation and publication of research results, at the same time using the most modern ICT technologies and statistical computer programs.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Plan and organise the test method. Recognise possible experimental issues.
2. Set up a scientific hypothesis and use the scientific methodology.
3. Make the proper selection assay methods (design of experiment) and choose the appropriate statistical tests for the data analysis.
4. Come to know with the technique of data processing using statistical computer programs (SAS, Statistica).
5. Interpret the result of statistical analysis and bring correct scientific conclusions.
6. Issue the research report on scientific and professional meetings or they prepare for the announcement in scientifically-specialist magazine or other publication.
7. Be introduced to fundamentals of scientific literacy, rhetoric and scientific culture.

Module content

Definition and general science division. Phase of the scientific work. Heuristic: choice of subject of scientific observation, goal and the subject of observation, forming the scientific hypothesis. Collection and the taking notes of test data (digital form). Edit statistical series and preparing data for the statistical analysis. Preliminary results of the experiment (ad hoc). Scientifically based data processing: recognition and the explanation of result of statistical research and analysis, graphical display. Correct spelling of the scientific, professional, seminar papers, dissertations and publications and their publication. Production of poster and other makes the presentation work in seminars, conferences and congresses. Basics of rhetoric and scientific culture. Doctorates will recommend (offer services) subjects for the production of seminar papers as well as thematically are selected scientifically-technical publications, regarding guidelines and help by the typing of the course work, and towards the scientific interest of attendant.

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students are required attend lectures (consultation) and on them actively participate. Desirable is the advance preparation for the discussion in sight general and targeted subject in the domain of plant protections. Obligatory is the production of the course work, with the theme which can propose and am the doctorate, and related is with his current or future research. Doctorates are obligatory appear written exam part tests and after his successful realizations and the oral exam. Assessment determines on the basis of cumulative activity or average performance at all examiners on the module.

Literature

Required reading:

1. Baban, Lj. i dr. (2000.): Primjena metodologije znanstvenog istraživanja. Sveučilište J. J. Strossmayera u Osijeku, Ekonomski fakultet u Osijeku.
2. Gribbing, J. (2001.): Vodič kroz znanost. Biblioteka Luč, Zagreb.
3. Horvat, D., Ivezić, M. (2005.): Biometrika u poljoprivredi. Poljoprivredni fakultet u Osijeku.
4. Ozretić, Đ., Pološki, N. (2003.): Upute za pisanje seminarskoga i diplomskoga rada. Ekonomski fakultet, Zagreb.
5. Šošić, I., Serdar, V. (1992.): Uvod u statistiku. Školska knjiga, Zagreb.

Recommended literature:

1. Negroponte, N. (2002.): Biti digitalan. SYSPRINT, Zagreb.
2. Pavić, H. (1980.): Znanstvene informacije. Školska knjiga, Zagreb.
3. Silobrčić, V. (1989.): Znanstveno djelo. Jumena, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.60	1-7	Prepares for the lecture, studing, communication with the teacher through the previously preparedand developed issues	Checking performedactivities through the oral conversation and the submission and the examination independently made tasks
Seminar	0.80	1-7	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria

Final exam	3.60	1-7	Preparation for the exam by studying mandatory and recommended literature, self-knowledge through WEB portals, solvingtasks offered (the statistical data analysis).	Written exam and the oral exam.
Total	6.00			

The way of calculating ECTS credits for certain activities:

Module carries 6 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
6 ECTS credits = 150 hours of module loads
40 teaching hours (lectures + exercises) = 1.60 ECTS (40 teaching hours/150 hours of total load x100 = 26.67% from total of 6 ECTS)
Seminar paper = 0.80 ECTS (20 hours/150 hours of total load x100 = 13.33% from total of 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Ecology in Plant Protection**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	First	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 20, E -10, S -30

Module aim

The students would acquire knowledge on impact of ecological factors on pests.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Predict the impact of environmental factors on the development of pests.
2. Make a forecast occurrence of pests.
3. To identify natural enemies of insects as vectors and plant diseases.
4. Identify fungi and bacteria used in biological control.
5. Explain the concepts of pesticide residues in the environment and food, waiting period, tolerance.
6. Critically assess the toxicity of pesticides to humans, animals and the environment.

Module content

Impact of ecological factors on pest development, forecast service, insects as vectors of plant diseases, natural enemies, succession of ecosystem. To elaborate the most important fungi and bacteria used as biological control (superparasites and competitors) through lectures and seminars. Toxicity of pesticides for humans, animals and environment (toxic groups, the mode of effect of pesticides); factors of pesticide degradation, residues in environment and food, waiting period, standards, pressure on environment.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Gullan, P. J. & Cranson, P. S. (1994): The Insects, An Outline od Entomology. Chapman & Hall.
2. Odum P. E. (1959): Fundamentals of ecology. W.B. Saunders Company, USA.
3. Znaor, D. (1996): Ekološka poljopriveda. Nakladni zavod Globus.
4. Ivezić, M. (2008.): Entomologija – Kukci i ostali štetnici u ratarstvu. Grafika d.o.o.
5. Huffaker, B. C., Gutierrez, P. A. (1999): Ecological Entomology. USA
6. Baker, K. F., Cook, R. J. (1974.): Biological Control of Plant Pathogens. Ed. Kelman, A., Sequeira, L. USA.
7. Ciglar, I. (1998.): Integrirana zaštita voćnjaka i vinograda. Zrinski d.d., Čakovec
8. BCPC: Pesticide Manual; http://extoxnet.orst.edu/

Recommended literature:

1. Journals (Plant Disease, Phytopathology, Plant Pathology Nematology, Journal of Entomology etc.)

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.20	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work andassignments
Seminar	1.20	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	3.60	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	6.00			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)
6 ECTS credits = 150 hours of module loads
30 teaching hours (lectures + exercises) = 1.20 ECTS (30 teaching hours/150 hours of total load x100 = 20.00% from total of 6 ECTS)
Seminar paper = 1.20 ECTS (30 hours/150 hours of total load x100 = 20.00% from total of 6 ECTS)
Final exam = 3.60 ECTS (90 hours of preparation/150 hours of total load x 100 = 60.00% from total of 6 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Insect Morphology and Physiology**	
Module coordinator	Ivana Majić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 5, E - 10, S - 5

Module aim

Students will gain knowledge of the insect morphological and physiological characteristics which are important for insect taxonomy, and will learn to use keys to identify insects.

Terms of admission

No specific prerequisite.

Expected learning outcomes

After completing the module, student will be able to:

1. Explain the importance of morphological and physiological characteristics of insects.
2. Describe the structure of insects and function.
3. Classify economically important insects in agricultural production.
4. Identify insects according to their morphological characteristics.
5. Explain the importance of insects.

Module content

Integrate knowledge of insect morphology and physiology in order to develop a context for understanding insect biology and evolutionary relationships. Review of the latest research in the insect morphology and physiology as well as molecular biology of insects, and methods of identification.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students should be prepared and be able to actively participate and discuss topics related to Acarology, which involves reading reccommeded literature. Student creates individualy seminar paper, and present it orally in a twenty-minute period using PowerPoint presentation. Lab coat is required for the purpose of laboratory work. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Oštrec, Ljerka; Gotlin Čuljak, Tanja (2005.): Opća entomologija. Čakovec, Zrinski.
2. Nation, J. L. (2002): Insect Physiology and Biochemistry, CRC Press.
3. Chapman, R. F. (1998). The Insects: Structure and Function. 4th Ed. Cambridge University Press.

4. Gullan, P. J. & Cranston, P. S. (2005). The Insects – an outline of Entomology. 3 ed. Blackwell Publishing.

Recommended literature:

1. Angelini, D. R. and T. C. Kaufman (2005.): Comparative developmental genetics and the evolution of arthropod body plans. Annual Review of Genetics 39: 95-119.
2. Akam, M. (2000.): Arthropods: developmental diversity within a (super) phylum. Proceedings of the National Academy of Sciences of the USA 97: 4438-4441.
3. Caterino, M. S., S. Cho and F. A. H. Sperling. 2000. The current state of insect molecular systematics: a thriving Tower of Babel. Annual. Review of Entomology 45: 1-54.
4. Fahrbach, S. E. (2004.): What arthropod brains say about arthropod phylogeny. Proceedings of the National Academy of Sciences of the USA 101: 3723-3724.
5. Kukalova-Peck, J. (1997.) Arthropod phylogeny and "basal" morphological structures. Chapter 19, pp. 249-268 in: Fortey, R. A. and R. H. Thomas, eds., Arthropod Relationships. Systematics Association Special Volume 55, Chapman and Hall, London.
6. Peel, A. (2004.): The evolution of arthropod segmentation mechanisms. BioEssays 26: 1108-1116.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.60	1-5	Literature studying, assignment work	Checking student activity through discussions, reviewing student'swork and assignments
Seminar	0.20	1-5	Literature studying, seminar preparation and presentation	Seminar examination andevaluation according to the pre-established criteria
Lab work	0.40	1-5	Literature studying, work in Lab	Evaluation according to thepre-established criteria
Final exam	0.80	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads

Teaching lessons (lectures + exercises) = 0.60 ECTS (15 teaching hours/50 hours of total load x100 = 30.00% from total of 2 ECTS)
Seminar paper = 0.20 ECTS (5 hours/50 hours of total load x100 = 10.00% from total of 2 ECTS)
Lab work = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Final exam = 0.80 ECTS (20hours /50 hours of total load x 100 = 40.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Insect Systematic**	
Module coordinator	Ivana Majić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 5, E -5, S - 10

Module aim

Insect taxonomy, biology and classification to the order; important families of insects in agriculture.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Indicate and describe systematic units.
2. Describe the characteristics of individual orders of insects important to agriculture.
3. Describe the types of insects to species level.
4. Collect insects and create a collection of insects.

Module content

Systematic units, characteristics of insect orders important in agriculture. Insect preparation and creation of insect collections.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Gullan, P. J. & Cranson, P. S. (1994): The Insects, An Outline od Entomology. Chapman & Hall.
2. Keys for insect identification.

