ENVIRONMENTAL GEOTECHNICS

Environmental Engineering MSc mesterszak

2022/23 I. félév

TANTÁRGYI KOMMUNIKÁCIÓS DOSSZIÉ

Miskolci Egyetem
Műszaki Földtudományi Kar
Környezetgazdálkodási Intézet

Tartalomjegyzék

1. Tantárgyleírás, tárgyjegyző, óraszám, kreditérték

Course Title: Environmental Geotechnics **Instructor:** Dr. Andrea Tóth Kolencsikné, associate professor	**Code:**MFKHT730030 **Responsible department/institute:** Institute of Environmental Management
	Type of course: Compulsory
Position in curriculum (which semester): 3	**Pre-requisites (if any):**MFKHT710008
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 2	**Course:** full time

Course Description:

The students will be familiar with the basic concepts of environmental geotechnics.

The short curriculum of the subject:

Barrier systems, geological and geosynthetic barrier systems, horizontal and vertical barriers. Geotechnical aspects of landfilling. Stability and deformation of waste dumps, liner systems. Physiochemistry of soils for geoenvironmental engineering. Changing of soil parameters caused by contaminants. Investigation of contaminated sites. Geotechnical problems of remediation. Soil improvement.

Compatencies to evolve:

Knowledge:

T3 – Knows and applies environmental and remediation procedures (operations, equipment, devices), environmental remediation methods.

T7 – Knows and applies the methodology and tools of environmental informatics and modeling in a complex way.

T8 – Knows the basics, boundaries, and requirements of the fields of work, as well as fire protection, safety technology, information technology, law, economics and management related to environmental engineering.

Ability:

K7 – Able to plan and conduct environmental sampling works, comprehensive laboratory testing and analysis, to apply monitoring systems, evaluate and document test results.

K10 – Able to apply integrated knowledge of environmental equipment, processes, technologies, and related electronics and informatics.

K13 – Able to perform energy efficiency analyzes, surveys, audits, identify measures and support their implementation.

K14 – Able to plan and support the execution of complex (environmental-economic-social) works.

K15

Attitude:

A2 – Assumes the professional and moral values related to the field of environmental protection.

A5 – Strives to improve the knowledge of both him/herself and subordinated employees through continuous training.

A7 – Shares experiences with co-workers, thus helping their development.

Autonomy and responsibility:

F1 – Can solve environmental engineering tasks independently, takes decisions carefully, in consultation with the representatives of other (mainly legal, economic, energy) fields, independently, takes responsibility for the decisions.

F3 – 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.

F6 – Monitors legislative, technical, technological and administrative changes in the field of profession.

Assessment and grading:

Students have to prepare several calculation tasks and lab experiments, which must be documented.

Students will be assessed through the attendance and the reports.

Requirement for the signature: >90 % attendance and >60% quality of the reports

Grading scale of the final exam:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Compulsory or recommended literature resources:

- Craig: Soil mechanics, 1969.
- Sarsby, R.: Environmental Geotechnics. Thomas Telford, 2000.
- Davis, M.L.- Cornwell, D.A.: Introduction to Environmental Engineering. WCB McGraw-Hill, Boston, 1998.

- Bell, F.B.: Environmental Geology. Blackwell Science Ltd, Oxford, 1998.
- Rowe, K.R.: Geotechnical and Geoenvironmental Engineering Handbook. Kluwer Academic Publishers, 2000.

2. TANTÁRGYTEMATIKA

Environmental Geotechnics
Tantárgytematika (Time schedule)
Aktuális tanév őszi félév
Hidrogeológus mérnök mesterszakMSc, 3. félév, törzsanyagos tárgy

Dátum	Lecture and practice
2022.09.06	Summary of previous knowledge in soil mechanics
2022.09.13	Lecture 1: Functions and applications of geosynthetic materials Lecture 2: Testing and designing with geosynthetics
2022.09.20	Lab experiment 1: loading test of soil with different moisture content, and reinforcement usage of geogrid
2022.09.27	Lecture 3: Landfill design 1 – site selection and geotechnical testing methods
2022.10.04	Lab experiment 2: measuring the effect of clogging on hydraulic conductivity of soil sample
2022.10.11	Lab experiment 3: measuring the water uptake capacity of soil samples
2022.10.18	Lecture 4: Landfill design 2 – landfill liner and covering systems
2022.10.25	Practice 1: Calculation task for Landfill drainage system design
2022.11.01	break
2022.11.08	Lecture 5: Soil- pore water – contaminant interaction, transport phenomenas in geotechnics
2022.11.15	Practice 2: Numerical calculations for creating breakthrough curves
2022.11.22	Lecture 6: Geotechnical site investigation methods and tools
2022.11.29	Lecture 7: Geotechnical aspects of remediation
2022.12.06	Lecture 8: Soil improvement methods

