UNIVERSITY OF MISKOLC

FACULTY OF
EARTH AND ENVIRONMENTAL
SCIENCE AND ENGINEERING

Subject name:
Water and wastewater treatment

FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES & ENGINEERING
MSc education

Course communication dossier

UNIVERSITY OF MISKOLC
FACULTY OF EARTH AND ENVIRONMENTAL SCIENCES & ENGINEERING
Institute of Raw Materials Preparation and Environmental Technology

Recommended semester: 3

Contents

1. COURSE DESCRIPTION

Course Title: Water and wastewater treatment	**Credits: 3**
Type of course: compulsory	Neptun code: MFEET730028
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: 2 **lec + 1 sem**	
Type of Assessment (exam. / pr. mark. / other): **pr. mark** **Assessment and grading** Requirements of the practical mark: Less than 20 % class missing; Presenting the laboratory measurements reports; Writing the classroom test successfully **Assessment:** Five grades scale Assessment according to a five grade scale: Missing basic knowledge – unacceptable Student demonstrates basic knowledge – acceptable Student demonstrates basic knowledge and can apply it in practice – intermediate Student demonstrates system level knowledge in contexts – good Student demonstrates outstanding system level knowledge in contexts - excellent **Assessment:** 88 – 100: excellent (5), 75 – 87: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).	
Position in Curriculum (which semester): 3	
Pre-requisites *(if any)*: -	
Course Description:	
Aim of the course: The students will be familiar with the basic elements and concepts of modern water and waste water purification technology and processes. The students will be able to choose the right purification technology concerning environmental protection aspects. **Course description:** Contamination and pollution processes in water. Pollution limits in water and in groundwater. The most typical contaminants and their physical and chemical properties. Sampling, and preparations of samples. Treatment processes: mechanical processes I. Treatment processes: mechanical processes II. Treatment processes: chemical processes. Treatment processes: biological processes. Cleaning and purification technology for municipal waste water I. Cleaning and purification technology for municipal waste water II. Cleaning and purification technology for industrial waste water. Case study. Technology design.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
Klaus Görner- Kurt Hübner: Gewaesserschutz und Abwasserbehandlung; Springer-Verlag Berlin heidelberg, 2002. M Henze; P Harremoes; J la C Jansen; E Arvin: Wastewater Treatment; Springer-Verlag Berlin heidelberg, 2002 Spellmann F. R.:Handbook of water, and wastewater treatment plant operations, Lewis Publishers, 2003.	

Woodard F.: Handbook of water, and waste water treatment technologies, Butterworth-Heinemann, 2001.
Dr. Michael R. Templeton , Prof. David Butler: Introduction to Wastewater Treatment. 2013
Drechsel, Pay, Qadir, Manzoor, Wichelns, Dennis (Eds.): Wastewater Economic Asset in an Urbanizing World. Springer 2017.
Fatta-Kassinos, Despo, Dionysiou, Dionysios D., Kümmerer, Klaus (Eds.): Advanced Treatment Technologies for Urban Wastewater Reuse

Competencies to evolve:

Knowledge

Knows and applies scientific and technical theory and practice related to the profession of environmental engineering.

Has a comprehensive knowledge of measurement technology and measurement theory related to the field of environmental engineering.

Knows the operation of environmental protection facilities (especially water and wastewater treatment plants, hazardous and communal landfills, waste incinerators), their structures and the possibilities of their development.

Skills

Can apply the acquired general and specific mathematical, natural and social science principles, rules, connections and procedures in solving problems arising in the field of environmental protection.

Able to plan in a complex way, implement and maintain engineering interventions in the fields of soil, subsurface, water, air, noise and vibration protection, wildlife protection, remediation and waste reduction, treatment, and processing.

Able to design, implement and operate environment-focused management systems.

Competence in terms of attitude

Open and receptive to the knowledge and acceptance of professional, technological development and innovation in the field of environmental protection, and its authentic mediation.

Assumes the professional and moral values related to the field of environmental protection. Strives to carry out the required work in a complex approach based on a systems-based and process-oriented way of thinking.

Competence in terms of autonomy and responsibility

Takes the initiative in solving environmental problems, identifies the shortcomings of the applied technologies, the risks of the processes and initiates the measures to reduce them.

Evaluates the work of subordinated employees, promotes their professional development by sharing critical remarks, educates employees and subordinates on responsible and moral professional practice.

Monitors legislative, technical, technological and administrative changes in the field of profession.

Responsible Instructor (*name, position, scientific degree): Sándor NAGY (PhD)*

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

2. COURSE TOPICS

Course topics (WEEKLY SCHEDULE)

Hét	**Dátum - *Date***	***Lecture and Practical Classes***
1.		Contamination and pollution processes in water.
2.		Pollution limits in water and in groundwater.
3.		The most typical contaminants and their physical and chemical properties.
4.		Sampling, and preparations of samples.
5.		Treatment processes: mechanical processes I.: *Screens and sedimentation*
6.		Treatment processes: mechanical processes II.: *Filtration*
7.		Treatment processes: chemical processes: *Acidic or base wastewaters, desaltening, heavy metals, oxidation*
8.		Treatment processes: biological processes: *Aerobic and anaerobic treatment.*
9.		Cleaning and purification technology for municipal waste water
10.		Cleaning and purification technology for industrial waste water.
11.		Case studies/Plant visit
12.		Case studies/Plant visit
13.		Witten examination/Pre-exam
14.		Witten examination/Pre-exam

3. SAMPLE Written examination

Written examination

Water and wastewater purification

14th December 2017.