Recommended literature:

1. Journals (Plant Disease, Phytopathology, Plant Pathology Nematology, Journal of Entomology etc.).
2. Journals and scientific papers on insect systematics.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.40	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.40	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.2	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Modul ima 2 ECTS boda

1 ECTS credit = 25 workload hours (student's working hours)

2 ECTS credits = 50 hours of module loads

10 teaching hours (lectures + exercises) = 0,.40 ECTS (10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)

Seminar paper = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)

Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Pests of Field Crops**	
Module coordinator	Ivana Majić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E -15, S - 15

Module aim

Pests of field crops, introduced insects in our country which may cause economic damages, as well as methods of detection.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Show most important insect pest in field crops during the growing season.
2. Use of GIS technology.
3. Assess the risk of plant protection with the help of GIS technology.
4. Analyze the threat of the population of harmful insects.

Module content

The most important pests during the vegetation. To introduce students to possibilities of evaluation and analyses of damages on arable crops caused by insects. The importance of information system (GIS) in detecting insect population density. Determination of economic important pests of field crops according to the keys of determination.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Maceljski, M., (2002): Poljoprivredna entomologija, Zrinski, Čakovec, 2002.
2. Gullan, P.J., Cranston, P.S. (1994): The Insects, an Outline of Entomology. Chapman & Hall.
3. Ivezić, M. (2008): Entomologija – kukci i ostali štetnici u ratarstvu. Grafika d.o.o.

4. Dent, D. (1993): Insect pest management. CAB International. Redwood books, UK.
5. Huffaker, B. C., Gutierrez, P. A. (1999): Ecological entomology, USA.
6. The keys for insect identification.

Recommended literature:

1. Manuals of forecasting services for crop protection.
2. Scientific papers.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.00	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.60	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.40	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
25 teaching hours (lectures + exercises) = 1.00 ECTS (25 teaching hours/100 hours of total load x100 = 25.00% from total of 4 ECTS)
Seminar paper = 0.60 ECTS (15 hours/100 hours of total load x100 = 15.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 =60.00% from total of 4 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Pests of Vegetables**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E -15, S - 15

Module aim

The knowledge about pests of vegetables.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Show most important pest insects in vegetable growing.
2. Describe the symptoms of infestation by insect pests in vegetable growing.
3. Develop a plan to protect vegetable crops.
4. To assess the importance of biological control to protect vegetables.
5. Create a collection of insects.

Module content

Coleoptera, Lepidoptera, Hymenoptera, Thysanoptera, Homoptera, Diptera, Heteroptera, entomophagous species of vegetable pests. Problems in protection of vegetables. Students will actualize the most common problems caused by pests in vegetable growing, and will discuss about possible solutions.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Maceljski i sur. (2004.): Štetočinje povrća. Zrinski, Čakovec.
2. Pollini, A. (1989): La difesa delle piante da Orto. Edizioni Agricole.
3. Ivezić, M. (2008): Entomologija – kukci i ostali štetnici u ratarstvu. Grafika d.o.o.

4. Dent, D. (1993): Insect pest management. CAB International. Redwood books, UK.
5. The keys for insect identification.

Recommended literature:

1. Journals and scientific papers relevant to pests of vegetables

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.00	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.60	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.40	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
25 teaching hours (lectures + exercises) = 1.00 ECTS (25 teaching hours/100 hours of total load x100 = 25.00% from total of 4 ECTS)
Seminar paper = 0.60 ECTS (15 hours/100 hours of total load x100 = 15.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Pests of Fruit Trees and Grape Vines**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E - 15, S - 15

Module aim
The knowledge about pests important for fruit trees and vineyards.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Show the most important pest insects in orchards and vineyards.
2. Describe the symptoms of an attack of harmful insect plantations.
3. Develop a plan of care per individual fruit species.
4. Develop a plan for the protection of the vineyard.
5. To assess the importance of biological control in the protection of fruit trees and vines.

Module content
Economicaly important pests of apple, pear, plum, sweet cherry, cherry, peach, apricot, strawberry, nuts, hazel-nut, raspberry, currant, goosberry, grape vine etc. Methods of collecting insects, determination of pests through practical work. Plant protection in orchards and vineyards. Biological protection.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Ciglar, I. (1998.): Integrirana zaštita voćnjaka i vinograda. Zrinski, d.d. Čakovec.
2. Ivezić, M. (2003.): Štetnici vinove loze i voćaka. Grafika, Osijek.
3. Maceljski, M., Cvjetković, B., Ostojić, Z., Barić, B. (2006.): Štetočinje vinove loze. Zrinski d.d. Čakovec.

Recommended literature:

1. Journals and scientific papers.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	1.00	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.60	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.40	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
25 teaching hours (lectures + exercises) = 1.00 ECTS (25 teaching hours/100 hours of total load x100 = 25% from total of 4 ECTS)
Seminar paper = 0.60 ECTS (15 hours/100 hours of total load x100 = 15% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/ 100 hours of total load x 100 = 60% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Pests in Storages**	
Module coordinator	Vlatka Rozman	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	3
	Lecture hours (L+E+S)	L - 10, E - 10, S - 10

Module aim
Biology and ecology of the most important pests in storage.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Synthesize and evaluate the significance of the damage caused by the presence of stored product pests.
2. Assess and evaluate the presence of species and populations of stored product pests in our country and the world.
3. Rank and compare indicators of the possible occurrence of resistant populations of stored product pests.
4. Identify and choose the newer methods and procedures of the laboratory growing of stored product pests.
5. Evaluate the methods of detection of storage pests.
6. Recommend the most acceptable method of monitoring stored product pests in practice.

Module content
Biology, ecology and damage from storage insects (primary, secondary, mycophagous, incidental species), hidden infection product by stored insects, the most important species of mites, rodents and birds. Determination of pests in storage. Culture methods of storage pests in the laboratory. The development of resistance in storage pests.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required and recommended literature list.

Literature

Required reading:

1. Korunić, Z, (1990): Štetnici uskladištenih poljoprivrednih proizvoda, biologija, ekologija i suzbijanje. Gospodarski list. Zagreb.
2. Rees, D. (2004): Insects of stored products. CSIRO Publishing. Australia.
3. Sauer, D. B. (1992): Storage of cereal grains and their products. American Ass.of Cereal Chemists, Inc., St.Paul, Minnsota, USA.
4. Subramanyam, B., Hagstrum, D. H. (1996): Integrated management of insects in stored products. Marcel Dekker, Inc., New York, USA.

Recommended literature:

1. Proceedings of DDD and ZUPP Seminars (2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015) Korunić d.o.o. Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-6	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.40	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.80	1-6	Preparing for exam by studying required and recommended literature	Exam (written)
Total	3.00			

The way of calculating ECTS credits for certain activities:

Module carries 3 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
3 ECTS credits = 75 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/75 hours of total load x100 = 26.67% from total of 3 ECTS)
Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x100 = 13.33% from total of 3 ECTS)
Final exam = 1.80 ECTS (45 hours of preparation/75 hours of total load x 100 = 60.00% from total of 3 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Control Methods of Stored Pests**	
Module coordinator	Vlatka Rozman	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 5, S - 5

Module aim
The complete knowledge of the means and control methods of stored pests.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Synthesize, apply methods of controlling storage pests.
2. Assess and evaluate the most acceptable methods suppression choice for certain species of stored product pests.
3. Rank and compare indicators of the possible occurrence of resistance to insecticides, fumigants and rodenticides.
4. Establish and choose the latest methods and procedures in the storage pest control.
5. Evaluate the ecological and conventional approach in the stored products protection.
6. Recommend the most acceptable methods of controlling storage pests.

Module content
Control methods of stored product pests (insects, mites, rodents, birds) most modern methods (preventive, curative, integrated protection measures), monitoring of pests in storage. Resistance of pests to insecticides, fumigants and rodenticides.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☒ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required and recommended literature list.

Literature

Required reading:

1. Proceedings of DDD and ZUPP Seminars (2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015) Korunić d.o.o. Zagreb.
2. Novine u DDD i ZUPP djelatnosti - Insekticidi, fumiganti i rodenticidi u prometu u republici Hrvatskoj, 15. izdanje (2014), ISSN 1846-209, Korunić d.o.o. Zagreb.
3. Subramanyam, B., Hagstrum, D. H. (1996): Integrated management of insects in stored products. Marcel Dekker, Inc., New York, USA.
4. Korunić, Z, (1990): Štetnici uskladištenih poljoprivrednih proizvoda, biologija, ekologija i suzbijanje. Gospodarski list. Zagreb.

Recommended literature:

1. Zbornici predavanja DDD Trajna edukacija za izvoditelje obvezatnih mjera dezinfekcije, dezinsekcije i deratizacije i osobe u nadzoru, Korunić d.o.o. Zagreb.
2. Rees, D. (2004): Insects of stored products. CSIRO Publishing. Australia.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.60	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.40	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.00	1-6	Preparing for exam by studying required and recommended literature	Exam (written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
15 teaching hours (lectures + exercises) = 0.60 ECTS (15 teaching hours/50 hours of total load x100 = 30.00% from total of 2 ECTS)
Seminar paper = 0.40 ECTS (10 hours of preparation/50 hours of total load x100 =20.00% from total of 2 ECTS)
Final exam = 1.00 ECTS (25 hours of preparation/50 hours of total load x 100 = 50.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Plant Resistance to Pests**	
Module coordinator	Ivana Majić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E -5, S - 5

Module aim
Importance of plants tolerant and resistant to pests.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Describe methods of breeding cultivars to pests.
2. Explain the importance of creating resistant cultivars.
3. Discuss the basics of genetic engineering.
4. List the benefits and risks of GMO plants.

Module content
Traditional breeding methods in developing resistant cultivars to pests, biotechnology and development of resistant plants, basis of genetic engineering, advantages and risks of GMO usage.Seminar paper about accomplishments in production of GM cultivars regarding pests.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Pedigo, L.P. (2002): Entomology & Pest Management. Prentice Hall. New Jersey. p.742.

Recommended literature:

1. Scientific papers on GM plants.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.60	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.20	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.20	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
15 teaching hours (lectures + exercises) = 0.60 ECTS (15 teaching hours/50 hours of total load x100 = 30.00% from total of 2 ECTS)
Seminar paper = 0.20 ECTS (5 hours/50 hours of total load x100 = 10.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/100 hours of total load x 100 =60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Urban Entomology**	
Module coordinator	Enrih Merdić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10 , E -5, S - 5

Module aim
To introduce students to insects specific for urban areas, their adversity and control measures.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Indicate and identify urban pests.
2. Explain the life cycle of mosquitoes, ants, flies and cockroaches.
3. Choose method of biological control of urban pests.
4. Make a plan for the control of urban pests.

