

# Ministry of Higher Education and Scientific research



Department of Soil and Water Sciences

College of Agricultural Engineering sciences

University of Salahaddin-Erbil

Subject: Soil Engineering

Course Book – *For* (3<sup>rd</sup> year students)

Lecturer's name:

1- Dr. Muslim Rasul Arab KHoshnaw<sup>1</sup>

2- Assist. Lect. Haval Haji Yousif<sup>2</sup>

<sup>1</sup>B.Sc. Soil and Water/ Salahaddin University – Erbil / 2006

<sup>1</sup>M.Sc. Soil and Water/Plant Nutrition/ Salahaddin University – Erbil / 2011

<sup>1</sup>PhD. In Soil and Water/Soil chemistry 2020// College of Agricultural Engineering sciences / Salahaddin University-Erbil

<sup>2</sup>BSc. 2013, in Soil and water/ University of Salahaddin-Erbil

<sup>2</sup>MSc. 2020, in Soil Engineering/ Soil and water/ University of Salahaddin-Erbil

**Academic Year: (2023-2024)**

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## Course Book

1. Course name	Spring semester 2023-2024
2. Lecturer in charge	Dr. Muslim Rasul Arab KHoshnaw <sup>1</sup> Assist. Lect. Haval Haji Yousif <sup>2</sup>
3. Department/ College	Soil and Water Sciences, Agricultural Engineering sciences.
4. Contact	e-mail: <a href="mailto:muslim.khoshnaw@su.edu.krd">muslim.khoshnaw@su.edu.krd</a> Tel: 7504538564 e-mail: <a href="mailto:haval.yousif@su.edu.krd">haval.yousif@su.edu.krd</a> Tel: 7504937535
5. Time (in hours) per week	Theory: 2 hours per week Practical: 2 hours per week
6. Office hours	6 hours/week
7. Course code	
8. Teacher's academic profile	The main points in my academic profile can be summarize as follow:  2. Lecturer in charge: Assist. Lect. Haval Haji Yousif 3. Department/ College, Soil and water/ College of Agricultural Engineering sciences 4. BSc. 2013, in Soil and water/ College of Agricultural Engineering sciences MSc. 2020, in <u>Soil Engineering</u> / Soil and water/ College of Agricultural Engineering sciences / Salahaddin Univ 5. Contact e-mail: <a href="mailto:haval.yousif@su.edu.krd">haval.yousif@su.edu.krd</a> Tel: (0750 493 7535) 6. Time (in hours) per week Practical: 2h. (35) Marks. 7. Office hours (6)h//week 8. Course code
9-Keywords	Soil definitions in different sciences, uses of soil in engineering, main soil properties in soil engineering. Earthworks, Soil volume change, Soil swelling and shrinkage and Soil geotechnical properties, Soil improvements.

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10-Soil is so important material and source for life that we cannot imagine life without it. The soil has different meanings depending on branch of science for example the use of soil in engineering science is differing from agricultural sciences. The soils very important in soil mechanic and civil engineering. It is also a type of natural resource and has different applications.

11. Course objective:

Goals of the course or Goals of studying Soil Engineering:

- 1-Introduce the students with the essential concepts of the engineering properties of soils in soil engineering in additional to the definition of soil in different sciences.
2. Understanding of soils as engineering materials and its uses.
3. Studying the engineering properties of soils.
4. Helping the students to be familiar with the soil sampling, soil testing and site investigation.
- 5- The differing between soil in engineering and agricultural sciences.

12. Student's obligation:

The student must have an important role:

- 1- The students must contribute in the scientific discussions in the class or teaching hall.
- 2- The students must know the importance of quizzes, homework, reports and exams.
- 3- It is necessary to contribute the student in presentation a scientific subject.

13. Forms of teaching:

There are different forms of teaching:

- 1-Datashow and power point.
- 2- White board.
- 3-Lectures.

14. Assessment scheme

Breakdown of overall assessment and examination:

- 1-Monthly exam 9 marks.
- 2-Quizzes 2 marks.
- 3-Present and contributing in scientific discussions 2 marks.
- 4-Seminar 2 marks.





