University of Zagreb Faculty of Agriculture
Svetošimunska cesta 25, 10000 Zagreb
Phone: +385 (0)1 2393 777
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Water management in agriculture (146053)

Course coordinator

Prof. Gabrijel Ondrašek, PhD

Course description

The goal of module is knowledge transfer to students about the issues of i) restricted availability hydro-resources for agricultural food production and ii) water management in different (e.g. waterlogged, water deficient) agro-ecosystems for reducing negative ecological and economical (yield declining, pollution) impacts. Also, the module provides insights and elaborates implementation some of the most applicative computational modelling approaches successful in water management planning and environmental risk assessment.

ECTS: **3.00**

English language: **L1**

E-learning: **L1**

Teaching hours: 30
Lectures: 22
Practicum: 3
Seminar: 5

Lecturer

- Prof. Gabrijel Ondrašek, PhD
- Asst. Prof. Marina Bubalo Kovačić, PhD
- Assoc. Prof. Ivan Mustać, PhD

Associate teacher for exercises

- Prof. Gabrijel Ondrašek, PhD

Grading

Sufficient (2): 60-70%
Good (3): 71-80%
Very good (4): 81-90%
Excellent (5): >91%

Type of course

- Graduate studies / Environment, agriculture and resource management (Compulsory course, 2 semester, 1 year)

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General competencies

Besides to have good knowledge in English language and basic computer skills, student should be able:
- to effectively communicate scientific and practical theories/methods,
- to identify, analyze, and synthesize the information needed to solve a scientific/practical problem and
- to work effectively with others when approaching a scientific/practical problem.

Types of instruction

- Lectures
  students will get the newest scientific and practical insights from the water management in agro-ecosystems.
- Practicum
  students will learn how to use and implement CROPWAT software in irrigation planning and water management.
- Seminars
  students will elaborate one topic related with the module program and present and discuss it with lecturers and colleagues.

Learning outcomes

Learning outcome	Evaluation methods
Arise the knowledge about global water resources and principal threats of their sustainable use.	Mid-term exams, final exams, and tests at the end of course units
Understand principal relations in water balancing and water cycling.	Mid-term exams, final exams, and tests at the end of course units
Understand the importance of proper water management in agriculture.	Mid-term exams, final exams, and tests at the end of course units
Capability to apply sustainable management strategy under disturbed water relations in agriculture.	Mid-term exams, final exams, and tests at the end of course units
Expand the knowledeg about implementation of modelling approaches in water management and environment protection strategies.	Mid-term exams, final exams, and tests at the end of course units
Capability to obtain modelling in irrigation planning.	Mid-term exams, final exams, and tests at the end of course units
Improving of student’s problem elaborating capacity.	Mid-term exams, final exams, and tests at the end of course units
Enhancing of student’s presentational skills.	Presentation of seminars

Working methods

Teachers' obligations

All teaching materials are available in electronic/print form and will be distributed to students.

Students' obligations

Attending lectures, laboratory exercises and seminars are mandatory.

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Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Total number of average student workload	ECTS
1st Colloquium	30%	<60% 60-70% 71-80% 81-90% >90%	Insufficient (1) Sufficient (2) Good (3) Very good (4) Excellent (5)	9	0.9	0.9
2nd Colloquium	30%	<60% 60-70% 71-80% 81-90% >90%	Insufficient (1) Sufficient (2) Good (3) Very good (4) Excellent (5)	9	0.9	0.9
3rd Colloquium	30%	<60% 60-70% 71-80% 81-90% >90%	Insufficient (1) Sufficient (2) Good (3) Very good (4) Excellent (5)	9	0.9	0.9
Seminar	10%			3	0.3	0.3
Total	100%			30	90	3

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Weekly class schedule

1. Water resources and their use in agriculture L - Distribution of surface and groundwater resources and their exploitation potential. Water consumption with emphasise on agri-sector. Main challenges in meeting increasing water demands with satisfied quality level in the era of global worming and human population growth.
2. Water balancing and cycling in soil-plant-atmosphere continuum L - Water cycling in terrestrial and hydro ecosystems. Water balance methods and their elements (input/output). Measuring (Lysimeters) and calculating (Penman Monteith) approaches.
3. Water surplus in agricultural areas and landscape L - Protection of agricultural areas and landscape from outside surplus water. Origin and types surplus water in agriculture areas and environment.
4. Modern drainage systems in regulation of surplus water in agriculture and landscape L - Different manners of regulation surplu water in agricultural areas and landscape, by means of canals, drainpipes, combination canals and drainpipes and etc.
5. Management on drainage areas. Impact of drainage on environment L - Point out on necessity of management on drainage areas and to give schedule of particularly operations and point out on possibly damaged effect drainage on environment. (natural soil and water sources).
6. Water deficit in agriculture L - Reference evapotranspiration. Crops coefficients. Crops water requirements. Water deficit and impact to crops.
7. Irrigation systems in agriculture L - Surface irrigation. Sprinkle irrigation. Micro-irrigation. Low pressurised and low energised irrigation (LEPA, LESA, LPIC, MESA).
8. Irrigation water management and impact to environment L - Irrigation impacts to: i) pedosphere, ii) hydrosphere and iii) irrigated crops.
9. Irrigation water modelling L - Irrigation planning and water management modelling over computational interfaces. Needed input data and their quality. Irrigation scheduling and field water supply calculations.
10. Working with CROPWAT E - Implementation and using a CROPWAT in irrigation planning and water management.
11. Water modelling for environmental assessment purposes L - Introduction in groundwater flow and transport models. Flow and transport processes and governing equations.
12. Water modelling for environmental assessment purposes L - Model design, development and application with emphasis on boundary conditions and model grid.
13. Water modelling for environmental assessment purposes L - Model calibration and validation.
14. Seminar S - Each student will elaborate one topic related with module program and thereafter present and discus it with lecturers and colleagues.
15. Written exam WE

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Obligatory literature

1. Ondrašek G. 2014. Water scarcity & Water stress in Agriculture. In “Physiological Mechanism and Adaptation Strategies in Plants Under Changing Environments I” Parvaiz Ahmad and Mohd Rafiq Wani (Eds.), Springer New York Dordrecht Heidelberg London, pp 439-463.
2. Ondrašek G, Rengel Z, Petosic D, Filipovic V. 2014. Land & Water Management Strategies for the Improvement of Crop Production. In “Emerging Technologies and Management of Crop Stress Tolerance Vol. 2 - A Sustainable Approach. Parvaiz Ahmad, Saiema Rasool (Ed.) London, Elesvier, 291-310.
3. Water for food Water for life. A comprehensive Assesment of Water management in Agriculture. 2007. David Molden ed. International Water Management Institute, 643 p.
4. Allen R.G., Pereira L.S., Raes D., Smith M. 1998. Crop evapotranspiration - Guidelines for computing crop water requirements. FAO Irrigation and Drainage Paper 56. Italy, Rome, 336 p.
5. Smith M. 1992. CROPWAT - A computer program for irrigation planning and management. FAO Irrigation and Draiange Paper 46. Italy, Rome, 127 p.

Recommended literature

1. Water for food Water for life. A comprehensive Assesment of Water management in Agriculture. 2007. David Molden ed. International Water Management Institute, 643 p.