Module content
Elaboration on mosquitoes (Culicidae), through different biological aspects: life cycle, roost selection, species present in Croatia and worldwide, antropophilic species, vector role, biological control methods. Ants (Formicidae): life cycle, species in urban areas, special adaptation for life in city, biological control methods. Cockroach (Blattidae): life cycle, roost characteristics, abundance, tolerance, control. Flies (Muscidae): life cycle, abundance, special flying abilities, control. Morphologic and anatomic characteristics of aforementioned families.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Clements, A. N., 1996: The biology of mosquitoes. Development, nutrition and reproduction. Chapman & Hall. London, New York, Tokio.
2. Ebeling, W., 1975: Urban entomology, University of California.

3. Elzinga, R. J., 2000: Fundamentals of Entomology. Prentice Hall, Ney Jersey.

Recommended literature:

1. Journals and scientific papers

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.60	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.20	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.20	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
15 teaching hours (lectures + exercises) = 0.60 ECTS (15 teaching hours/50 hours of total load x100 =30.00% from total of 2 ECTS)
Seminar paper = 0.20 ECTS (5 hours/50 hours of total load x100 = 10.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/100 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Quarantine Pests**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	1
	Lecture hours (L+E+S)	L -5 , E -0, S - 5

Module aim
Students would get acquainted to the list of quarantine pests.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Made a list of a qurantine pests for Croatia.
2. Recognize the dangers of quarantine pest spreading.
3. Described the way of spreading of the quarantine pests.
4. Collect legislation concerning quarantine pests.

Module content
A1 i A2 list of quarantine pests. Elaboration of quarantine pests listed in EPPO.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Quarantine Pests for Europe. CABI and EPPO for the EU. CAB International p. 1425.
EPPO Bulletin.

Recommended literature:

1. Journals and scientific papers relevant to quarantine pests.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.20	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.20	1-4	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	0.60	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	1.00			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)
1 ECTS credits = 25 hours of module loads
5 teaching hours (lectures) = 0.20 ECTS (5 teaching hours/25 hours of total load x100 = 20,00% from total of 1 ECTS)
Seminar paper = 0.20 ECTS (5 hours/25 hours of total load x100 = 20,00 % from total of 1 ECTS)
Final exam = 0.60 ECTS (15 hours of preparation/25 hours of total load x 100 = 60,00% from total of 1 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Acarology**	
Module coordinator	Ivana Majić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 0, S - 10

Module aim
To introduce students to both useful and harmful mite species in field crops, and mite species of stored grain crops.

Terms of admission
No specific prerequisite.

Expected learning outcomes
After completing the module, student will be able to:
1. Explain the importance and role of useful and harmful mites in field crops and storage facilities.
2. Describe and identify the most important families and genera of mites.
3. Define and compare damage and management measures of harmful mites.
4. Define ways and possibilities of introduction and cultivation of useful mites.
5. Argue the advantages and disadvantages of using beneficial mites in agricultural production.
6. Integrate knowledge and make a decision on the need to apply management measures.

Module content
Useful mites in field crops (family Phytoseiidae: genus Phytoseiulus, Amblyseius and Thyphodromus; family Cheyletidae, species C. eruditus and C. trouessarti) – their role, the way of introduction and growth. Harmful mites in field crops (family Tyroglyphidae, Cheyletidae, Glycyphagidae and Tetranychidae) – biology, morphology, damage, and control treatment. Mite species in storage facilities (families Tyroglyphidae, Cheyletidae, Tarsonemidae, Pyroglyphidae, Pyemotidae, Ascidae, Glycyphagidae, Tydeidae, Amerosiidae, Dermanyaaidae) – biology, space and time distribution, ecology, damage and control treatment.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students should be prepared and be able to actively participate and discuss topics related to Acarology, which involves reading reccommeded literature. Student creates individualy seminar paper, and present it orally in a twenty-minute period using PowerPoint presentation. Lab coat is required for the purpose of laboratory work. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Genson, U., Smiley, R.L. (1990): Acarine biocontrol agents – an illustrated key and manual. Chapman and Hall, Lonodon.
2. Tuomas S. Kostiainen & Marjorie A. Hoy (1996): The Phytoseiidae As Biological Control Agents of Pest Mites and Insects A Bibliography (1960-1994). IFAS, University of Florida, Gainesville.
3. Hoy, M. A. (2011) Agricultural Acarology: Introduction to Integrated Mite Management. CRC Press Inc., 430 pp.
4. Zhang, Z.-Q. & Liang, L.-R. (1997) An Illustrated Guide to Mites of Agricultural Importance. Tongji University Press, Shanghai. 228 pp
5. Korunić, Z. (1990.): Štetnici uskladištenih poljoprivrednih proizvoda – biologija, ekologija i suzbijanje. Gospodarski list, Zagreb.

Recommended literature:

1. Bolland, H. R., Gutierrez, J. & Flechtmann (1998) World Catalogue of the Spider Mite Family (Acari: Tetranychidae). Brill: Leiden, Boston, Koln. Hardcover, 392 pp.
2. Subramanyam, B., Hagstrum, D. W. (1995): Integrated management of insects in stored products. Marcel Dekker, Inc. New York, USA. Published scientific papers in scientific journals and proceedings for seminar preparations.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.40	1-6	Literature studying, assignment work	Checking student activity through discussions, reviewing student'swork and assignments
Seminar	0.40	1-6	Literature studying, seminar preparation and presentation	Seminar examination andevaluation according to the pre-established criteria
Lab work	0.40	1-6	Literature studying, work in Lab	Evaluation according to thepre-established criteria
Final exam	0.80	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

2 ECTS credits = 50 hours of module loads

10 Teaching lessons (lectures) = 0.40 ECTS (10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)

Seminar paper = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)

Lab work = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)

Final exam = 0.80 ECTS (20hours /50 hours of total load x 100 = 40.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Nematology**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 20, S - 0

Module aim

Students would get acquainted with nematode morphology, development, life cycle, feeding habit, parasitism, systematics and nematodes as virus vectors.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify plant parasitic nematodes to genus level.
2. Identify nematodes as vectors of the virus.
3. Use laboratory equpment for free-living and cyst nematodes separation.
4. Recommend protective measures for plant parasitic nemtodes.

Module content

Through the exercises and lectures students will get educatation about techniques in nematology laboratory, determination of specific nematode genera, virus vectors, free living and cyst nematodes, and protection measures in Nematology.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare forlectures and exercises using recommended reading literature. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Andrassy, J. (1984.): Klasse nematoda. Gustav Fisher Verlag, Stuttgart, pp. 509.
2. Bongers, T. (1994.): De nematoden van Nederland. KNNV: Utrecht. pp. 408.
3. Mai, W. F., Lyon, H.H. (1975): Pictorial key to genera of Plant-parasitic nematodes. Cornell University Press. Ltd. USA.
4. Sadekm M. A. (1980): Plant nematology an agricultural training aid. Nema Aid Publication, USA.
5. Ivezić, M. (2014.): Fitonematologija. Poljoprivrednl fakultet u Osijeku.

Recommended literature:

1. Dropkin, V. H. (1980): Introduction to plant nematology. A Wiley-Interscience Publication, USA.
2. Scientific papers.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexcersise	1.60	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	2.40	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
40 teaching hours (lecture) = 1.60 ECTS (40 teaching hours/100 hours of total load x100 = 40.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Nematode Ecology**	
Module coordinator	Mirjana Brmež	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 0, S - 10

Module aim

To introduce students with nematode community and environment interaction, nematode distribution and classification, nematode reaction on disturbation, role of nematodes in nutrient cycle.

Terms of admission

No prerequisites

Expected learning outcomes

After completing the module, student will be able to:

1. Distinguish the most important trophic groups of nematodes in the soil.
2. To determine the role of nematodes in the soil.
3. Eexplain the most important indexes of disturbance nematode in soil.
4. Explain the most important diversity indices of nemtodes.
5. Enumerate and explain the ecological indicators of neamtode community.

Module content

Life cycle of nematodes, trophic groups, c-p groups, role of terrestrial nematodes. Nematodes life habits and interaction with environment, nematodes as bioindicators of processes of succession, disturbation or pollution of ecosystem, Maturity Index.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Goede, R. G. M. (1993.): Terrestrial nematodes in a changing environment. Wageningen Agricult. Univ. 138 p.
2. Freckman, D. W. (1982): Nematodes in Soil Ecosystems. University of Texas Press.

Recommended literature:

Scientific papers

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.40	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.40	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	1.20	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

1 ECTS credit = 25 workload hours (student's working hours)

2 ECTS credits = 50 hours of module loads

10 teaching hours (lecture) = 0.40 ECTS (10 teaching hours/50 hours of total load x 100 = 20% from total of 2 ECTS)

Seminar paper = 0.40 ECTS (10 hours/50 hours of total load x 100 = 20 % from total of 2 ECTS)

Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Zoocides**	
Module coordinator	Ankica Sarajlić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20 , E -0, S - 20

Module aim
Zoocides and its application in agriculture.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Make a plan of protection against pests in crops.
2. Use new insights on sustainable use zoocides.
3. Indicate measures disposal of packaging waste.
4. Select formulations with a smaller environmental risk.
5. Create biological protection of harmful insects.

Module content
Active substances of synthetic chemical compounds, groups of bioinsecticides, inhibitors of chitin formation, juveline and antijuvenile hormones, insect development regulators, avermectins, new acaricides, nematocides, limacides, rodenticides and bird repelents. Compounds with Bacillus thuringiensis, new bacterial, fungal, viral and plant bioinsecticides as well as entomopathogenic nematodes.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Glasilo biljne zaštite – pregled sredstava za zaštitu bilja u Hrvatskoj, 2005., Infomart.
2. Manuals of pharmaceutical houses of means of plant protection.

Recommended literature:
1. Journals and scientific papers

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.80	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.40	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 =20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Laboratory methods in mycology**	
Module coordinator	Jasenka Ćosić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 0, E - 20, S - 0

Module aim
IIntroduction to laboratory work methods in phytopathology and mastering laboratory skills.

Terms of admission
No terms of admission.

