REQUIREMENTS
20/2021 academic year II. semester

Name and code of the subject: **Environmental Technologies II (Water Protection), MK5KVT2K03K117-EN**
Name and title of the person responsible for the subject: Prof. Dr, Tamas Janos
Additional instructors involved in teaching the subject: Dr. Boczonadi Imre
Name and level of the program: Environmental Engineering MSc Program
Subject type: compulsory
Teaching timetable of the subject, type of examination: 2+1 K
Credit value of the subject: 3

Purpose of teaching the subject: Completing the course, students will be familiar with the actual issues and challenges, as well as programs, laws, and technical solutions concerning qualitative and quantitative water resource protection and environmental damage prevention, particularly for water. Considering water resource protection, the course includes related elements of environmental risk assessment and hydrogeological and transport modelling. In addition, strategies and technical solutions for the protection against flood, drought, excess surface water and contamination. Tools to reduce risk and damage in the environment caused by them will also be detailed.
Completing the practice, students will gain skills on water resource and water balance calculations for both surface and groundwater bodies via individual project work and assessment of case-studies, they will understand and be able to apply modelling and risk assessment methods related to water resource protection and environmental damage prevention related to water.

Content of the subject (14 weeks):

1. Lecture: Vulnerability of water resources, global water balance and related issues.
Practice: Water resource and water balance calculations: individual project.
2. Lecture: Water resources, water utilization, water balance.
Practice: Hydrogeological modelling: model parametrization.
3. Lecture: Assessment, monitoring and protection of drinking water resources. Water Framework Directive of the European Union.
Practice: Hydrogeological modelling: scenario analyses.
4. Lecture: Methods for qualitative and quantitative protection of surface water bodies and subsurface water bodies.
Practice: Case-study: water body vulnerability, actions for protection – surface water.
5. Lecture: Environmental risk assessment methodology.
Practice: Case-study: water body vulnerability, actions for protection – groundwater water.
6. Lecture: Legal relations of ERA.
Practice: Environmental risk assessment, individual project: hazard identification and quantification.
7. Lecture: Tools of ERA. Drought prevention, risk reduction and mitigation. Practice: Environmental risk assessment, individual project: applying risk evaluation methods and applicability assessment.

8. Lecture: Hydrogeological and transport processes and modelling. Regional sharing of water. Practice: Environmental risk assessment, individual project: risk evaluation.
9. Lecture: Flood prevention, risk reduction and mitigation. Rehabilitation of contaminated water bodies.

Practice: Environmental risk assessment, individual project: assessment of risk reduction alternatives.

Type of mid-term examination:

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): written exam

Teaching aids:

Recommended literature:

1. Required: • Hipel, Keith W.; Fang, Liping; Cullmann, Johannes; Bristow, Michele (2015): Con-flict Resolution in Water Resources and Environmental Management. Springer Verlag. ISBN-13: 9783319142142

2. Recommended: • Loucks, Daniel P.; van Beek, Eelco; Stedinger, Jery R.; Dijkman, Jozef P.M.; Villars, Monique T. (2005): Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications, Paris: UNESCO, ISBN 9231039989: https://ecommons.cornell.edu/handle/1813/2804.

REQUIREMENTS
21/2022 academic year II. semester

Name and code of the subject: Irrigation for horticulture production, MTMVG 7010A
Name and title of the person responsible for the subject: Attila Nagy, PhD, associate professor
Additional instructors involved in teaching the subject: Zsolt Zoltán Fehér, Senior lecturer
Name and level of the program: Agricultural Engineer in Environmental Management MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 2+1 K
Credit value of the subject: 3

Purpose of teaching the subject: Production of appropriate quality and quantity horticultural products is provided by excellent irrigation technological practices. The main purpose is the irrigation for the water demand of cultivated plants. The aim of the subject is to introduce the students to the basics of vegetable and fruit irrigation, to recognize the most effective irrigation methods in horticultural crop production, to recognize the irrigation water requirement of horticultural plants and the opportunities of irrigation modelling in horticulture.

1. The role of water management. The historical overview of irrigation. Situation of irrigation in the world.
2. Basic irrigation concepts and principles of irrigation planning. Recognition of water forms in soil.
3. Measuring of water resources in soil and water status in plants.
4. Technical basics of irrigation (water acquisition, pumps, pipe networks).