3.ÍRÁSBELI VIZSGA KÉRDÉSSOR

The exams have written form.
It contains:

- a minimum part from terminology (the minimum level is 3 accepted answer from 5 questions)
- a second part needed longer descriptions of learned topics (the minimum level is 60 %)
- a third part contains test type questions covering all the topics

Environmental Geotechnics
terminology for final written test

Terminology related to Geosynthetic materials

Anchor Trench
Bottom Barrier System
CCL
Clogging
Composite Barrier
Cover System
Creep
Extrusion Welding
Fibre
Filtration
Gas Control System
Geocell
Geocomposite
Geogrid
Geomembrane
Geonet
Geopipe
Geosynthetics
Geosynthetic Clay Liner (GCL)
Geotextile
Grab Test
Heat Bonded
HDPE High Density Polyethylene
HDPE Membrane
Interface Shear Strength
Landfill
Leachate
LCRS - Leachate Collection and Removal System
Liner
Mass Per Unit Area
Needle Punched
Non-Destructive Seam Testing
Nonwoven fabric
Opening Size

Permittivity
Polyester Fibre
Polyethylene
Polymer
Polyvinyl Chloride (PVC)
Protection Layer
PVD – Prefabricated Vertical Drain
Reinforcement
Sealing Compounds
Separation
Service Life
Stress Relaxation
Survivability
Tensile strength
Tensile Testing
Tear Testing
Waste

Environmental geotechnics - Terminology related to transport, remediation

Absorption
Active Barrier
Adsorption
Advection
Aerobic
Anaerobic
Aqueous Solubility
Attenuation
Biodegradation
Breakthrough Curve
Cation Exchange Capacity
Chemical Stability
Constituent
Contaminant
Contaminant Transport
Contamination
Diffusion
Dispersion
Distribution Coefficient (kd)
Flux
Hydrocarbon
Hydrophilic
Hydrophobic
Ion Exchange
Natural Attenuation
Nutrients
Oxidation and Reduction (Redox)
Partitioning
Pathway
Remediation

Remediation Target
Residual Contamination
Retardation
Retention Time
Solubility
Solutes
Source
Travel (Transit) Time
Aliphatics
Aromatics
BTEX
Chlorinated aliphatics
Chlorinated aromatics
DNAPLs
Dry residue
EC
Heavy metals
LNAPLs
MTBE
NAPLS
PAHs
PCBs
Phenols
TDS
TPH
VOCs

Environmental Geotechnics
topics of the final written test

Topics of the second part:

1. Geosynthetic materials:
    a. types, behaviour
    b. functions, applications
    c. main properties
    d. testing methods
2. Landfills
    a. waste pyramid
    b. landfill types
    c. subsoil requirements, needed testing methods
    d. the building of liner layers
    e. advantages and disadvantages of GCL
    f. landfill recultivation, covering system
    g. Geotechnical laboratory and field testing methods in landfill site design and operation
3. Bottom liner system based on hungarian regulations (order of layers and important properties)
4. Drainage collection and removal system:

    a. parts of the system
    b. functions of the system’s parts
    c. regulated parameters
    d. analytical design of drainage layer properties
5. transport phenomenas, clay minerals and contaminant-soil interaction
    a. types of clay minerals
    b. main properties of clay minerals
    c. diffuse double layer and dependency of parameters
    d. the effects of contaminants on different parameters of soils
    e. contaminant transport phenomenas in groundwater
    f. parameters of transports
    g. the effects of the different transports for a plume
    h. sources of plumes
6. Soil improvement
    a. the theory of soil improvement
    b. types of soil improvement
    c. the basics of compaction
    d. the basics of pre-compression
    e. type of admixtures
    f. grouting methods
7. Geotehnical aspects of remediation
    a. planning of the investigation
    b. investigation methods
    c. tpyes of subsurface investigations
    d. CPT and special sondes
    e. horizontal and vertical barriers
    f. hydraulic barriers