Department of Earth Science and Petroleum

College of ……Science…….

University of …Salahaddin…….

Subject: …Engineering Geology…….

Course Book – (Year 4)

Lecturer's name: Rebaz Muhammed Qader – MSc

Academic Year: 2022/2023

Course Book

1. Course name 2. Lecturer in charge 3. Department/ College	Engineering Geology Rebaz Muhammed Qader Geology /Science
4. Contact 5. Time (in hours) per week	e-mail: rebaz.qader@su.edu.krd Tel: Theory: 2 hours Practical: 2 hours
6. Office hours	Available all the week
7. Course code 8. Teacher's academic profile	A general Geologist with a Master's degree in Engineering Geology and abroad working experience in geological sampling and procedures, including, Geomechanics, Ground Investigation, Ground Improvement Techniques, Geotechnical Design, Applied Geology, Borehole Design and Construction, Ground Water Assessment and Contaminated Land. Highly numerate with understanding of soil and rock mechanics. I achieved Master's degree in Engineering Geology - University of Newcastle - United Kingdom in the year 2013 - 2014. Relevant Courses: Geomechanics, Ground Investigation - Design, Principles and Practice, Ground Improvement Techniques, Field Class, Geotechnical Design, Engineering and Applied Geology, MSc Project and Dissertation in Geotechnical Engineering and Engineering Geology, Borehole Design, Construction and Operation, Ground Water Assessment and Contaminated Land. I am an academic staff - Assistant lecturer in Engineering Geology - College of Science - Geology Department - Salahaddin University - Erbil, from December 2014 until now.
9. Keywords	Physical properties of soil, soil mechanics, slope stability.

10. Course overview:

- The importance of studying the subject

engineering geology is important in following ways:-

1. Engineering geology can aid in locating natural resources.

2. It can help us with flood control and other natural disasters.

3. Study of geology gives us clue of people lived many year ago.

4. It let us know how the environment has evolved and adapted to the world around us.

5. It is showing its importance in its application i.e in study about soil profile and character about the soil and strength of soil.

6. It gives us knowledge of hydrological cycle, climatic conditions, living and non-living things on the particular site.

7. It gives us knowledge of origins of earth, its structure.

8. It plays an important role in interpretation of landforms and earth's process to identify potential geologic and related man made hazards that may impact civil structures and human development.

- Understanding of the fundamental concepts of the course

Is the application of the geological sciences to engineering study for the purpose of assuring that the geological factors regarding the location, design, construction, operation and maintenance of engineering works are recognized and accounted for. Engineering geologists provide geological and geotechnical recommendations, analysis, and design associated with human development and various types of structures. The realm of the engineering geologist is essentially in the area of earth-structure interactions, or investigation of how the earth or earth processes impact human made structures and human activities.

Engineering geology studies may be performed during the planning, environmental impact analysis, civil or structural engineering design, value engineering and construction phases of public and private works projects, and during post-construction and forensic phases of projects. Works completed by engineering geologists include; geological hazard assessments, geotechnical, material properties, landslide and slope stability, erosion, flooding, dewatering, and seismic investigations, etc. Engineering geology studies are performed by a geologist or engineering geologist. The principal objective of the engineering geologist is the protection of life and property against damage caused by various geological conditions.

11. Course objective:

The primary purpose of this course is to give students in engineering geology, understanding of earth materials and their properties, and the natural processes that act on those materials and affect manmade structures. This knowledge will be applied to various examples from Civil Engineering and Reclamation. A secondary course goal is based upon the assumption that most of you in this class will deal professionally with geologists in your careers. Thus an understanding of the terms and methods used by geologists will better enable you to better communicate with geoscientists.

12. Student's obligation

Students are expected to attend all lectures, to arrive on time, and to remain for the entire class. Cell phones should be switched off during lectures. It is the student's responsibility to note any announced schedule changes .The classroom and laboratory is expected to be a place of learning and Discovery. Each student is expected to be quiet, and courteous. Discussions are to be directed to the instructor, not individual classmates.

13. Forms of teaching

Different forms of teaching will be used to reach the objectives of the course: power point presentation for the head titles and definitions and summary of conclusions, classification of materials and any other illustration.