5. Technical basics of irrigation (fertigation, fertilizer delivering and dosing).
6. Irrigation methods and purposes in vegetable production.
7. Irrigation methods and purposes in fruit production.
8. Irrigation opportunities in field vegetable production.
9. Irrigation opportunities in greenhouse vegetable production.
10. Irrigation properties of certain fruit species.
11. Irrigation properties of vineyards.
12. Relationship between irrigation and plant protection in vegetable and fruit production.
13. The role of irrigation quality.
14. Remote sensing and GIS in precision irrigation techniques.

Content of the subject (14 weeks):

Skills to be learnt: The general aim of the practice is that students learn modern irrigation systems in vegetable and fruit plantation and such greenhouse systems, where effective growing is provided by developed irrigation control and fertigation system.
Students adopt irrigation scheduling, quantity, quality and temporal issues of irrigation practices. In order to determine irrigation water requirement, the moisture content of soil, practical calculations are learnt. Students learn the applicability of the most modern irrigation simulation programs in horticulture.

1. Soil moisture calculation, practical application of pF curve in horticulture.
2. Calculation of irrigation requirement of horticultural plants.
3. Water abstraction planning.
4. The role of FAO Cropwat 8.0 and AquaCrop 6.0 software in irrigation modelling.
5. Applicability of FAO Cropwat 8.0 irrigation modelling software in horticulture I.
6. Applicability of FAO Cropwat 8.0 irrigation modelling software in horticulture II.
7. Applicability of FAO Cropwat 8.0 irrigation modelling software in horticulture III.
8. Field exercise/farm visit I.
9. Field exercise/farm visit II.
10. Field exercise/farm visit III.
11. Field exercise/farm visit IV.
12. Field exercise/farm visit V.
13. Field exercise/farm visit VI.
14. Consultation about compulsory practical report.

Type of mid-term examination: -

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): written exam at the end of the semester

Teaching aids: -

Recommended literature:

1. Allen, R. G., Pereira, L. S., Raes D., Smith M. (1998): Crop evapotranspiration: guidelines for computing crop water requirements. Irrigation and Drainage Paper no. 56. FAO. Rome, Olaszország, 300 p.

2. Christen, E., Ayars, J., Hornbuckle, J., Hickey, M. (2006): Technology and practice for irrigation in vegetables. NSW Department of Primary Industries. State of New South Wales. 59 p.
3. Stetson, L. E. (2011): Irrigation. 6th edition. Irrigation Research Institute. 1089 p.
4. Wickson, E. J. (2015): Irrigation in Fruit Growing. Scholar's Choice, 166 p. (ISBN: 978-129-809-435-3)

REQUIREMENTS
2021-22. academic year II. semester

Name and code of the subject: Hydrobiology MTMVG7003A.
Name and title of the person responsible for the subject: Dr. Pregun Csaba
Additional instructors involved in teaching the subject: -
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: 2/1
Teaching timetable of the subject, type of examination: 28 hour(s) lecture and 14 hour(s) practice per **semester**
Credit value of the subject: 3

Purpose of teaching the subject:
Course objectives: Students will acquire knowledge of the hydrobiological aspects of the agriculture, water management, environmental protection and nature conservation. Students learn about the relationship among the environment and aquatic ecosystems. Students will acquire the water biological and ecological knowledge that are necessary for agricultural water management practice (water qualifications, abstraction and distribution, design, construction and maintenance of water treatment and wastewater treatment, management of natural and artificial waterbodies and wetlands, aquaculture & irrigation systems etc.).

Content of the subject (14 weeks):
1. The concept of Hydrobiology. The main forms of surface water and groundwater bodies.
2. The biologically relevant physical and chemical properties of inland waters. The material and energy cycles of waters.
3. General Limnology. The aquatic habitats and biomes.
4. Aquatic communities. General. The concept of plankton
Aquatic communities. The phytoplankton
5. Aquatic communities. The zooplankton
6. Aquatic communities. Macroinvertebrates
7. Aquatic communities. Macroinvertebrates & FFG,
8. Aquatic communities. Macrophytes.
9. Aquatic communities. The animals of nekton. Physiology & ecology of fishes.
10. The ecological relationships of aquatic life communities (C-N-P cycles).
11. The biological (ecological) water qualification.
12. The methods of biological indications. The role of the macroscopic aquatic invertebrate in the field of the ecological water qualification.
13. Water pollution and eutrophication. Protection of natural and artificial water bodies (ponds) against eutrophication.
14. The biological aspects of waste water purification (Constructed Wetlands)