27 (5)

1. Settlement (principle, process, 3 example for equipment) (10) 10

2. Aerobe biological treatment (flowsheet, equipment 2 type) (10) 10

3. Water treatment plant in Miskolc Tapolca (flow sheet, capacity, about membrane) (8) 7

60 minutes

Min.: 14 points

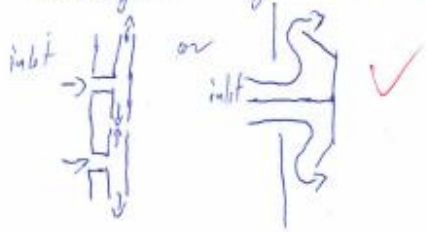
1.a) Principle is based on the Stokes law where the particles settle based on the particle size, liquid and solid density and the driving force of the settlement is the gravity. Stokes also consider the viscosity of the fluid.

$$v = \frac{d^2 \cdot (\rho_s - \rho_f) \cdot g}{18 \cdot \mu}$$

d = particle diameter
g = gravity constant
μ = viscosity of the fluid
v = viscosity
ρ_s = solid density

Particles bigger than $d \geq 0{,}02$ µm can settle, below this the colloids remain in suspension.

b) The settlement process can be static or moving. The aim of this process is to remove particles like sand or sludge. The inlet of the water must not disturb the settling process therefore they should be designed in respect to this.



The most common static sludge removal is the circular tank.
The diameter of these tanks are 15-30 m usually and ~3 m deep.

sludge is collected on the bottom and pumped out

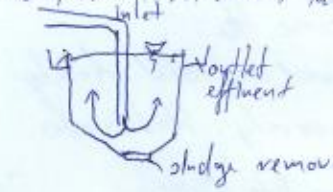
There is an equipment which direct the sludge to the bottom by using a plate.

this moving belt directs the particles to the sludge removing part.

Dinamic settlement tank.

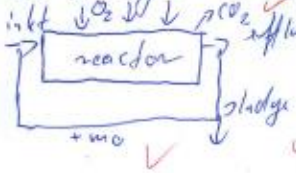
Compressed air is moving the water in a circular pattern. The bubbles decrease the adhesive ability of the particles to remain in suspension and therefor they settle
The settled particles moved by a vehicle

Continuous settlement tank

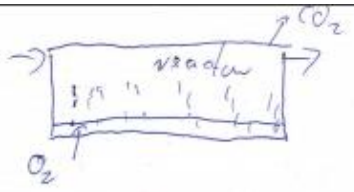


2. Aerob biological treatment

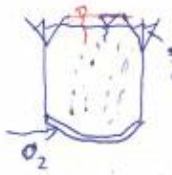
The basic theory is that micro organisms use the waste water as food a useful material.
The micro organism use the biologically degradable material with oxygen and create energy and CO_2.
BOD is the measurement base which gives the amount of biological oxygen demand.
The main nutrients compounds for bio treatment are C, N, P, S and they ratio is best in 100:16:1:1 amount. The pH is also important best is between 6-8 pH
Temperature is also important and also special type of mo. There should be enough but not too much m.o.



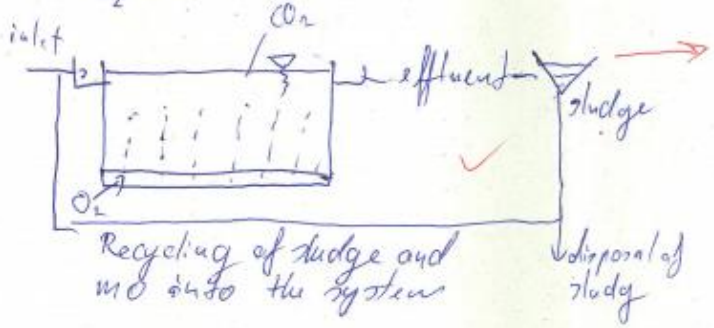
The surface O_2 replenishment is inefficient only 2-3 m effective depth and 20% oxygen efficiency



Compressed air is pumped from the bottom
6m deep tanks can operate with 30% oxygen efficiency



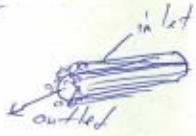
Vertical tower like tanks



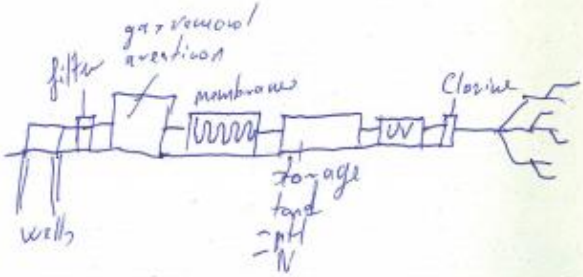
3. The water extracted from quantic aquifers, from 20-30m deep wells. The daily capacity is 1500 m^3 of drinking water ✓

- First step is filtration for particles ✓
- Aeration for dissolved gas removal
- The water for biological and other ~~the~~ treatment is flown through a membrane system.
- Released into a storage tank where N content is measured, also pH.
- Water before released into the system is cleaned with UV and
- Finally Cl is added to the system water to avoid infection in the pipeline system

- Long membrane system
- pH is also measured



The membranes have holes the small tubes which allow the water to flow through but not the mo. and other contaminants. They can be cleaned and made from synthetic materials ✓



4. EXAM QUESTIONS

5. OTHER REQUIREMENTS

Using mobile phones during the exam is forbidden.

Miskolc, 04/01/2023

Dr. Sándor Nagy
Head of Institute, Associate Professor