Expected learning outcomes
After completing the module, student will be able to:
1. Identify the plant diseases based on symptomatology and morphology.
2. Select techniques and instruments for sampling.
3. Choose and prepare appropriate growth medium for fungal parasite.
4. Carry out biometrical measurements.
5. Identify fungal species using molecular tools.

Module content
Preparation of growth medium for facultative parasite. Light microscopy, determination of fungi by a native preparation, fungi measurement, imaging and saving images to the PC. Molecular identification of pathogens.

Types of teaching

☐ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students will receive suggestions of paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for Lab work, according to scientific interest of participants. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Burgess, L. W., Liddell, C. M., Summerell, B.A. (1988.):Laboratory manual for Fusarium research. The University of Sydney.
2. Dhingra, O. D., Sinclair, J. B. (1986.): Basic Plant Pathology Methods. CRC Press, USA.
3. Singleton, L. L., Mihail, J. D., Rush, C. M. (1992): Methods for Research on Soilborne Phytopathogenic Fungi. APS Press.

Barnett, H. L., Hunter, B. B. (1998.): Illustrated Genera of Imperfect Fungi. APS Press.
4. Cummins, G. B., Hiratsuka, Y. (2003.): Illustrated Genera of Rust Fungi. APS Press.
5. Dhingra, O. D., Sinclair, J. B. (1986.): Basic Plant Pathology Methods. CRC Press, USA.
6. Hanlin, R. T. (1992.): Illustrated Genera of Ascomycetes. APS Press.
7. Mühle, E., Wetzel, T., Franenstein, K., Fuchs, E. (1983.): Praktikum zur Biologie und Diagnostik der Krankheitserreger und Schädlinge unserer Kulturpflanzen. S. Hirzel Verlag Leipzig.

Recommended literature:

1. Gilchrist-Saavedra, L., Fuentes-Davila, G., Martinez-Cano, C. (1997.): Practical Guide to the Identification of Selected Diseases of Wheat and Barley. CIMMYT, Mexico.
2. Trigiano, R. N., Windham, M. T., Windham, A. S. (2006.): Plant Pathology - Concepts and Laboratory Exercises. CRC Press.
3. Burns, R. (2009.): Plant Pathology - Techniques and Protocols. Humana Press.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Exercises	0.80	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Lab work	0.80	1-5	Literature studying, work in Lab	evaluation according to the pre-established criteria
Final exam	0.40	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
20 teaching hours (exercises) = 0.80 ECTS (20 teaching hours/50 hours of total load x100 = 40.00% from total of 2 ECTS)
Lab work = 0.80 ECTS (20 hours/50 hours of total load x100 = 40.00% from total of 2 ECTS)
Final exam = 0.40 ECTS (10 hours of preparation/50 hours of total load x 100 = 20.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Quarantine Diseases**	
Module coordinator	Jasenka Ćosić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	1
	Lecture hours (L+E+S)	L - 5, E - 0, S - 5

Module aim

To teach students the relevance of quarantine service and diseases that are entered in the quarantine lists.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify the most important quarantine pathogens.
2. Assessment of the impact of environmental factors on incidence of quarantine pathogens.
3. Predict the spread of quarantine pathogens.
4. Design and propose the plant disease managemen against quarantine pathogens.
5. Oranize quarantine service.

Module content

Quarantine service as a part of plant protection, legislative, overview of quarantine diseases (cereales, arable crops, vegetables. ornamental plants and fruits).

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Krstić, B. B., Bulajić, A. R. (2007.): Karantinski virusi povrća i ukrasnih biljaka u zaštićenom prostoru. Poljoprivredni fakultet Beograd.
2. CABI i EPPO (1997.): Quarantine Pests for Europe.

Recommended literature:

Journals (Plant Diseases, Phytopathology, Plant Pathology, etc.).

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.20	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.20	1-5	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	0.60	1-5	Preparing for exam bystudying required andrecommended literature	Exam (oral)
Total	1.00			

The way of calculating ECTS credits for certain activities:

Module carries 1 ECTS credits

1 ECTS credit = 25 workload hours (student's working hours)

1 ECTS credits = 25 hours of module loads

5 teaching hours (lectures + exercises) = 0.20 ECTS (5 teaching hours/25 hours of total load x100 = 20.00% from total of 1 ECTS)

Seminar paper = 0.20 ECTS 5 teaching hours/25 hours of total load x100 = 20.00% from total of 1 ECTS)

Final exam = 0.60 ECTS (15 hours of preparation/25 hours of total load x 100 = 60.00% from total of 1 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Seed Diseases**	
Module coordinator	Karolina Vrandečić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	6
	Lecture hours (L+E+S)	L - 5, E - 5, S - 10

Module aim
Introduction to the seed borne diseases.

Terms of admission
No prerequisite.

Expected learning outcomes
After completing the module, student will be able to:
1. Identify the seed borne pathogens.
2. Assessment of the impact of environmental factors on seed infection.
3. Predict the occurrence of seed borne diseases and possible losses of yield and quality.
4. Design and propose the plant disease management against seed born pathogens.
5. Compare the different methods of identificaton for seed borne pathogens.

Module content
During the course students will learn about the most important pathogens of seeds (biology, ecology, epidemiology) and seed health testing methods (cereales, corn, soybean and sunflower). Laboratory research of pathogens; study of morphological, cultural and biometric characteristics. Molecular idnetificattion of seed born pathogens.Students will receive suggestions of seminar paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for their paper writing, according to scientific interest of participants.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Mathur, S. B., Kongsdal, O. (2003.): Common Laboratory Seed Health Testing Methods for Detecting Fungi. First Edition.
2. Hutchins, J. D., Reeves, J. C. (1997.): Seed health testing: Progress towards the 21st century. CAB International.
3. Jovičević, B., Milošević, M. (1990.): Bolesti semena. Dnevnik, Novi Sad.
4. Compendium of Soybean Diseases, Compendium of Wheat Diseases, Compendium of Corn Diseases.
5. Maceljski, M. i sur. (1997.): Zaštita povrća od štetočinja. Znanje, Zagreb.

Recommended literature:

1. Magazines (Plant Diseases, Phytopathology, Plant Pathology, etc.).

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.40	1-5	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.40	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Lab work	0.40	1,5	Literature studying, work in Lab	evaluation according to the pre-established criteria
Final exam	0.80	1-5	Preparing for exam by studying required and recommended literature	Exam (oral)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 100 hours of module loads
10 teaching hours (lectures + exercises) = 0.40 ECTS (10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Seminar paper = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Lab work = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Final exam = 0.80 ECTS (20 hours of preparation/50 hours of total load x 100 = 40.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Vegetable Protection**	
Module coordinator	Jasenka Ćosić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E - 10, S - 20

Module aim
Introduction to the diseases of vegetables caused by pseudofungi, fungi, bacteria and viruses.

Terms of admission
Passed Laboratory methods in mycolgy.

Expected learning outcomes
After completing the module, student will be able to:
1. Identify the plant diseases based on symptomatology, morphology.
2. Identify the pathogens using molecular tools.
3. Assessment of the impact of environmental factors on infection and disease incidence.
4. Predict the occurrence of diseases (plant diseases forecasting) and possible losses of yield and quality.
5. Design and propose the plant disease management.
6. Compare the effectiveness of different plant protection strategies.

Module content
Biology, ecology and epidemiology of potatoes, fruit vegetables (tomatoes, peppers), leafy vegetables (lettuce), bulb vegetables, legumes (beans), brassicas (cabbage), root vegetables (carrots, celery). Determination of disease agents. Molecular idnetificattion of pathogens. Plant protection management. Students will receive suggestions of seminar paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for their paper writing, according to scientific interest of participants.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using Powe rPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Blancard, D. (2000.): A Colour Atlas of Tomato Diseases. INRA.
2. Gullino, M. L., Katan, J., Garibaldi, A. (2012.): Fusarium wilts of greenhouse vegetable and ornamental crops. APS.
3. Koike, S. T., Gladders, P., Paulus, A.O. (2009.): Vegetable Diseases – A Color Handbook. Academic Press.
4. Zitter, T. A., Hopkins, D. L., Thomas, C. E. (2010.): Compendium of Cucurbit Diseases. APS Press.
5. Rimmer, R. S., Shattuck, V. I., Buchwaldt, L. (2007.): Compendium of Brassica Diseases. APS Press.

Recommended literature:

1. Balaž, F. F., Balaž, J. S., Tošić, M. T., Stojšin, V. B., Bagi, F. F. (2010.): Fitopatologija Bolesti ratarskih i povrtarskih biljaka. Poljoprivredni fakultet Novi Sad.
2. Krstić, B. B., Bulajić, A. R. (2007.): Karantinski virusi povrća i ukrasnih biljaka u zaštićenom prostoru. Univerzite u Beogradu - Poljoprivredni fakultet.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.80	1-6	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Lab work	0.40	1-2	Literature studying, work in Lab	evaluation according to the pre-established criteria
Final exam	2.00	1-6	Preparing for exam by studying required and recommended literature	Exam (oral)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Lab work = 0.40 ECTS (10 hours/100 hours of total load x100 = 10.00% from total of 4 ECTS)
Final exam = 2.00 ECTS (50 hours of preparation/100 hours of total load x 100 = 50.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Diseases of Arable Crops**	
Module coordinator	Jasenka Ćosić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E - 10, S - 20

Module aim
Introduction to the diseases of arable crops caused by pseudofungi, fungi, bacteria and viruses.

Terms of admission
Passed Laboratory methods in mycolgy.

Expected learning outcomes
After completing the module, student will be able to:
1. Identify the plant diseases based on symptomatology, morphology.
2. Identify the pathogens using molecular tools.
3. Assessment of the impact of environmental factors on infection and disease incidence.
4. Predict the occurrence of diseases (plant diseases forecasting) and possible losses of yield and quality.
5. Design and propose the plant disease management.
6. Compare the effectiveness of different plant protection strategies.