Type of mid-term examination:
Partial written exam

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): colloquium,

Teaching aids:
Ppt, Water Quality Labour
Recommended literature:

1. Mitsch, William J., and James G. Gosselink. Wetlands, Wiley, 2015. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/unidebhu/detail.action?docID=1895927. Created from unidebhu on 2018-10-30 01:05:36.
2. Wetzel R. (2001): Limnology. Lake and River Ecosystems. 3rd Edition. Academic Press. Hardcover ISBN: 9780127447605, eBook ISBN: 9780080574394.
3. FISRWG (10/1998).Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the US gov't). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN3/PT.653. ISBN-0-934213-59-3.

REQUIREMENTS
2021-22. academic year II. semester

Name and code of the subject: Floodplain management MTMVG7009A
Name and title of the person responsible for the subject: Dr. Pregun Csaba
Additional instructors involved in teaching the subject: -
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: obligatory
Teaching timetable of the subject, type of examination: 28 hour(s) lecture and 14 hour(s) practice per **semester 2+1 K**
Credit value of the subject: 3

Purpose of teaching the subject:
The purpose of the course is to provide the student with an understanding of the principles and current practices for managing floodplains, and other flood hazard areas, to bring about flood-loss reduction and natural resource protection, emphasizing multi-disciplinary approaches to management. Students will learn the relationship between the hydrology, hydraulics, ecology, river morphology. Students get to knowledge the impacts of human activities on the floodplains and the basic possibilities of the river corridor restoration. Within the integrated river basin management, the river valley is presented as an ecological entity along with its flood and inland water protection, water resource management and environmental and nature conservation aspects. The latter are concerned with the role of floodplain and backwaters in landscape protection, in the ecological corridor network, in recreation, in aquatic and ecotourism. The possibilities for river and wetlands restoration are also reviewed.
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Content of the subject (14 weeks):
1. The concept of floodplain. History of flood management. Floodplain management as part of water resources management. Integrated river basin management and water resource management in the river valley.
2. The hydraulics of the streams.
3. The fluvial geomorphology of the streams and river corridors.

4. Geomorphological and ecohydrological properties of the rivers and river valley.
5. River ecology. The river as a living ecosystem (River continuum and Flood Pulse Concept)
6. The types of floods and floodplains;
7. The river and floodplain classification. The Rosgen classification.
8. The hydrologic computational techniques. Risk assessment.
9. Flood hazard studies; discussion of floodplain management plan.
10. Flood damage reduction strategies and tools.
11. Natural functions and resources of floodplains and their value.
12. Strategies and tools to preserve and/or restore natural and beneficial floodplain resources.
13. Floodplain Management and Protection of Wetlands.
14. River corridor and watershed management

Type of mid-term examination:
Partial written exam

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): colloquium,

Teaching aids:

3. The theoretical and practical material of the course is available in pdf and ppt format.

Recommended literature:

1. Mitsch, William J., and James G. Gosselink. Wetlands, Wiley, 2015. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/unidebhu/detail.action?docID=1895927. Created from unidebhu on 2018-10-30 01:05:36.
2. Wetzel R. (2001): Limnology. Lake and River Ecosystems. 3rd Edition. Academic Press. Hardcover ISBN: 9780127447605, eBook ISBN: 9780080574394.
3. FISRWG (10/1998).Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the US gov't). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN3/PT.653. ISBN-0-934213-59-3.

REQUIREMENTS
Academic year 2021/2022, semester 2

Name and code of the subject: Wastewater and slurry management MTMVG7011A
Name and title of the person responsible for the subject: Péter Tamás Nagy (PhD)
Additional instructors involved in teaching the subject: -
Name and level of the program: Agricultural Environmental Management Engineering MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 2+1 practical grade
Credit value of the subject: 3

Purpose of teaching the subject:
It introduces students to laboratory and rapid analytical methods used in wastewater analysis and the related wastewater and slurry management.
Students will be able to determine the quality of wastewater, and thus the likely impact of water pollution and its hazardousness, and to decide on the need for intervention. They will gain useful knowledge on the application of different water cleaning technologies. They will gain an overview of the main issues and options for the treatment and use of sewage sludge.