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<p>7- Laboratory Measurement of Optimum Moisture Content (OMC) and Maximum Dry Density (MDD)</p>	<p>Assist. Lect. Haval H. Yousif (2) h</p>
<p>7- Engineering properties of Gravels, sand, silt, organic matter and clay.</p> <p>8- (Compaction Test) by Sand cone method, and Nuclear Method (compacted density).</p>	<p>Dr. Muslim Rasul Arab KHoshnaw 8<sup>th</sup> (2) h. Assist. Lect. Haval H. Yousif (2) h</p>
<p>9 and 10 - Role of soil and clay minerals in limiting soil engineering properties in irrigation projects and buildings.</p> <p>9- Visiting to Hawler Construction Laboratory</p> <p>10- CBR test</p>	<p>Dr. Muslim Rasul Arab KHoshnaw 9<sup>th</sup> and 10<sup>th</sup> meeting (4) h. Assist. Lect. Haval H. Yousif (2) h Assist. Lect. Haval H. Yousif (2) h</p>
<p>11-and 12 - General comparison between soil in uses engineering science and agricultural science.</p> <p>11-Soil swelling and shrinkage</p> <p>and 12. Soil improvements technics</p>	<p>Dr. Muslim Rasul Arab KHoshnaw 11<sup>th</sup> and 12<sup>th</sup> meeting (4) h. Assist. Lect. Haval H. Yousif (2) h Assist. Lect. Haval H. Yousif (2) h</p>

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13- Soil Chemical Analysis (Calcium Carbonate)	Assist. Lect. Haval H. Yousif (2) h									
14- Visiting to MRG Laboratory or any Eng. Project in the Erbil City	Assist. Lect. Haval H. Yousif (2) h									
<b>15- Second examination.</b>	(1)h.									
<p>18 Extra notes: Nothing</p> <p><b>Q.1- Define each of the following terms:</b></p> <p><b>1- Soil engineering:</b> means the application of the principles of soil mechanics in the investigation, evaluation and design of civil works involving the use of earth materials and the inspection and testing of the construction. It also deals with taking various soil tests that helps in correctly interpreting what field conditions are safe or unsafe for construction works</p> <p><b>2- Coarse Aggregate:</b> Generally aggregate larger than 4.75 mm in diameter, referred to as stone or gravel.</p> <p><b>3- Sieve Analysis:</b> A process in which an aggregate is separated into its various sizes by passing it through screens of various size openings for the purpose of determining the distribution of the quantities separated.</p> <p><b>4- ASTM:</b> American Society for Testing and Materials</p> <p><b>5- Plastic Limit (PL):</b> The water content, in percent, at the point of transition from semisolid to plastic state. Or the moisture content at which soil begins to behave as a plastic material</p> <p><b>Q.2- What is the differences between soil sampling For (Agriculture and Engineering)</b></p> <table border="1"> <thead> <tr> <th></th> <th>for <b>Engineering</b></th> <th>for <b>Agricultural</b></th> </tr> </thead> <tbody> <tr> <td><b>1</b></td> <td>samples are taken will include <b>surface</b> exploration (study) and <b>subsurface</b> exploration of a <b>site</b>.</td> <td>samples are taken will include only surface of the <b>field</b></td> </tr> <tr> <td><b>2</b></td> <td>Subsurface exploration is done by using various methods such as digging pits, trenches, borings and cone or standard penetration tests, using heavy trucks</td> <td>Surface exploration is done by using auger, shovel and other simple tools.</td> </tr> </tbody> </table>			for <b>Engineering</b>	for <b>Agricultural</b>	<b>1</b>	samples are taken will include <b>surface</b> exploration (study) and <b>subsurface</b> exploration of a <b>site</b> .	samples are taken will include only surface of the <b>field</b>	<b>2</b>	Subsurface exploration is done by using various methods such as digging pits, trenches, borings and cone or standard penetration tests, using heavy trucks	Surface exploration is done by using auger, shovel and other simple tools.
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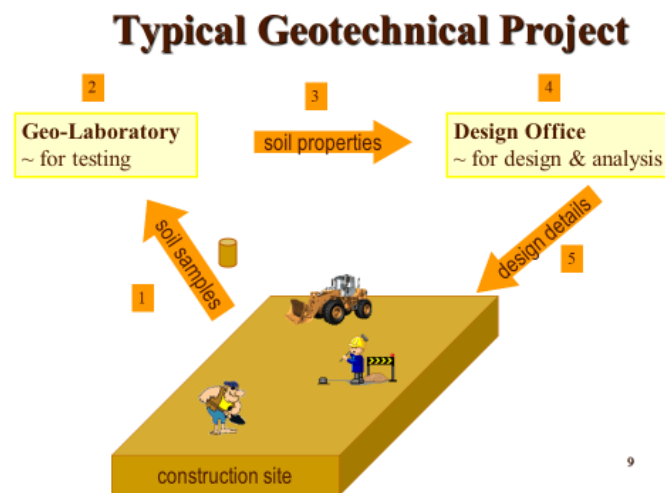
3	Amount of sample must be more than 50 kg.	Amount of sample less than 50 kg.
4	Tools using for soil sampling simple heavy trucks and not easy.	Tools using for soil sampling simple and easy.
5	Some of the common works of soil engineering includes Canal construction, water Networking, irrigation engineering, land leveling, landslide repairs, constructing seawalls, shoring and underpinning.	Some of the common works of soil in agriculture includes: irrigation, drainage, soil fertility evaluation and fertilizer recommendations for crops and Tillage.
6	Purpose of sampling - Design foundation for proposed structures -For repair of distress to earthworks and structures caused by subsurface conditions	Purpose of sampling -soil sampling purpose is described which is done for soil fertility evaluation and fertilizer recommendations for crops.
7	Soil sampling taking from stock or in the road site by different soil types according to Materials	Soil sampling by different methods for example: Random, zigzag and gird
8	Take sample Containing all particle size Gravel, Sand, Silt and Clay) and rocks around a site	Take sample contain only soil around a site without gravel and rocks Not Containing all particle size , only Sand, Silt and Clay) without gravel and rocks
9	Determining percentage (Passing and Retain) the #4 sieve) 4.75mm.	Determining percentage only (Passing) the #4 sieve) 4.75mm.
10	The most frequently-used types of (Testes) analyze and measure: <ul style="list-style-type: none"> <li>• Site investigation and Soil improvements.</li> <li>• Density of Material in all Cases ( in-situ (Bank, Excavated and Compacted Materials)</li> <li>• MDD (Maximum Dry Density)</li> <li>• OMC (Optimum Moisture Conten)</li> <li>• Specific Gravity</li> <li>• Shrinkage Percent</li> <li>• Swell Percent</li> <li>• shear strength parameters</li> <li>• CBR (California Bearing Ratio)</li> <li>• Los Angeles abrasion test , etc.</li> </ul>	The most frequently-used types of (Testes) analyze and measure: <ul style="list-style-type: none"> <li>• Fertilizer Recommendation.</li> <li>• Mineral content,</li> <li>• pH level,</li> <li>• Soil moisture,</li> <li>• salinity,</li> <li>• pesticides and chemical contamination,</li> <li>• structure</li> <li>• texture, etc.</li> </ul>