Module content
Biology, ecology and epidemiology of cereal, corn, soybean, sunflower, sugar beet and tobacco diseases, determination of disease agents. Molecular idnetificattion of pathogens. Plant protection management. Students will receive suggestions of seminar paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for their paper writing, according to scientific interest of participants.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Agrios, G. N. (1997., 2005.): Plant Pathology. Specific Plant Diseases. Academic Press, New York.
2. Balaž, F. B., Balaž, J. S., Tošić, M. T., Stojšin, V. B., Bagi, F. B. (2010.): Fitopatologija – Bolesti ratarskih i povrtarskig biljaka. Poljoprivredni fakultet Novi Sad.
3. Leonard, K. J., Bushnell, W. R. (2003.): Fusarium Head Blight of Wheat and Barley. APS Press.
4. Roelfs, A. P., Singh, R. P., Saari, E. E. (1992.): Rust Diseases of Wheat: Concepts and Methods of Disease Management. CIMMYT, Mexico.
5. Wallwok, H. (1996.): Cereal Root and Crown Diseases.
6. Gulya, T., Rashid, K. Y., Maširević, S. M. (1997.): Sunflower Diseases. In Sunflower Technology and Production, Nr. 35 in Seris Agronomy, 263-379.
7. Sinclair, J. B., Backman, P. A. (1993.): Compendium of Soybean Diseases. APS Press.
8. Tuitert, G. (1994.): Epidemiology of Rizomania disease of sugar beet. Wageningen, Netherland.

Recommended literature:

1. Mathre, D. E. (1997.): Compendium of Barley Diseases. APS Press.
2. Harveson, R. M., Hanson, L. E., Hein, G. L. (2009.): Compendium of Beet Diseases and Pests. APS Press.
3. Bockus, W. W., Bowden, R. L., Hunger, R. M., Morrill, W. L., Murray, T. D., Smiley, R. W. (2010.): Compendium of wheat diseases. APS Press.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.80	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Lab work	0.40	1,2	Literature studying, work in Lab	evaluation according to thepre-established criteria
Final exam	2.00	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20% from total of 4 ECTS)
Lab work = 0.40 ECTS (10 hours/100 hours of total load x100 = 10% from total of 4 ECTS)
Final exam = 2.00 ECTS (50 hours of preparation/100 hours of total load x 100 = 50% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Toxicogenic Fungi and Micotoxins**	
Module coordinator	Jasenka Ćosić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 0, S - 10

Module aim
To transfer to students knowledge on toxicogenic fungi and micotoxins, on their relevance for agricultural production and human health.

Terms of admission
No prerequisites

Expected learning outcomes
After completing the module, student will be able to:
1. Assess the risk of contamination of agricultural products with mycotoxins.
2. Connect the impact of environmental factors with the risk of mycotoxin contamination of agricultural products.
3. Compare the impact of different groups of mycotoxins on human and animal health.
4. Suggest preventive and curative measures against toxigenic fungi.

Module content
Fungal species as producers of micotoxins, the most important groups of micotoxins, micotoxins as human disease agents and other secondary metabolites of fungi.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students will receive suggestions of paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for Lab work, according to scientific interest of participants. After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Duraković, S., Duraković, L. (2000.): Specijalna mikrobiologija. Sveučilište u Zagrebu.
2. Kozakiewicz, Z. (1994.): Aspergillus, p. 575-606. In Foodborne Diseases Handbook; Diseases Caused by Viruses, Parasites and Fungi. Edited by Hui Y.H., Gorham R.J., Murrell K.D., Cliver D.O., Marcel Dekker, Inc. New York.
3. Leonard, K. J., Bushnell, W. R. (2003.): Fusarium Head Blight of Wheat and Barley. APS Press.

4. Marasas, W. F. O., Nelson, P. E., Toussoun, T. A. (1984.): Toxigenic Fusarium Species. Identity and Mycotoxicology. The Pennsylvania State University Press. University Park and London.
5. Ožegović, L., Pepeljnjak, S. (1995.): Mikotoksini i mikotoksikoze, str. 7-25. U "Mikotoksikoze", Školska knjiga, Zagreb.

Recommended literature:

Journals (Plant Diseases, Phytopathology, Plant Pathology, etc.).

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.40	1-4	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Seminar	0.40	1-4	Literature studying, seminar preparation and presentation	evaluation according to the pre-established criteria
Final exam	1.20	1-4	Preparing for exam bystudying required andrecommended literature	Exam (oral)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
10 teaching hours (exercises) = 0.40 ECTS (10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Seminar = 0.40 ECTS(10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Final exam 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Diseases of Tree Fruits and Grapevine**	
Module coordinator	Karolina Vrandečić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E - 10, S - 20

Module aim

Introduction to the biological, enviromental and epidemiological characteristics of tree fruits and grapevine disease agents.

Terms of admission

Passed Laboratory methods in mycolgy.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify the plant diseases based on symptomatology, morphology and molecular characteristics of pathogens.
2. Assessment of the impact of environmental factors on infection and disease incidence.
3. Predict the occurrence of diseases (plant diseases forecasting) and possible losses of yield and quality.
4. Design and propose the plant disease management.
5. Compare the effectiveness of different plant protection strategies.

Module content

During the course students will learn about the most important pathogens of tree fruits and grapevine. Laboratory research of pathogens; study of morphological, cultural and biometric characteristics. Molecular idnetificattion of pathogens.Students will receive suggestions of seminar paper titles, and recommendation of magazines with relevant scientific and professional articles, necessary for their paper writing, according to scientific interest of participants.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☒ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students have a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Cvjetković, B. (2010.): Mikoze i pseudomikoze voćaka i vinove loze. Zrinski d.d., Čakovec, 1-418.
2. Ciglar, I. (1998.): Integrirana zaštita voćnjaka i vinograda. Zrinski d.d. Čakovec.
3. Jurković, D., Ćosić, J. (2003.): Zaštita vinograda i voćnjaka od uzročnika bolesti. Veleučilište u Požegi.4. Compendium of Soybean Diseases, Compendium of Wheat Diseases, Compendium of Corn Diseases.
5. Maceljski, M. i sur. (1997.): Zaštita povrća od štetočinja. Znanje, Zagreb.

Recommended literature:

1. Magazines (Plant Diseases, Phytopathology, Plant Pathology, etc.).
2. (1995.): Compendium of Stone Fruit Diseases. APS Press, 1-98.
3. (1991.): Compendium of Raspberry and Blackberry Diseases and Insects. APS Press, 1-100.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-5	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.80	1-5	Literature studying, seminarpreparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Lab work	1.00	1	Literature studying, work in Lab	evaluation according to the pre-established criteria
Final exam	1.40	1-5	Preparing for exam bystudying required and recommended literature	Exam (oral)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures + exercises) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Lab work = 1.00 ECTS (25 hours/100 hours of total load x100 = 25.00% from total of 4 ECTS)
Final exam = 1.40 ECTS (35 hours of preparation/100 hours of total load x 100 = 35.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Soil Microbiology**	
Module coordinator	Suzana Kristek	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E – 10, S - 20

Module aim
Get students acquainted with microorganisms in the environment with special emphasis on soil microorganisms.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Rank microorganisms in different natural environments.
2. Classify and compare soil microorganisms.
3. Compare the environmental factors and their impact on soil microorganisms.
4. Identify the interaction between microorganisms and distinguish categories of microbial relationships.
5 Assess the importance and role of beneficial microorganisms of the soil.

Module content
Microbial communities. Influence of physicochemical factors on the growth and behavior of microorganisms in the environment. The interaction between microorganisms, microorganisms and higher organisms. Microorganisms and their natural sites (air, soil, water). Microbiology of pesticides. Processing of relevant scientific and professional articles related to application of modern methods in soil microbiology.

Types of teaching

☒ lectures	☒ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. For laboratory work, students need emergency protective laboratory clothing (lab coat). After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Tate, R. L. (1995): Soil Microbiology. Wiley. New York.
2. Van Elsas, J. D., Trevors, J. T., Wellington, E. M. H.(1997): Modern Soil Microbiology, Marcel Dekker, Inc. New York.
3. Maier, R. M., Pepper, I. L., Gerba, C. P. (2009): Environmental Microbiology. Academic Press Inc. San Diego.
4. Varnam, A. H., Evans, M. G. (2000): Environmental Microbiology. Manson Publishing Ltd. London.
5. Alef, K., Nannipieri, P. (1995): Methods in Applied Soil Microbiology and Biochemistry. Academic press Inc. San.

Recommended literature:

1. Sylvia, D. M., Fuhrmann, J. J., Hartel, P. G., Zuberer, D. A. (2004): Principles and Applications of Soil Microbiology. Prentice Hall Inc. New York.
2. Varma, A., Oelmüller, R. (2007): Advanced Techniques in Soil Microbiology. Springer.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.80	1-5	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.80	1-5	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.40	1-5	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Herbology**	
Module coordinator	Edita Stefanic	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Get aquainted students with biological and ecological characteristics of weeds, damages that they causes in agriculture and control measures (chemical, mechanical, biological). Finding economically efficient strategy for weed control in conventional, integrated and ecological crop production.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
1. Describe and explain term "weed".
2. Identify biological and ecological characteristics of weeds.
3. Distinguish and compare noxious weeds in Croatia.
4. Describe and band interaction between crops and weeds.
5. Distinguish and compare short and longterm aspect of weed control.
6. Explain decision model any yield loss function.
7. Estimate economic effect of weed control in various crops.
8. Create and select economically acceptable progrem of weed control in various crops.

Module content

Weed definition, biology and ecology of weeds. Methods of weed management, Noxious weeds in agriculture, Research methods in weed science, Weed sucess criteria compared to crops, crop-weed interaction, yield loss function, impact of herbicide application, regional and social aspect of weed management, precision farming, low-term aspect of weed management, long-term aspect of weed management, crop management system and weed management, decision models - support to effective weed control, assessments of economic weed control.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are obliged to atend lectures and to be prepared for seminars and individual tasks by studying required and recomended literature, Each student pick out topic for individual seminar and are responsible to deliver it in written form on given time. Also, each student present their

work orally in 15 min. period using Power Point presentation. At the end of semester students have written examination. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Moodle (PFOS_WS) – E. Štefanić -predavanja
2. Anderson, W. P. (1993) Weed Science - principles and applications, 3. edition. WestPublishing Company,
Minneapolis/St.Paul, New York, Los Angeles, San Francisko.
3.Oerke, E. C. C., Weber, A., Dehne, H. W., Schonbeck, F. (1994) Crop Production and Crop Protection: Estimated Losses in Major Food and Cash Crops. Elsevier Science & Technology Books, 830pp.
4. Reichelderfer,K. H., Norton, G. A., Carlson G. A. (1984) Economic Guidelines for Crop Pest Control. Bernan Associates, 89pp.

Recommended literature:

1. Pimentel, D. (1997) Techniques for Reducing Pesticide Use: Economic and Environmental Benefits. Wiley, John & Sons, Incorporated, 456pp.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-8	8Literature study	Checking student activity orally (conversation), reviewing student's work and assignments
Seminars	0.80	1-8	Literature studying, seminar preparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	2.40	1-8	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module carries 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/75 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Special herbology**	
Module coordinator	Sanda Rašić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E -0, S - 20

Module aim

Introduction of postgraduate students with principles of weed control and weed management systems for any crop-weed situation. Integration available weed control techniques into management.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand the logical steps that are part of complete weed management systems.
2. To know how to combine weed management and control techniques into a weed management systems.
3. To understand the design and implementation systems for a few crops and cropping situations.
4. To know what things other then weeds must be considered in the design of weed management systems.
5. To know the role of mechanical, cultural, physical, biological and chemical weed management systems.
6. To be able integrate all know methods of weed control into the integrated plant protection management.

Module content

Control measures (agrotechnical, chemical, biological and genetic). Ecological effects of weed control. Weed suppression in field crops.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Aldrich R. J., Kremer R. J. (1997). Principles in Weed Management.
2. Radosevic S., Holt J., Ghersa C. (1977). Weed Ecology, Implications for Management.
3. Smith A. E. (2000): Handbook of Weed Management System

Recommended literature:

1. Experts bibliography from Department of herbology, at the Faculty of Agriculture, available on web pages.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminar	0.80	1-6	Literature studying, seminar preparationand presentation	Seminar examination and evaluation accordingto the pre-established criteria
Final exam	2.40	1-6	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module has 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 3 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Weed control in arable crops**	
Module coordinator	Renata Baličević	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 10, S - 10

Module aim
Introduction of participants with the negative impact of weeds on yield and possibilities of weed control in arable crops.

Terms of admission
There are no terms of admission.

Expected learning outcomes
After completing the module, student will be able to:
1. Classify plant protection measures in crops.
2. Separate chemical and non-chemical control measures.
3. Calculate the dose and concentration of plant protection product.
4. Compare the threshold of cost-effectiveness and designed protection plan.
5. Design and present a plant protection program of the selected crop.

Module content
Impact of weeds on crop development, quantity and quality of yield, weeds systematics, weed flora of cereal crops, row crops and forage crops, critical period of weed infestation; characteristics and division of herbicides, persistence, selection of herbicides, selectivity, application time and mode of action, review of herbicides by individual crops, application of herbicides, herbicide selection in relation to crop rotation, resistant weeds; selection certain types and methods of application of herbicides, efficiency. Non-chemical weed control measures.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students are expected to attend classes and participate actively in the tasks during the lectures and exercises. All students are obliged to prepare for lectures and exercises by studying the relevant literature. Students are obliged to prepare and write seminar paper. Seminar paper should be present orally for about 20 minutes with a Power Point Presentation. Schedule of presentation will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature. For laboratory work students are required to wear protective clothing.

Literature

Required reading:

1. Glasilo biljne zaštite. Hrvatsko društvo biljne zaštite. Zagreb.
2. Baličević R., Ravlić M. (2013): Fitofarmacija, interna skripta za studente Poljoprivrednog fakulteta u Osijeku.
3. Baličević, R., Ravlić, M. (2014): Herbicidi u zaštiti bilja, Sveučilište Josipa Jurja Strossmayera u Osijeku, POljoprivredni fakultet u Osijeku.
4. M.Maceljski i sur. (2002): Priručnik iz zaštite bilja, Zagreb.

Recommended literature:

1. Published scientific papers in reference journals and proceedings.
2. Plant protection programs for crops – from pesticide suppliers in Croatia.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	1.20	1-5	Reading reqired literature, tasks solving	Assessment of theactivities carried out through conversation, submission and review of completed tasks.
Seminars and seminar paper preparation	0.40	1-5	Studying the required literature, writing andpresentation of seminar paper	Review and evaluation of seminar paper according to pre-defined criteria.
Final exam	2.40	1-5	Exam preparation through studying therequired and recommended literature	Exam (written or oral)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module has 4 ECTS credits
1 ECTS credit = 25 workload hours (hours of student work)
4 credits = 100 workload hours
30 lecture hours (lectures + excercises) = 1.20 ECTS (30 lecture hours /100 workload hours x 100 = 30.00% of total 4 ECTS
Seminar paper = 0.40 ECTS (10 hours/100 hours of total load x100 = 10.00% from total of 2 ECTS)
Final exam = 2.40 ECTS = (60 hours / 100 workload hours x 100 = 60.00% of total 4 ECTS

Module quality assessment

The evaluation of lecturer and module quality through anonymous surveys.

Module name	**Herbicides (New Cognition)**	
Module coordinator	Renata Baličević	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E -0, S - 10

Module aim

Introduction to chemical weed control. History of weed control. Advantage and disadvantage of chemical weed control. Introduction of students with chemical measures of weed control. Herbicides division, way of accession into plant, biochemical mechanism of action, ecological consequences of implementation, advantages and disadvantages.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
understand:
1. When did chemical weed control begin.
2. How did herbicides change the practice of agriculture.
3. What are the advantages and disadvantages of herbicides.
4. Classification of herbicides based on chemical structure, made of action on according time of application.
5. Absorption and translocation of herbicides in the plants.
6. Mechanism of selectiv activity, resistant principles, influence on persistence and on degradation, waiting period, tolerance.

Module content

Herbicides division by the chemical determination, by the accession into plant through leaf and root, translocation, molecular place of action, metabolism, mechanism of the selective activity, resistant principles, processes which influence on persistence and on degradation, waiting period, tolerance.Elaboration of the specific problem concerning to attendants interest (mechanism of activity, resistance, selectivity and similar).

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

All students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Scalla R. (1989): Les herbicides, mode d'action et principes d'utilisation.
2. Cobb A. (1992): Herbicides and Plant Physiology.
3. Hock B., Fedtke C., Schmidt R. R. (1995). Herbizide, Entwicklung, Andwendung, Wirkungen, Nebenwirkungen.
4. Audus L. J. (1976): Herbicides, Physiology, Biochemistry, Ecology. Vol. 1 and 2.
5. Literature will be specific on problem of the chosen theme.

Recommended literature:

1. Experts bibliography from Department of herbology, at the Faculty of Agriculture, available on web pages.
2. Scientific collaborations from referred journals.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.40	1-6	Literature studying, assignment work	Checking student activityorally (conversation), reviewing student's work and assignments
Seminar	0.40	1-6	Literature studying, seminarpreparation and presentation	Seminar examination and evaluation according to the pre-established criteria
Final exam	1.20	1-6	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module has 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
10 teaching hours (lectures) = 0.40 ECTS (10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Seminar paper = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/75 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Interaction Herbicide – Soil – Plant**	
Module coordinator	Renata Baličević	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	1
	Lecture hours (L+E+S)	L - 10, E -0, S - 0

Module aim

The aim of the course is to understand the fate and behaviaur of herbicides in soil includid: herbicide distribution by the soil phases, adsorption, absorption, leaching, evaporation, chemical reduction, microbiological reduction, photochemical reduction, persistence, residual effect on crops in crop rotation.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
assess and evaluate:
1. How does the physical structure of the soil and chemical properties of the soil effect herbicides.
2. The role of adsorption in herbicide activity.
3. Interaction between adsorption and leaching.
4. How do microorganisms affect herbicides in soil.
5. What role does photodegradation of herbicide play.
6.What factors determine how long an herbicide persist in soil.
7. Do herbicide accumulate in the environment.
8. The effect of herbicide residues on crop in crop rotation.

Module content

Climatic factors impact on herbicide effect, bioassay methods of leaching, reduction and persistence, evaluation of selective and phytotoxic result, evaluation of negative residues impact on crops in crop rotation.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for exercises using recommended reading literature. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Audus L. J. (1976): Herbicides, Physiology, Biochemistry, Ecology. vol 1.
2. Hance R. J. (1980): Interaction between herbicides and the soil.
3. Hance R. J., (1984): Soils and crop protection chemicals.

Recommended literature:

1. Experts bibliography from Department for herbology, at the Faculty of Agriculture, available on web pages.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	0.40	1-8	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Final exam	0.60	1-8	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	1.00			

The way of calculating ECTS credits for certain activities:

Module has 1 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
1 ECTS credits = 25 hours of module loads
10 teaching hours (lectures) = 0.40 ECTS (10 teaching hours/25 hours of total load x100 = 40.00% from total of 1 ECTS)
Final exam = 0.60 ECTS (15 hours of preparation/50 hours of total load x 100 = 60.00% from total of 1 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Pesticides Application and Legislative**	
Module coordinator	Sanda Rašić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 20, E - 0, S - 0

Module aim

introduction of postgraduate students with pesticides application methods, with proposed rules according to pesticide world legislative, EU countries and Croatia .

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:
understand:

1. That the pesticides created a major change in the way agriculture is practiced by substituting chemical energy of human and animal energy.
2. The formulations of pesticides.
3. That the goal of formulation are to improve biological efficacy and to put the pesticides in physical form convenient for use.
4. Method of applying pesticides. Application of pesticides to targets.
5. Droplet size technology in relation to effectiveness. Application systems (atomizers, low pressure general purpose system, herbicide application).
6. The principles of pesticide registration.
7. National and EU plant protection lows and other regulations rules of control and applications of pesticides.
8. What does it mean when pesticide is registered?
9. Why is the pesticide label important? What things must manufacturer prove to register pesticide?
10. What information must be included with petition for registration and who bears responsibility for preparing the information?

Module content

Pesticides implementation techniques, pesticides implementation equipment, climatic impact on implementation, drift, unwished side effects by the application, dealings, registration, pesticides implementation. Inspection works according to dealings and implementation of pesticides.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☐ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

All students will prepare for exercises using recommended reading literature. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Glasilo biljne zaštite (latest years)
2. Narodne novine (latest years) with printed proposed rules (The law of Plant Protection, The law of food, The law of environment protection, The law of toxicants and all other following rules.
3. Mcwhorter G. (1987): Methods of Applying Herbicides.
4. Novak, M., Maček J. (1990): Tehnike nanašanja pesticidov.

Recommended literature:

1. Experts bibliography from Department for herbology, at the Faculty of Agriculture, available on web pages.
2. Scientific collaborations from referred journals.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student's work and assignments
Final exam	1.2	1-6	Preparing for exam bystudying required and recommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/50 hours of total load x 100 = 40.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**GMO in Plant protection**	
Module coordinator	Ivana Majić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 0, S - 10

Module aim
Introduction of postgraduate students with advantages and disadvantages of genetic modified cultivars of the species considering to diseases pests and weeds.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Understand current efforts in research and development of herbicide resistant crops and genetically modified plants resistant to insects and pests.
2. Understand methods of generation resistant crops to herbicides and insects and pests.
3. Understand potential impacts on weed managements, insect and pest control, pesticide use patterns, scientific research and environment.
4. Economic of herbicides and pest and insects resistant crops.
5. Regulation of the biotechnology in EU, USA and in the other countries in the world.
6. Advantage and disadvantage of use and production of genetically modified crops.

Module content
Genetic modified cultivars of soybean, corn, rapeseed and other cultivars resistant on herbicides application, advantages, disadvantages, agricultural aspect, ecological aspect, bioethical aspect, proposed rules of the GMO in EU and SAD countries and in Croatia.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
All studentswillprepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. Students are advised to prepare exams from required literature lis

Literature
Required reading:

1. Manuscripts from the GMO field in Department of herbology.
2. Duke S. O. et al (1991): Herbicide Resistant Crops.

3. Pierpoint W. S., Shewry (1996): Genetic Engineering of Crops Plants for Resistance to Pest and Diseases.
Old R. W., Primrose S. B. (1994): Principles of Gene Manipulation.
4. Jelaska S. (1994.): Kultura biljnih stanica i tkiva.
5. Anonimus (2001): The Biopesticide Manual, sec. edition BCPC.

Recommended literature:

1. Experts bibliography from Department for herbology, at the Faculty of Agriculture, available on web pages.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.40	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminarski	0.40	1-6	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	1.20	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:
Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
10 teaching hours (lectures) = 0.40 ECTS (10 teachinghours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Seminar paper = 0.40 ECTS (10 hours/75 hours of total load x100 = 20.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/75 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Orchard and Vineyard Protection Against Weeds**	
Module coordinator	Sanda Rašić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Introduction of postgraduate students with problems and possibilities of weed control menagement and weed control methods in orchards and vineyards.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand what are the main weeds in vineyard and orchard.
2. Crop losses by weeds in vineyard and orchards.
3. Methods of weed management and weed control in vineyard and orchards.
4. Why are perennial weeds so hard to control in vineyard and orchards.
5. How can living mulch be incorporated in weed management in vineyard and orchard.
6. To know the advantage and disanvantage of each mechanical, cultural, cover crops, living mulch, physical, biological and chemical weed control technique.

Module content

Weed problems in perennial fruit and grape vine species plantations, control measures, mechanical, cultivation, chemical control measures, measures for soil erosion prevention, unacceptable effect of chemical control measures, plant species in cap function as a control method.

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. Students are advised to prepare exams from required literature lis

Literature

Required reading:

1. Ciglar I. (1998.): Integrirana zaštita voćnjaka i vinograda.
2. Anonimus, Nursery and Landscape Weed Control Manual 2001.

3. Thomson W. T., Tree, Turf and Ornamental Pesticide Guide.
4. Smith A. E. (2000): Handbook of Weed Management System.

Recommended literature:

1. Expert's bibliography from Department of herbology, at the Faculty of Agriculture, available on web pages.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminarski	0.80	1-6	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	2.40	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:
Module has 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Finalexam = 2.40 ECTS (60 hours of preparation/75 hours of total load x 100 = 60.00% from total of 4 ECTS)

Module quality assessment
Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Weed Management in Vegetable Crops**	
Module coordinator	Sanda Rašić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Compulsory module	
Year of studies	All	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 20, E - 0, S - 20

Module aim

Introduction to the weed management in vegetable crops. Problems resulted from weeds in vegetable production, losses caused by weeds and measures to manage on control of weeds.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Understand definition and relative merits of weed prevention, control, eradication and menagement.
2. What are the basic weed problem in vegetable production.
3. What are the basic weed management techniques that should be considered for weed management systems.
4. What things other than weeds must be considered in the design of weed management in vegetable weed management system.
5. Understand and explain the role of cultural, mechanical, physica, biological and chemical control in weed management systems.
6. Understand the role of models and modeling in weed management in vegetable crops.

Module content

Weed problems in vegetable crops. Losses caused by weeds. Measures of weed management and weed control, (cultural (crop rotation and problems caused by residual effect of herbicides), mechanical, physical, biological chemical). Weeds and weed control problems in vegetable crops. Crop rotation and problem by residual effect of herbicide. Repeated low rate application of herbicide. Problem of «minor uses» (small implementation of pesticides in vegetable crops).

Types of teaching

☒ lectures	☐ individual tasks
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements

Students will prepare for seminars and exercises using recommended reading literature. Students make individual seminar works, which they present orally in a twenty-minute period using PowerPoint presentation. Schedule of presentations will be arranged in advance. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Maceljski M. i sur. (2004.): Zaštita povrća od štetočina.
2. Aldrich R. J., Kremer R. J. (1997): Principles in Weed Management.

Recommended literature:

1. Expert's bibliography from Department of herbology, at the Faculty of Agriculture, available on web pages.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.80	1-6	Literature studying, assignment work	Checking student activity orally (conversation), reviewing student'swork and assignments
Seminarski	0.80	1-6	Literature studying, seminar preparationand presentation	Seminar examination andevaluation according to the pre-established criteria
Final exam	2.40	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module has 4 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
4 ECTS credits = 100 hours of module loads
20 teaching hours (lectures) = 0.80 ECTS (20 teaching hours/100 hours of total load x100 = 20.00 % from total of 4 ECTS)
Seminar paper = 0.80 ECTS (20 hours/100 hours of total load x100 = 20.00% from total of 4 ECTS)
Final exam = 2.40 ECTS (60 hours of preparation/100 hours of total load x 100 = 60.00% from total of4 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Allergenic Plants: Monitoring and Control**	
Module coordinator	Edita Stefanic	
Study programme	Postgraduate university study of Agricultural sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 10, S - 0

Module aim

Get acquainted students with most important allergenic plants, research meethods and forecast models in aerobiology, present effective strategies of their control.

Terms of admission

No prerequisites.

Expected learning outcomes

After completing the module, student will be able to:

1. Identify allergenic plants in Republic of Croatia.
2. Interpret phenology of allergenic plants.
3. Distinguish and compare influence of meteorological parameters on pollen presence in the air.
4. Evaluate passive transport of biological particles in the air.
5. Explain the structure of pollen grains.
6. Distinguish pollen grains under microscope and statisticaly analyze and present results.
7. Create and select economically acceptable progrem of management of allergenic weeds.

Module content

Allergenic plants in Republic of Croatia, spread and phenology, Principes of passive transoprt of biological particles in the air, Influence of climatic conditions on pollen presence in the air; Structure of biological particles (pollen grains and spores), Methods, microscopy and presentation of results, Forecast models, Presentation and analze of results, Management of allergenic plant.

Types of teaching

- ☒ lectures
- ☐ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are obliged to atend lectures and exercises. Each student individualy prepare monitoring tape, permanent slides, microscope and analyze obtained results. At the end of semester students have written examination. Students are advised to prepare exams from required literature list.

Literature

Required reading:

1. Grant Smith, E. (1990.): Sampling and identifying allergenic pollens and molds. San Antonio, Texas.
2. Moore, P. D., Webb, J. A., Collins, M. E. (1983): Pollen analysis. Blackwell Scientific Publications.
3. Mandrioli, P., Comtois, P., Levizziani (Eds.)(1998): Methods in Aerobiology. Pitagora Editrice, Bologna.
4. Regione Emilia-Romagna (1994): Monitoraggio aerobiologico in Emilia-Romagna, contributi 30, Unita' Sanitaria Locale n. 31-Ferrara.

Recommended literature:

1. Winkler, H., Ostrowski, R., Wilhem (1993): Pollenbestimmungbuch der Stiftung Deutscher Polleninformationsdienst. TAKT- Verlag.
2. British Aerobiology Federation (1995): A guide to trapping pollen and spores. ISBN 0-9525617-0-0.
3. Ahrens, C. D. (1999): Meteorology Today: An Introduction to Weather, Climate and the Environment. Brookes & Cole.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.40	1-7	Literature study	Checking student activity orally (conversation), reviewing student'swork and assignments
Excercises	0.40	5-6	Literature studying, preparation and analyze of microscopic slides	Review of obtained results
Final examI	1.20	1-7	Preparing for exam bystudying required andrecommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
10 teaching hours (lectures) = 0.40 ECTS (10 teaching hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Exercises = 0.40 ECTS (10 hours/50 hours of total load x100 = 20.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Weed Communities in Agricultural Crops**	
Module coordinator	Edita Stefanic	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	All	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 5, S - 5

Module aim
Acomplish basic knowledge about weed vegetation in different crops.

Terms of admission
No prerequisites.

Expected learning outcomes
After completing the module, student will be able to:
1. Describe morphology of weed commuinities.
2. Identify and interpret factors that influences on habitat.
3. Understand the life cycle of weeds.
4. Interpret relationships in agrosystems.
5. Apply current methods of weed mapping and monitor of weed communites.
6. Recognize weed communities in the fields.

Module content
Significance of phytocosiology in agriculture. Morphology of weed communities. Sintaxonomic units of vegetation. Sinecology of habitats. Sinecology of reproduction and dispersal. Relationships in agroecosystems. Weed flora in cereals and row crops (on fields, horticulture, orchards and vineyards) and ruderal areas. Weed mapping and monitoring of changes in weed comminities and their habitats. Introduction of weed communities on teh fields.

Types of teaching

☒ lectures	☐ individual tasks
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratory
☐ distance education	☐ mentoring
☐ field work	☐ other

Student requirements
Students are obliged to atend lectures and to be prepared for seminars and individual tasks by studying required and recomended literature, Each student pick out topic for individual seminar and are responsible to deliver it in written form on given time. Also, each student present their work orally in 15 min. period using Power Point presentation. At the end of semester students have written examination. Students are advised to prepare exams from required literature list.