Students will be able to actively participate in teamwork and thus be involved in research and development research and development projects.

Content of the subject (14 weeks):

1. Introduction to the course, Importance of water cleaning, Rights and legal claims, Water and health, Challenges.
2. Why treat wastewater? Water pollution classifications, types, sources.
3. Case study about struvite and nitrate as an actual problem in wastewater treatment.
4. Iron and manganese in wastewater.
5. Ocean pollution problems (HAB) Calculation of iron and oxigen removing
6. Arsenic in Groundwater - a Natural Threat
7. Chemical calculations (water hardness)
8. Odours in waste water – emissions and technical measures
9. Reverse osmosis, ion exchange, green roofs in urban waste water management
10. Sewer systems, Wetlands
11. Sewage treatment plant
12. Treatment flow chart, primary treatment in waste water management
13. Secondary and tertiary treatment in waste water management
14. Slurry management

Type of mid-term examination:

2 mid-year exams. Attendance of the practices, keeping a practical diary. Being active in group works; Completing lab works; Taking part in field visits

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): practical grade is based on oral report is taken in the examination period of the semester focusing on the knowledge gained. Submitting reports in due time, successful mid-year exams, taking part actively in the practices and field trips and completing home work individually are compulsory.

Teaching aids: ppt presentations, online websites

Recommended literature:

Wun Jern N.G 2006. Industrial wastewater treatment. Imperial College Press, ISBN 1-86094-508-5

Cheremisinoff N.P. 2002. Handbook of water and wastewater technologies. Butterworth-Heinemann, ISBN: 0-7506-7498-9

Russell D.L. 2006. Practical Wastewater Treatment, 2nd Edition, John Wiley & Sons, Inc. ISBN: 978-1-119-10085-0

REQUIREMENTS
academic year 2021/2022, semester 2

Name and code of the subject: Water resource protection and water damage prevention MTMVGH7013A

Name and title of the person responsible for the subject: Dr. Elza Kovács, associate professor

Additional instructors involved in teaching the subject:

Name and level of the program: agricultural water management engineering MSc

Subject type: compulsory

Teaching timetable of the subject, type of examination: 2+2 practice

Credit value of the subject: 4

Purpose of teaching the subject: Completing the subject, students will understand the actual challenges of water resource protection and water-related environmental damage prevention, the European legislation of qualitative and quantitative water resource protection, and its implementation. They will know the environmental risk assessment methods in relation to the water resource protection, including the modeling tools, too. As part of the subject, the water resource management, flood and drought management, and handling water contamination in practice will be introduced as well. Practice will include the improvement of skills such as water resourcee and water balance calculations, modeling hidrogeological processes, and applying different risk assessment tools. They work on individual projects and use relevant software.

Content of the subject (14 weeks):

1. Vulnerability of water resources
2. Global and regioinal water resources and their utilization, water balances
3. Actual and potential drinking water resources, and their protection
4. Water policy and implementation in the European Union
5. Qualitative and quantitative monitoring and protection tools for surface water resources
6. Qualitative and quantitative monitoring and protection tools for groundwater resources
7. Environmental risk assessment methodology
8. Legislation of environmental risk assessment and management
9. Tools of environmental risk assessment
10. Hidrogeological processes and their modeling
11. Flood control
12. Drought control
13. Regional water resource management
14. Management of surface water and groundwater contamination

Type of mid-term examination: Completing assignments / exercises adapted from the Exercise book: Practical exercises for the course of Agro-environmental management II -

ecotoxicology, environmental management; Being active in group works; Completing lab works; Taking part in field visits

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): Essay type written exam is taken in the examination period of the semester focusing on the knowledge gained. Submitting reports in due time, taking part actively in the practices and field trips and completing home work individually are compulsory. Student may skip class maximum 3 times during the semester.