**Q. 2-** Fill in the following blanks:

1. In a fine and coarse aggregate sieve analysis, the representative sample is washed over a sieve **No. 200 / 0.075 mm or 75 mic.**
2. In the design of any foundation system, the central problem is to prevent the settlements large enough to **damage the structure** .
3. Soil engineering mainly deals with analyzing the **Density** and **M. C. / W. C.** in the soil.
4. Deep foundations mostly for **weak** Soils or **heavy loads** .
5. Soil boring used for **subsurface exploration (analysis).**
6. Soil engineering properties are the important items in the analysis of **site conditions** , **design** and **construction** of the foundation.

**Q.3-** A- What is the process of typical geotechnical project? (Answer By Figure)



B- What is the importance or uses the Atterberg's limits?

1. To obtain general information about a soil and its strength, compressibility, and permeability properties.
2. Empirical correlations for some engineering properties.
3. Soil classification
4. used to assess swelling potential ("fat clays")
5. Activity (A) and Liquidity Index (LI)

**Q. 5)** Determine the (Percent gravel, sand, and fines) for soil (**D**) in below Figure:

Gravel = 3 in - #4 = 100% - 88% = 12%

Sand = #4 - #200 = 88% - 40% = 48%

Fines = #200 = 40%

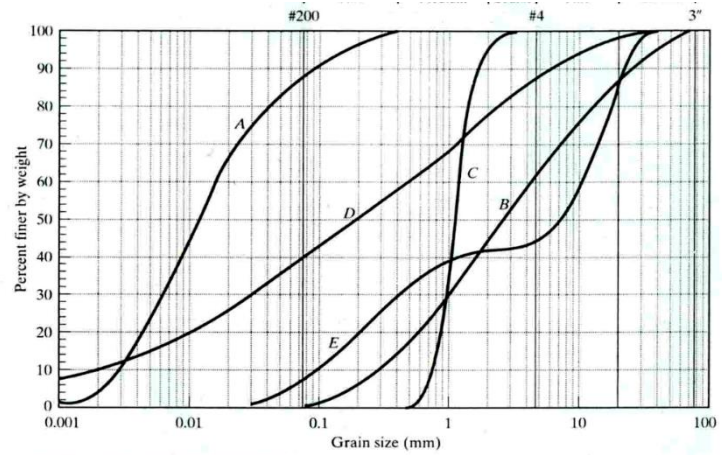


Figure 4.13 Grain size distribution curves for five soils.

1. Peer review: Approved by Prof. Dr. Akram Othman Esmail