There will be classroom discussions and the lecture will give enough background to translate, solve, analyze and evaluate problems sets, and different issues discussed throughout the course.

To get the best of the course, it is suggested that the student attend classes as much as possible, read the required lectures, teachers notes regularly as all of them are foundations for the course. Lectures notes are for supporting and not for submitting the reading material including the handouts. Try as much as possible to participate in classroom discussions ,preparing the assignments given in the course

15. Student learning outcome:

The general objective of this course is to provide students with an understanding of the role that Earth materials and geological processes play in controlling human activities on the Earth's surface. Upon completion of this course, the student will be able to:

1. Show an understanding of the physical properties used to identify Earth Materials.
2. Identify and classify common minerals, rocks and soils, and understand their Significance to different types of engineering projects.
3. Show an understanding of the geomorphic processes that modify the Earth's Surface.
4. Show an understanding of the engineering and construction problems associated with Earth processes and of the procedures used to counteract such Problems.
5. Describe case histories of geological engineering problems and the lessons we have learned from past mistakes.
6. Communicate and work effectively with geoscientists when working in a Multidisciplinary project.
7. Examine one or more geological engineering problems and present an oral And/or written report.

16. Course Reading List and References:

1-Text Book

Principles of Engineering Geology, Robert B. Johnson and Jerome V. DeGraff

2–Reference

1- Engineering Geology An Environmental Apprroach, Perry H. Rahn.

2-Soil mechanics.

17. The Topics: Theory	Lecturer's name
Week 1 1- Introduction Definition, Geologic Fundamentals , Rocks , Minerals , and soils, investigation Fundamentals Week 2 , Engineering soil , Soil scientist, Geologic soil , soil development , The importance of soil Week 3 , 4 Soil For Engineering purposes, Volume and weight Relationships, Cohesive and Non cohesive Soils, grain size analysis. Week 5 , Atterberg limits , Determination of Liquid Limit , Casagrandy Method , Cone Pentrometer Method Week 6 Determination of the plastic limit and plasticity index of soils, Soil classification, Unified soil classification (USC) Week 7 The importance of clay mineralogy The engineering properties of soil , Shear strength Week 8 Shear Strength in Noncohesive Soils , Shear Strength in Cohesive Soils , Week 9 Measuring Shear Strengths, Compressibility, Consolidation. Week 10 Engineering properties of rocks, intact rocks and rock mass ,intact rocks , Rock Strength , Failure ,Rupture , Strength criterion , Compressive Stress ,Shear Stress ,Tensile Stress Compressive Strength , Shear Strength Week 11 Tensile Strength ,rock deformation , Deformation , Stiffness , Stress , Strain , Kinds of Strain , Week 12 Poisson's ,deformation behavior of rock , dynamic elastic	Lecturer's name Dr.Nadhmia Najmaddin 2 hrs)

moduli

Week 13
rock mass , rock mass characterization ,
evaluation of the engineering properties of a rock mass ,
Discontinuities in Rock Masses.

Week 14
Rock slope stability-analysis , Basic mechanics and types of rock slope failures , Planar Failure Analysis , Stability analysis,

Week 15
Wedge Failure , - Kinmatic Analysis of wedge failure ,
Stability analysis of Wedge Failure

18. Practical Topics

Lecturer's name : Rebaz Muhammed Qader - 2 hrs

Practical Topics and their contents
SOIL SCIENCE Introduction. Engineering geology as a scientific discipline. Lab 1: Weight-volume relationships: Earth materials are either two or three phase systems. The phases include solid particles, water and air. (Dry and fully saturated materials are of two phase systems but partially saturated materials are three phase systems).
Lab 2: Densities and Unit Weights (continue for previous lab): Earth materials are either two or three phase systems. The phases include solid particles, water and air. (Dry and fully saturated materials are of two phase systems but partially saturated materials are three phase systems).
Lab 3: Grain size Analysis Sieve Analysis The particle size analysis of a soil sample involves determining the percentage by mass of particles within the different size ranges. The particle size distribution of a coarse soil can be determined by the method of sieving. The soil sample is passed through a series of standard test sieves having successively smaller mesh sizes. The mass of soil retained in each sieve is determined and the cumulative percentage by mass passing each sieve is calculated. If fine particles are present in the soil, the sample should be treated with a deflocculating agent and washed through the sieves.
Lab 4: Grain size Analysis Hydrometer Method