Literature
Required reading:

1. Moodle (PFOS_WS) – E. Štefanić -predavanja.

2. Skender, A. (1990): Fitocenologija u spontanim i antropogenim ekosustavima. Sveučllište J.J. Strossmayera u Osijeku,
Poljoprivredni fakultet, Osijek
3. Barbour, M. G., Burk, J. H., Pitts, W. D. (1987): Terrestrial plant ecology. The Benjamin / Cummings Publishing Company, Inc.

Recommended literature:

1. Hulina, N. (1998): Korovi. Školska knjiga, Zagreb.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures	0.60	1-6	Literature study	Checking student activityorally (conversation), reviewing student's work and assignments
Exercise	0.20	1-6	Individual tasks	Deliver and check of individual tasks
Final exam	1.20	1-6	Preparing for exam by studying required and recommended literature	Exam (oral or written)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module carries 2 ECTS credits
1 ECTS credit = 25 workload hours (student's working hours)
2 ECTS credits = 50 hours of module loads
15 teaching hours (lectures + exercises) = 0.60 ECTS (15 teaching hours/50 hours of total load x100 = 30.00% from total of 2 ECTS)
Seminar = 0.20 ECTS (5 hours/50 hours of total load x 100 = 10.00% from total of 2 ECTS)
Final exam = 1.20 ECTS (30 hours of preparation/50 hours of total load x 100 = 60.00% from total of 2 ECTS)

Module quality assessment

Evaluation of teacher's work and evaluation of mentioned module's quality via anonymous student surveys.

Module name	**Plant Protection in Organic Agriculture**	
Module coordinator	Marija Ravlić	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	4
	Lecture hours (L+E+S)	L - 10, E - 15, S - 15

Module aim

Introduction to the basic principles and standards of organic agriculture, methods, measures and plant protection products allowed in organic production in accordance with Croatian and international standards.

Terms of admission

There are no terms of admission

Expected learning outcomes

After completing the module, student will be able to:

1. Define the basic principles of environmentally acceptable plant protection.
2. Describe direct and indirect measures of environmentally acceptable plant protection.
3. Classify biopesticide applicable in plant protection.
4. Apply the rules and laws of integrated pest management.
5. Compare plant protection measures in conventional, integrated and organic agricultural production.

Module content

History, principles and standards in organic agriculture; agro-technical, physical, chemical and biological measures and methods of plant protection allowed in organic production.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are expected to attend classes and participate actively in the tasks during the lectures and exercises. All students are obliged to prepare for lectures and exercises by studying the relevant literature. Students are obliged to prepare and write seminar paper. Seminar paper should be present orally for about 20 minutes with a Power Point Presentation. Schedule of presentation will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature. For laboratory work students are required to wear protective clothing.

Literature

Required reading:

1. Kisić I. (2013):Uvod u ekološku poljoprivredu, Agronomski fakultet Sveučilišta u Zagrebu, Grafički zavod Hrvatske d.o.o.
2. Znaor, D. (1996): Ekološka poljoprivreda. Nakladni zavod Globus. Zagreb.
3. Igrc Barčić J., Maceljski M.(2001): Ekološki prihvatljiva zaštita bilja od štetnika.

Recommended literature:

1. Published scientific papers in reference journals and proceedings.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures an dexercises	1.00	1-5	Reading reqired literature, tasks solving	Assessment of theactivities carried out through conversation, submission and review of completed tasks.
Seminars and seminar paper preparation	0.6	1-5	Studying the required literature, writing andpresentation of seminar paper	Review and evaluation of seminar paper according to pre-defined criteria.
Final exam	2.40	1-5	Exam preparation through studying therequired and recommended literature	Exam (written or oral)
Total	4.00			

The way of calculating ECTS credits for certain activities:

Module has 4 ECTS credits
1 ECTS credit = 25 workload hours (hours of student work)
4 credits = 100 workload hours
25 lecture hours (lectures + excercises) = 1.00 ECTS (25 lecture hours/100 workload hours x 100 = 25.00% of total 4 ECTS
Seminar paper = 0.60 ECTS (15 hours/100 hours of total load x100 = 15% from total of 4 ECTS)
Final exam = 2.4 ECTS = (60 hours /100 workload hours x 100 = 60.00% of total 4 ECTS)

Module quality assessment

The evaluation of lecturer and module quality through anonymous surveys.

Module name	**Toxycology and Ecotoxycology**	
Module coordinator	Suzana Ćavar	
Study programme	Postgraduate university study of Agricultural Sciences, major Plant Protection	
Module status	Elective module	
Year of studies	First	
Credits and teaching	ECTS credits	2
	Lecture hours (L+E+S)	L - 10, E - 5, S - 5

Module aim

Introduction to the toxic effects of pesticides on living organisms, the behavior of pesticides in the environment, methods of determining pesticide residues.

Terms of admission

There are no terms of admission.

Expected learning outcomes

After completing the module, student will be able to:

1. Appoint different groups of pesticides including plant protection products.
2. Compare physicochemical properties and toxicology of plant protection products.
3. Distinguish restrictions in the use of pesticides.
4. Apply safety measures when working with pesticides and prevent environmental contamination.

Module content

Toxicity of pesticides to humans, animals and the environment (toxicity, mode of action), factors of pesticide degradation, pesticide residues in the environment and food, the withdrawal period, tolerance, legislation.

Types of teaching

- ☒ lectures
- ☒ seminars and workshops
- ☒ exercises
- ☐ distance education
- ☐ field work
- ☐ individual tasks
- ☐ multimedia and network
- ☐ laboratory
- ☐ mentoring
- ☐ other

Student requirements

Students are expected to attend classes and participate actively in the tasks during the lectures and exercises. All students are obliged to prepare for lectures and exercises by studying the relevant literature. Students are obliged to prepare and write seminar paper. Seminar paper should be present orally for about 20 minutes with a Power Point Presentation. Schedule of presentation will be arranged in advance. After that, students write a final exam. Students are advised to prepare exams from required literature. For laboratory work students are required to wear protective clothing.

Literature

Required reading:

1. Baličević R., Ravlić M. (2013): Fitofarmacija, interna skripta za studente Poljoprivrednog fakulteta u Osijeku.
2. Baličević R., Ravlić M. (2014): Herbicidi u zaštiti bilja, priručnik, Sveučilište J. J. Strossmayera, Poljoprivredni fakultet u Osijeku.
3. Bagi, F., Bodnar, K. (2012): Fitomedicina, Univerzitet u Novom Sadu, Poljoprivredni fakultet.
4. Šovljanski, R., Lazić, S. (2007): Osnovi fitofarmacije, Univerzitet u Novom Sadu, Poljoprivredni fakultet.

Recommended literature:

Published scientific papers in reference journals and proceedings.

Correlating learning outcomes with teaching methods

Teaching activity	ECTS credits	Learning outcomes	Student activity	Assessment methods
Lectures and exercises	0.60	1-4	Reading reqired literature, tasks solving	Assessment of the activities carried out through conversation, submission and review of completed tasks.
Seminars and seminar paper preparation	0.20	1-4	Studying the required literature, writing and presentation of seminar paper	Review and evaluation of seminar paper according to pre-defined criteria.
Final exam	1.20	1-4	Exam preparation through studying the required and recommended literature	Exam (written or oral)
Total	2.00			

The way of calculating ECTS credits for certain activities:

Module has 2 ECTS credits
1 ECTS credit = 25 workload hours (hours of student work)
2 credits = 50 workload hours
15 lecture hours (lectures + excercises) = 0.60 ECTS (15 lecture hours /50 workload hours x 100 = 30.00% of total 2 ECTS
Seminar paper = 0.20 ECTS (5 hours/50 hours of total load x100 = 10.00% from total of 2 ECTS)
Final exam = 1.20 ECTS = (30 hours /100 workload hours x 100 = 60.00% of total 2 ECTS)

Module quality assessment

The evaluation of lecturer and module quality through anonymous surveys.

After completing the major Plant Protection, student will be able to:

Learning Outcome 1	Define the modern methods of plant protection
Learning Outcome 2	Create a plan for plant protection in agricultural crops on the principles of integrated and ecological pest management
Learning Outcome 3	Apply methods of biological control of weeds, pests, nematodes or diseases
Learning Outcome 4	Connect environmental factors with the possibility of infection with pathogens and the appearance of pests and weeds, as well as soil microorganisms
Learning Outcome 5	Recommend the most appropriate methods of monitoring weeds, pathogens and pests
Learning Outcome 6	Identify allergic plants, nematode community, quarantine pests and disease
Learning Outcome 7	Set up scientific hypotheses and scientific methodology used in plant protection
Learning Outcome 8	Explain the risks of pesticides use on humans, animals, food and environment

2.9. Learning outcomes of the doctoral study "Agricultural Sciences"

	Description of learning outcomes
Outcome 1	Valorization and presentation of basic types of research and technical-technological processes in agriculture.
Outcome 2	Categorization of basic concepts and development of scientific and research work in agriculture.
Outcome 3	Conceive and design independent research in the field of agriculture.
Outcome 4	Critically analyze and evaluate the use of mathematical and statistical models.
Outcome 5	Analysis and synthesis and creation of new research ideas .
Outcome 6	Achieving and interpreting new knowledge through various laboratory and field research.
Outcome 7	Ability to participate in domestic and international scientific research projects .
Outcome 8	Implementation of the latest scientific knowledge and technologies to improve production and organizational processes in agriculture by national research priorities and needs in the public and private sector.
Outcome 9	Quality judgement , connection and solution of the problems seen from a higher level of integration of agricultural science.
Outcome 10	Successful publication of research results in recognized publications to implement new knowledge and skills necessary for the development of a knowledge-based society, both in national and international priorities.
Outcome 11	Successful mastering of applied statistical models in the creation of future research, as well as quality synthesis and presentation of research results in a narrower and wider environment.
Outcome 12	Develop learning skills necessary for lifelong education and further scientific education.
Outcome 13	Quality monitoring, synthesizing and evaluating the necessary domestic and international professional and scientific literature in Croatian and foreign languages.
Outcome 14	Apply and independently improve acquired knowledge and skills by the needs of the workplace.