



# ENVIRONMENTAL GEOTECHNICS

Hydrogeology MSc mesterszak

2020/21 I. félév

TANTÁRGYI KOMMUNIKÁCIÓS DOSSZIÉ

**Miskolci Egyetem**  
**Műszaki Földtudományi Kar**  
**Környezetgazdálkodási Intézet**

## **Tartalomjegyzék**

1. Tantárgyleírás, tárgyjegyző, óraszám, kreditérték
2. Tantárgytematika (óraóra lebontva)
3. Vizsgakérdéssor

## 1. Tantárgyleírás, tárgyjegyző, óraszám, kreditérték

<b>Course Title:</b> Environmental Geotechnics	<b>Code:</b> MFKHT730030												
<b>Instructor:</b> Dr. Andrea Tóth Kolencsikné, associate professor	<b>Responsible department/institute:</b> Institute of Environmental Management												
	Type of course: Compulsory												
<b>Position in curriculum (which semester):</b> 3	<b>Pre-requisites (if any):</b> MFKHT710008												
<b>No. of contact hours per week (lecture + seminar):</b> 1+1	<b>Type of Assessment (examination/ practical mark / other):</b> exam												
<b>Credits:</b> 2	<b>Course:</b> full time												
<p><b>Course Description:</b>  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.  Competencies to evolve:  Knowledge: T3, T7, T8  Ability: K7, K10, K13, K14, K15  Attitude: A2, A5, A7  Autonomy and responsibility: F1, F3, F6</p>													
<p><b>Assessment and grading:</b>  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: &gt;90 % attendance and &gt;60% quality of the reports  Grading scale of the final exam:</p> <table> <thead> <tr> <th>% value</th> <th>Grade</th> </tr> </thead> <tbody> <tr> <td>90 -100%</td> <td>5 (excellent)</td> </tr> <tr> <td>80 – 89%</td> <td>4 (good)</td> </tr> <tr> <td>70 - 79%</td> <td>3 (satisfactory)</td> </tr> <tr> <td>60 - 69%</td> <td>2 (pass)</td> </tr> <tr> <td>0 - 59%</td> <td>1 (failed)</td> </tr> </tbody> </table>		% value	Grade	90 -100%	5 (excellent)	80 – 89%	4 (good)	70 - 79%	3 (satisfactory)	60 - 69%	2 (pass)	0 - 59%	1 (failed)
% value	Grade												
90 -100%	5 (excellent)												
80 – 89%	4 (good)												
70 - 79%	3 (satisfactory)												
60 - 69%	2 (pass)												
0 - 59%	1 (failed)												
<p><b>Compulsory or recommended literature resources:</b></p> <ul style="list-style-type: none"> <li>• Craig: Soil mechanics, 1969.</li> <li>• Sarsby, R.: Environmental Geotechnics. Thomas Telford, 2000.</li> <li>• Davis, M.L.- Cornwell, D.A.: Introduction to Environmental Engineering. WCB McGraw-Hill, Boston, 1998.</li> <li>• Bell, F.B.: Environmental Geology. Blackwell Science Ltd, Oxford, 1998.</li> <li>• Rowe, K.R.: Geotechnical and Geoenvironmental Engineering Handbook. Kluwer Academic Publishers, 2000.</li> </ul>													

## 2. TANTÁRGYTEMATIKA

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

<b>Dátum</b>	<b>Lecture and practice</b>
<b>2020.09.15</b>	Lecture 1: Functions and applications of geosynthetic materials Lecture 2: Testing and designing with geosynthetics
<b>2020.09.29</b>	Lab experiment 1: loading test of soil with different moisture content, and reinforcement usage of geogrid
<b>2020.10.13</b>	Lab experiment 2: measuring the effect of clogging on hydraulic conductivity of soil sample Lab experiment 3: measuring the water uptake capacity of soil samples
<b>2020.10.20</b>	Lecture 3: Landfill design 1 – site selection and geotechnical testing methods Lecture 4: Landfill design 2 – landfill liner and covering systems Practice 1: Calculation task for Landfill drainage system design
<b>2020.11.10</b>	Lecture 5: Soil- pore water – contaminant interaction, transport phenomenas in geotechnics Practice 2: Numerical calculations for the effect of soil parameters for the breakthrough curves
<b>2020.11.24</b>	Lecture 6: Geotechnical site investigation methods and tools Lecture 7: Geotechnical aspects of remediation
<b>2020.12.08</b>	Lecture 8: Soil improvement methods
<b>2020.09.15</b>	Lecture: Geotechnical site investigation methods and tools
<b>2020.09.29</b>	Lecture: Geotechnical aspects of remediation

### **3.ÍRÁSBELI VIZSGA KÉRDÉSSOR**

**The exams have written form.**

**It contains:**

- a minimum part from terminology (the minimum level is 7 accepted answer from 10 questions)
- a second part needed longer descriptions (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 ( $k_d$ )  
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. Geotechnical 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