Teaching aids: ppt presentations, online websites

Recommended literature:
Journal of Water Resource Protection https://www.scirp.org/Journal/jwarp/
Hadrian F. Cook: The protection and conservation of water resources. 2nd Ed. Wiley Online Library, ISBN:9781119334316, DOI:10.1002/9781119334316
Áine Gormley, Simon Pollard, Sophie Rocks: Guidelines for Environmental Risk Assessment and Management. Cranfield University, 2011:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69450/pb13670-green-leaves-iii-1111071.pdf
Best available techniques – guidelines: http://eippcb.jrc.ec.europa.eu/reference/
http://eippcb.jrc.ec.europa.eu/reference/BREF/IRPP_Final_Draft_082015_bw.pdf
Exercise book: Practical exercises for the course of agro-environmental management II - ecotoxicology, environmental management

REQUIREMENTS
2021/2022 academic year II. semester

Name and code of the subject: Farm machines of the irrigation-irrigation technology MTMVG7015A
Name and title of the person responsible for the subject: Dr. Zoltan Hagymassy associate professor
Additional instructors involved in teaching the subject: Safwan Mohammed
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 1+2 Practical grade
Credit value of the subject: 3

Purpose of teaching the subject:
Students learn about the irrigation systems equipment, the machines structural elements, and the settings of the equipment. Students able to managing the operation of the machines. Based on the studies Students necessary to plan the workflow of the irrigation system.

Content of the subject (14 weeks):

1. Mechanics of Fluids I.
2. Mechanics of Fluids II.
3. Water Pump Features

4. Type of pumps
5. Operation of Water Pump
6. Pipes and pipelines
7. Couplings, pipe fittings
8. Pipe Shut-off devices.
9. Water supply systems in agriculture
10. Drainage equipment
11. Irrigation equipment I.
12. Irrigation equipment II.
13. Irrigation equipment III.
14. Water Power Machines

Type of mid-term examination:
Participation in practical classes is a condition for obtaining a signature. Absences are no more than 30**%.** Completing exercises.

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): practical grade

Teaching aids: Power point slides of university lectures issued to students

Recommended literature:
Glenn J. Hoffman, Robert G. Evans, Marvin Eli Jensen, Derrel L. Martin, Ronald L. Elliott: Design And Operation Of Farm Irrigation Systems ISBN-13: 978-1892769640, ISBN-10: 1892769646
Brian Bell: Farm Machinery ISBN 1903366682
John Carrol: Tractors and Farm Machinery ISBN-13: 978-0754826583

REQUIREMENTS
21/2022 academic year II. semester

Name and code of the subject: Integrated water management and monitoring, MTMVG7018A
Name and title of the person responsible for the subject: János Tamás professor
Additional instructors involved in teaching the subject:
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 3+2 K
Credit value of the subject: 5

Purpose of teaching the subject: Within this subject the students get acquainted with the Hungarian and international management systems of water catchment areas and the evaluation methods of these systems as well. They learn the planning specifications of water catchment areas of the Carpathian basin emphasing the cases of the Hungarian catchment areas. By this subject the students will be able to solve water management tasks alone, and they will be able to coordinate the planning and implementation phases of minor catchment areas.

Content of the subject (14 weeks):

1. Definition and development of integrated watershed management
2. International management systems of catchment areas, Catchment areas of the Carpathian basin

3. Elaboration of monitoring systems, data collection and data analysis
4. Specifications of catchment area management of Tisza
5. Danube - Drava river basin management
6. Watershed management of the Lake Balaton and its area
7. Industrial water use – Alternative water resources
8. Urban water management
9. Waterways regulation
10. Drainage and reserving of water
11. Irrigation – drought management
12. HEC-RAS
13. SWAT
14. DHI

Type of mid-term examination:

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): written exam

Teaching aids: -

Recommended literature:

Chow, V. T., Maidment, D. R., Mays, L. W. (1988) Applied Hydrology. McGraw-Hill Book Company. 558 p. (ISBN: 978-007-010-810-3)

ICPDR (2015): The Danube River Basin District Management Plan. International Comission for the Protection of the Danube River – ICPDR. https://www.icpdr.org/

Lawson, J. (2005): River Basin Management. CRC Press. 369 p. (ISBN: 0415392004)

REQUIREMENTS
22/2021 academic year II. semester

Name and code of the subject: Excess water management, MTMVG7020A
Name and title of the person responsible for the subject: Attila Nagy, PhD, associate professor
Additional instructors involved in teaching the subject: Edit Gorliczay, assistant lecturer
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 2+2 K
Credit value of the subject: 4

Purpose of teaching the subject: Causes and conditions of forming of excess water. Excess water systems and water shed areas in plain lands. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration. Tools of implementation, technical, agrotechnical and agronomical measures aiming at excess water management. Designing and setting of outlet systems. Setting and maintaining excess water outlet canals. Objects of excess water outlet canals – sluices, water controlling objects – objects serving outlet water control. Preparation of water shed management plans. Retaining and fast outlet of excess waters in a particular area. Utilisation of excess waters for the decrease of water demand of irrigation. Reutilisation of waters, the quality of retained, stored water. Management

focusing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.