The particle size distribution of a fine soil or the fine fraction of a coarse soil can be determined by the method of sedimentation. This method is based on Stokes' law which governs the velocity at which spherical particles settle in a suspension: the larger the particles the greater is the settling velocity and vice versa	
Lab 5: Atterberg Limits Plasticity is an important characteristic in the case of fine soils, the term plasticity describing the ability of a soil to undergo unrecoverable deformation without cracking or crumbling. In general, depending on its water content (defined as the ratio of the mass of water in the soil to the mass of solid particles), a soil may exist in one of the liquid, plastic, semi-solid and solid states. If the water content of a soil initially in the liquid state is gradually reduced, the state will change from liquid through plastic and semi-solid, accompanied by gradually reducing volume, until the solid state is reached. The upper and lower limits of the range of water content over which the soil exhibits plastic behavior are defined as the liquid limit (LL) and the plastic limit (PL), respectively. The water content range itself is defined as the plasticity index (IP), (IP = LL-PL). Two tests are requiring determining the liquid limit and plastic limit those test are Cone penetration method and Casagrande method.	
Lab 6: Unified Soil Classification: General classification systems in which soils are placed into groups on the basis of grading and plasticity have been used for many years. The feature of these systems is that each soil group is denoted by a letter symbol representing main and qualifying terms. The terms and letters used are based on the standard soil classification. The 50% is boundary between coarse and fine grain soil. The liquid and plastic limits are used to classify fine soils, employing the plasticity chart; therefore, the plasticity characteristics of a particular soil can be represented by a point on the chart. Classification letters are allotted to the soil according to the zone within which the point lies. As a result from the lab we able to classify soil on their properties.	
Strength of Soil The shear strength parameters for a particular soil can be determined by means of laboratory tests on specimens taken from representative samples of the in-situ soil. Great care and judgment are required in the sampling operation and in the storage and handling of samples prior to testing. In the case of clays and sand the test are different according to their test requires. Lab 7: Strength of Soil Direct shear test: The specimen is confined in a metal box (known as the shear box) of square or circular cross-section split horizontally at mid-height, a small clearance being maintained between the two halves of the box. Porous plates are placed below and on top of the specimen if it is fully or partially saturated to allow free drainage: if the specimen is dry, solid metal plates may be used	

Lab 8: Unconfined compression tests: The primary purpose of this test is to determine the unconfined compressive strength, which is then used to calculate the unconsolidated undrained shear strength of the clay under unconfined conditions.
Lab 9: Triaxial compression test: This is the most widely used shear strength test and is suitable for all types of soil. The test has the advantages that drainage conditions can be controlled, enabling saturated soils of low permeability to be consolidated, if required, as part of the test procedure, and pore water pressure measurements can be made. A cylindrical specimen, generally having a length/diameter ratio of 2, is used in the test and is stressed under conditions of axial symmetry in the manner. Typical specimen diameters are 38 and 100 mm.
Lab 10: Consolidation of soil Lab 11: Settlement of soil
ROCK SCIENCE Lab 12: Rock mechanics Lab 13: Rock slope analysis
Lab 14: Slope stabilization technique
Lab 15: Slope stabilization - Case study
Lab 16: Slope stability computing

The grading breakdown will be as follows:

Lab Reports ……..……...5 %
Attendance and activities …....10 %
Quiz ……..…. 5 %
Exam..…….……....15 %

19. Examinations:

Will cover theoretical material presented in lecture and studied through homework problems and the Practical Quizzes – during the practical hours.in the laboratory. Each of the tests will cover material presented in lecture prior to that test.

1. Compositional: In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?
With their typical answers
Examples should be provided

2. True or false type of exams:

In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. Examples should be provided

3. Multiple choices:
In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. Examples should be provided.

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review: This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject.