Kiertotalous AMK – Circular Economy for Water ($CE4H_2O$)

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Use of study materials

This is an assisting material especially for teachers who would like to get ideas how and what to teach about circular economy of water. The topic of water management and circular economy is wide, therefore this material is not trying to cover all of the related aspects. For example, the importance of hydrology, water circulation and infrastructure as well as nutrients and energy flows are important in this content and part of these topics are dealt in other material packages produced in the project. This material can also be used for independent study and no pre-requisites expect basic computer skills (word, excel, and PowerPoint software, the Internet) are needed.

The course consists of 5 parts:

Rules and Regulations in international as well as national context, 1 ECTS (Metropolia)
Risk Assessment, 1 ECTS (Metropolia)
Blue Economy, 1 ECTS (LAB)
Sustainable sanitation, 1 ECTS (LAB)
Case studies of RDI, technological solutions and business opportunities, 2 ECTS (KAMK)
Sustainable wastewater treatment plants
Adsorption for wastewater treatment and water purification.

Each part contains study materials (lectures, ready-to-use presentations, or collection of external links), assignments, and instructions for their implementation.

If you or your students have a little knowledge of the circular economy in water management one can see for example the recording done in the world circular economy forum (2019): https://www.sitra.fi/en/articles/circular-economy-water/

Learning outcomes:

The student will:

- understand the benefits of using the risk assessment through calculation of annual average damage (ADD) method
- understand drivers and concepts of the blue and circular economy
- get alternative solutions for sustainable sanitation and water management

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- understand objectives and implementation of national and international regulations used water management sector
- gain social awareness and acceptance as a factor of development for innovative technological solutions and their implementations
- understand the needs in recovery and re-use of raw and valuable materials for economy and technological development

Task performance requirements (assigments):

Calculation of the AAD -value according to given data (assessment is qualitative, 1-5)

UN convention - group work questions (grading summary)

Short Essay about Treaty (UN) and its implementation with respect to Finnish boarder (assessment is qualitative, 1-5)

Essay about SDG14 (assessment is qualitative, 1-5)

Reflection task: Principles of Circular Economy (assessment is qualitative, 1-5)

Reflection task: Abstract about drinking Water, Sanitation and Hygiene (peer reviewed)

Essay about dry toilet seminars (assessment is qualitative, 1-5)

Multiple choice task: test of basic knowledge on adsorption technique (80% pass)

Multiple choice task: cost-effective adsorbents for water treatment ((80% pass)

Water reclamation and reuse (grading summary, assessment is qualitative, 1-5)

Judgment:

The judgment is done against competence objectives. Teacher can select criterias by oneself suitable for context.

Short description of the contents of different topics:

Each of the following topics are described more detailed in separated documents.

Part 1. Risk Assessment

The student will be using different simple methods and tools to measure and observe the world around them self. They will be following up what is happening with flood-endangered areas and how this might be possible to avoid or mitigate. In addition, the various methods for enabling the circular economy in practice will be implemented and reviewed.

Course Material: Study materials are compiled mainly from online material on the basis of supervisors' instructions. Two pre-recorded lectures: Risk management for Storm water and Flooding, AAD method and calculations.

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Assignment: Calculation of the AAD -value according to given data

Part 2. Rules and Regulations in international as well as national context

The student will be using various examples to picture the scenarios and observe the world around them self. They will be following up what is happening with different internationally sensitive areas. The various methods for reporting the impacts, including circular economy and sustainable development in practice will be implemented and reviewed.

Course Material: Study materials are compiled mainly from online material on the basis of supervisors' instructions. Group work.

Assignments: UN convention - group work and questions as peer assessment

Short Essay about Treaty (UN) and it's implementation with respect to Finnish boarder (assessment is qualitative, 1-5- peer assessment and presentation). In distance studies, the presentation can be recorded and peer assessment can be requested for the videos made of the presentations).

Part 3. Blue Economy

The student will have the knowledge about the principles of blue economy and be aware of the related SDG14 (Sustainable development goal 14) due to the videos and documents available online. The student will also understand the integration and possibilities of the blue economy and circular economy. The knowledge will be deepen due to the two assignments.

Course Material: Study materials are compiled mainly from online material on the basis of supervisors' instructions. Ready-to-use presentation.

Assignments:

Essay about SDG14 (assessment is qualitative, 1-5);

Reflection task: Principles of Circular Economy (assessment is qualitative, 1-5).

Part 4. Sustainable sanitation

The student will learn how SDG (sustainable development goals) will ensure availability and sustainable management of water and sanitation in a global level. Also selected case studies related to dry toilets will deepen student knowledge of the practical applications and their interactions with principles of circular economy.

Course Material: Study materials are compiled mainly from online material on the basis of supervisors' instructions. Topics: current global situation of the water and sanitation services, sustainable development goals (esp. 6), different dry toilet concepts, their relations to circular economy. Ready-to-use presentation.

Assignments:

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Reflection task: Abstract about drinking Water, Sanitation and Hygiene (peer reviewed)

Essay about dry toilet seminars (assessment is qualitative, 1-5)

Part 5. Case studies of RDI, technological solutions and business opportunities

5.1 Sustainable wastewater treatment plants

The student will learn a conventional point of view on operation and purposes of wastewater treatment facilities. New vision on wastewater treatment plant as Water Resourse Facroties (WRF) will be given. Novel practices and real cases implemented will be described. Necessity and possibilities of resource recovery for purpose of sustainable development will be addressed.

After studying this nugget the student will be acquainted with a history of wastewater treatment actions, potential resources to be recovered from wastewater treatment plant (WWTP), drivers for reconstruction of WWTP to WRF, and real cases of resource recovery successfully implemented worldwide.

Course Material: Study materials are compiled mainly from online material on the basis of supervisors' instructions. Ready-to-use presentation.

Assignments

Presentation group task: Water reclamation and reuse (grading summary, peer assessment). The presentation can be recorded and peer assessment can be requested for the videos made of the presentations).

5.2 Adsorption for wastewater treatment and water purification

The student will be able to learn, by means of selected case studies, necessity and practices of adsorption approach implementation in different areas of water treatment technology for industrial and municipal applications. Nutrient recovery and reuse, emerging pollutant removal (including organic and pharmaceutical restudies, toxic metals, and microplastics), and an improving overall water quality by adsorption will be addressed.

The basic knowledge on adsorption will be given as open-source lectures in order to refresh and deepen the attainments. Two presentations devoted to adsorbent types and applications of adsorption in industrial and municipal water treatment practices will be allocated for independent study hours. Course assignments will include the choice of an absorption approach for the particular case and some technical calculations for its implementation. Students will be following up state-of-the-art adsorption techniques based on waste-to-value and circular economy concepts in accordance with principles of sustainable development.

Course Material: Study materials are composed from online open access sources (text and video), presentations, and supervisors' instructions. Ready-to-use presentations.

Assignments

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Assignments through Moodle-platform. Multiple choice task: test of basic knowledge on adsorption technique.

Assignments through Moodle-platform. Multiple choice task: cost-effective adsorbents for water treatment.

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