Content of the subject (14 weeks):

1. Basic definitions of excess water management.
2. Causes and conditions of forming of excess water.
3. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration.
4. Tools of implementation, technical, agrotechnical and agronomical measures aiming excess water management.
5. Excess water systems and watershed areas.
6. Technical, agrotechnical and agronomical measures of excess water management.
7. Objects of excess water outlet canals, objects serving outlet water control.
8. Designing and setting of outlet systems. Objectives of drainage, types of drainage systems in excess water (temporary water cover) management.
9. Setting, maintaining and objects of excess water outlet canals.
10. Preparation of water shed management plans.
11. Utilisation of excess waters for the decrease of water demand of irrigation.
12. Management focussing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.
13. Formation mechanism of temporary excess (surface) water cover and its adverse effects on soil quality and crop production.
14. Basic principles of law governing water use management.

Type of mid-term examination: -

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): Written exam is taken in the examination period of the semester focusing on the knowledge gained.
Teaching aids: -

Recommended literature:

1. Larry W. Mays (2011): Water resources engineering. ISBN-13: 978-0470460641, ISBN-10: 0470460644
2. Nakagami, Ken'ichi, Kubota, Jumpei, Setiawan, Budi Indra (Eds.) (2016): Sustainable water Management. Springer. ISBN: 9789811012044 9811012040 9811012024 9789811012020
3. Cech, Thomas. 2005. Principles of Water Resources: History, Development, Management, and Policy. 2nd Edition. Wiley.
4. Todd, D.K., Groundwater Hydrology, 2nd ed., Wiley, New York, 1980.

REQUIREMENTS
22/2021 academic year II. semester

Name and code of the subject: Excess water management, MTMVG7020A
Name and title of the person responsible for the subject: Attila Nagy, PhD, associate professor
Additional instructors involved in teaching the subject: Edit Gorliczay, assistant lecturer
Name and level of the program: Agricultural Water Management Engineering MSc

Subject type: compulsory
Teaching timetable of the subject, type of examination: 2+2 K
Credit value of the subject: 4

Purpose of teaching the subject: Causes and conditions of forming of excess water. Excess water systems and water shed areas in plain lands. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration. Tools of implementation, technical, agrotechnical and agronomical measures aiming at excess water management. Designing and setting of outlet systems. Setting and maintaining excess water outlet canals. Objects of excess water outlet canals – sluices, water controlling objects – objects serving outlet water control. Preparation of water shed management plans. Retaining and fast outlet of excess waters in a particular area. Utilisation of excess waters for the decrease of water demand of irrigation. Reutilisation of waters, the quality of retained, stored water. Management focusing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.

Content of the subject (14 weeks):

15. Basic definitions of excess water management.
16. Causes and conditions of forming of excess water.
17. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration.
18. Tools of implementation, technical, agrotechnical and agronomical measures aiming excess water management.
19. Excess water systems and watershed areas.
20. Technical, agrotechnical and agronomical measures of excess water management.
21. Objects of excess water outlet canals, objects serving outlet water control.
22. Designing and setting of outlet systems. Objectives of drainage, types of drainage systems in excess water (temporary water cover) management.
23. Setting, maintaining and objects of excess water outlet canals.
24. Preparation of water shed management plans.
25. Utilisation of excess waters for the decrease of water demand of irrigation.
26. Management focussing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.
27. Formation mechanism of temporary excess (surface) water cover and its adverse effects on soil quality and crop production.
28. Basic principles of law governing water use management.

Type of mid-term examination: -

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): Written exam is taken in the examination period of the semester focusing on the knowledge gained.
Teaching aids: -

Recommended literature:

5. Larry W. Mays (2011): Water resources engineering. ISBN-13: 978-0470460641, ISBN-10: 0470460644

6. Nakagami, Ken'ichi, Kubota, Jumpei, Setiawan, Budi Indra (Eds.) (2016): Sustainable water Management. Springer. ISBN: 9789811012044 9811012040 9811012024 9789811012020
7. Cech, Thomas. 2005. Principles of Water Resources: History, Development, Management, and Policy. 2nd Edition. Wiley.
8. Todd, D.K., Groundwater Hydrology, 2nd ed., Wiley, New York, 1980.

REQUIREMENTS
2021/2022 academic year II. semester

Name and code of the subject: Agricultural water supply systems MTMVG7001A

Name and title of the person responsible for the subject: Dr. Juhász Csaba, associate professor

Additional instructors involved in teaching the subject: Kovács Elza, associate professor

Name and level of the program: Agricultural Water Management Engineering MSc

Subject type: obligatory

Teaching timetable of the subject, type of examination: 2+2K

Credit value of the subject: 4

Purpose of teaching the subject: Acquiring theoretical and practical knowledge of agricultural water supply systems (mainly of their technical tasks and legislation).

Content of the subject (9 weeks):

1. The basics and tasks of water management planning. The most important separate provisions of water licensing and the water management planning process.
2. The water management and water protection authorities
3. Water legislation
4. The elements of water supply for agricultural purposes
5. Authorization of agricultural water facilities
6. Watercourses, channels, reservoirs
7. Flood protection, readiness states, flood barriers, water meadows
8. Legislation of maintain river basins and sides
9. The water use charge, and the agricultural water supply fee. Agricultural water management sector development.

Summary of content – practice (9 weeks):

1. GIS and remote sensing in water management planning
2. The water management and water protection authorities
3. Water legislation
4. The elements of water supply for agricultural purposes
5. Authorization of agricultural water facilities
6. Inland water channel design

7. The concept, purpose and means of flood protection, readiness states, flood barriers, water meadows
8. Legislation of maintain river basins and sides
9. The water use charge, and the agricultural water supply fee.

Type of mid-term examination:
Written exam.

Method of assessment (semester examination mark - report, practical grade, colloquium, examination):
The implementation of the practices. Missing the practice in accordance with the University of Debrecen Study and Exam Regulations. Active participation in exercises.

Teaching aids:
ppt presentations.

Recommended literature:
M. Gupta, P. Srivastava, G. Tsakiris, N. Quinn.: 2019. Agricultural Water Management. Theories and Practice. Academic Press. 416 p.
A. Iglesias, L. Garrote, A. Cancelliere, F. Cubillo, D. Whilhite.: 2009. Coping with Drought Risk in Agriculture and Water Supply Systems. Springer. 356 p.
S.N. Ghosh.: 2018. Flood Control and Drainage Engineering. CBC Press. 400 p.

REQUIREMENTS
2021/22 academic year II. semester

Name and code of the subject: **Agricultural water management planning and implementation , MTMVG7022A**
Name and title of the person responsible for the subject: Dr. habil. Attila Nagy, associate professor
Additional instructors involved in teaching the subject:
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 1+2 G
Credit value of the subject: 3

Purpose of teaching the subject: In order to get acquainted with agricultural production security and with the adaption to climate change students will study water retention, sustainable management of water resources, water saving irrigation technology planning, design, production methods adapted to climate change and sustainable land use planning processes. Students will acquire the appropriate methods, tools and effects of irrigation technology for the creation of a sustainable irrigated crop management conditions.
Students will be able to evaluate the water capacity of soils at agricultural sites, analyzing the water balance of agricultural sites, identification of sites with erosion risk, assessment and application of agronomic, technical and forestry practices of hilly drainage, lowland drainage, analyzing and planning amelioration. Identification of sites with excess water, creating irrigation fertigation scheduling, and irrigation planning.

Content of the subject (14 weeks):

1. Water drainage on hilly regions.
2. Delineation of areas at risk of erosion, evaluation and applicability of agronomic, technical and forestry practices of hilly drainage
3. Plains water management, excess water drainage.
4. Channeling, channel planning
5. Methods of soil pipe drainage network planning and design. Soil and groundwater investigations methods in correspondence with soil piping, the soil pipe network construction, operation and maintenance.
6. Structure and planning of Micro Irrigation Systems
7. Structure and planning of Sprinkler Systems
8. Structure and planning of Surface Design of irrigation systems
9. irrigation and fertigation planning.

The purpose of the practice is to enable students to understand the water balance of arable land and orchards. In addition, Student will be able to delineate erosion risk areas, landscaping on hilly sites by agro technical, technical and forestry methods, melioration options and design. In addition, vulnerable areas can be delineated for the preparation of irrigation plans and planning of irrigation turns for nutrient solution.

1. Geospatial delimitation of excess water effected areas, drainage collection calculation modeling
2. Channel measurement
3. Methods of designing the piping networks. Soil and groundwater studies related to soil piping.
4. Designing, operating and maintaining pipeline networks.
5. Design of surface irrigation systems
6. Preparation of irrigation and nutrient plan for sprinkling irrigation systems
7. Assessment of irrigation and nutrient management plan for sprinkling irrigation systems
8. Preparation of irrigation and nutrient plan for sprinkling micro-sprinkling systems
9. Assessment of irrigation and nutrient management plan for sprinkling micro-sprinkling systems

Type of mid-term examination:

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): written exam

Teaching aids:

Recommended literature:

1. Uhlig, U. (2011): Current Issues of Water Management. InTech Published. 340 p. ISBN: 978-9533074139.

2. Kumar, M. D., Sivamohan, M. V. K., Bassi, N. (2012): Water Management, Food Security and Sustainable Agriculture in Developing Economies (Earthscan Studies in Water Resource Management). Routledge. 256 p. ISBN: 978-0415624077.
3. Tanji, K. K., Kielen, N. C. (2006): Agricultural Drainage Water Management in Arid and Semi-arid Areas. FAO. ISBN: 978-8172334567.
4. H. Bjornlund, C. A. Brebbia, S. Wheeler: Sustainable Irrigation and Drainage IV: Management, Technologies and Policies. WIT Press / Computational Mechanics. 2012. ISBN-13: 978-1845646486
5. Chaudhry, M. H. (2007): Open-Channel Flow. Springer. 2nd edition. 540 p. ISBN: 978-0387301747.
6. Majumdar, D. K. (2012): Irrigation Water Management: Principles and Practice. PHI Learning Private Limited. 570 p. ISBN: 978-8120317297.

REQUIREMENTS
22/2021 academic year II. semester

Name and code of the subject: **Water policy, water law and sectoral public administration, MTMVG7023A**
Name and title of the person responsible for the subject: Dr Nikolett Szőllősi, assistant professor
Additional instructors involved in teaching the subject:
Name and level of the program: Agricultural Water Management Engineering MSc
Subject type: compulsory
Teaching timetable of the subject, type of examination: 2+1 K
Credit value of the subject: 3

Purpose of teaching the subject: In the frame of global environmental problems, students get detailed information about water related environmental issues. Students gain knowledge about the legal background of water as natural resource. In addition strategic planning and implementation in EU.

Content of the subject (14 weeks):

1. Water related environmental problems and achievements, Importance of water, global organizations - WHO, Global Water Partnership, High Level Panel On Water
2. Environmental policy and other related sectoral policies
3. European Innovation Partnership on Water and achievements, WFD, Ground Water
4. Water in Nature protection in EU, Natura 2000, standard data forms
5. EU water acquis
6. Water abstraction; Legal Institutions for water allocation and water-related Organisations in Hungary
7. Agriculture and climate change - Land Identification System, Green Direct Payments
8. European Irrigation Association, ISO 16075-1:2020, Minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge (JRC) – Risk Management Framework
9. Urban Waste Water Treatment Directive
10. Institute for European Environmental Policy (IEEP), CAP post 2020

Type of mid-term examination: Completing assignments / exercises listed in Exercise
Practical exercises for the course of Water Policy

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): Colloquium

Teaching aids: ppt presentations, online websites

Recommended literature:

4. Groundwater Governance 2016. Global Framework for Action to achieve the vision on Groundwater Governance, p. 115.
5. UNESCO 2016. The United Nations World Water Development Report 2016. ISBN 978-92-3-100146-8, ePub ISBN 978-92-3-100155-0, p. 148.
6. United Nations Environment Programme 2014. Green Infrastructure Guide for Water Management: Ecosystem-based management approaches for water-related infrastructure projects. ISBN: 978-92-807-3404-1 p. 75.
7. HIGH LEVEL PANEL ON WATER 2016. Action Plan. p. 23.
8. European Commission 2014. General Union Environment Action Programme to 2020 Living well, within the limits of our planet. European Union. ISBN 978-92-79-34724-5 doi:10.2779/66315 p. 87.