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**Department of Science and environmental health**

**College of Sciences**

**University of Salahaddin**

**Subject: Soil sciences**

**Course Book – *For example* ( Year 4)first semester**

**Lecturer's name Lecturer Nihal Suhail Hanna**

**Academic Year: *2023-2024***

**Course Book**

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| **1. Course name** | **Soil sciences**  |
| **2. Lecturer in charge** | **Nihal Suhail Hanna** |
| **3. Department/ College** | **Sciences and Environmental health/Science** |
| **4. Contact** | **e-mail: Nihal S. Hanna****Tel: (optional)** |
| **5. Time (in hours) per week**  | **Practical: 2**  |
| **6. Office hours** |  **Every days from 10:30 to 12:30 .Availability for students during the week** |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | * **I graduate from Salahaddin University in 2012 (Ranked 1st in Environmental sciences department). In 2015 I finished M.Sc degree in water quality and pollution (aquatic insect as bioindicator). Finally, I became lecturer assistant in 2016.**

**• I published 9 papers in international scientific journal. I teach under graduate student like, entomology, water quality, water pollution, engineering drawing, principles of environmental sciences, computer science and academic debate.****• I worked as a member of the examination committee for college of science in (2015-2016) , (2017-2018) and (2020-2021).****I become lecturer in 12/9/2019.****I completed my Ph.D. in Ecotoxicity in February 2024 at the Environmental Health and Science Department, College of Science, Salahaddin University** |
| **9. Keywords** | **Soil science , encyclopedia of soil , soil pollution , environmental index ….?** |
| **10. Course overview:** The course will involved soil science texts of selective topics together with print media or internet articles which deal with current soil issues." Instructional strategies attempt to strike a balance between developing the students' ability to cope with soil texts, extending their general academic reading skills, and increasing their basic knowledge and understanding of soil. The course will give students a better understanding of a number of soil science topics, the followings are examples but not restricted to: soil profile soil mineral and some chemical properties of soil, with some extra topics that will be indentified as the course progress. students will be asked to prepare research papers on selective topics and summarize articles contents published in English into either Kurdish or Arabic language, those articles need to be from printed media or internet articles. 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. |
| **11. Course objective:**The course will cover soil science texts of selective topics together with print media or internet articles which deal with current soil issues." Instructional strategies attempt to strike a balance between developing the students' ability to cope with soil texts, extending their general academic reading skills, and increasing their basic knowledge and understanding of soil. The course will give students a better understanding of a number of soil science topics, the followings are examples but not restricted to: soil profile soil mineral and some chemical properties of soil, with some extra topics that will be indentified as the course progress. |
| **12. Student's obligation**students will be asked to prepare research papers on selective topics and summarize articles contents published in English into either Kurdish or Arabic language, those articles need to be from printed media or internet articles. 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. |
| **13. Forms of teaching**Different forms of teaching will be used to reach the objectives of the course: power point presentations for the head titles and definitions and summary of conclusions, classification of materials and any other illustrations, besides worksheet will be designed to let the chance for practicing on several aspects of the course in the classroom |
| **14. Assessment scheme**The students are required to do one closed book exam at the mid of the semester besides other assignments including class room activity and solving statistics problem. The exam has 30 marks, the attendance, classroom activities; count 10 marks. There will be a final exam on 60 marks. So that the final grade will be based upon the following criteria:Mid-semester exam: 30%Classroom participation and assignments 10%Final exam: 60%‌ |
| **15. Student learning outcome:**The main object of this course is to give the student the information about soil physical , chemical , and biological properties and these properties in relation to land use and management , as well as find out the relation between soil properties with plant growth , organisms , building ,road and dam construction, however explain the main role of soil in another science such as geology , biology , agriculture and environmental science , However we try to describe the main function of soil in biogeochemical cycle of nutrient, stability and support , purification of water , detoxification and degradation of toxic materials that come from different source , I think that soil is very important I both sector prime and governorate sectors  |
| **16. Course Reading List and References‌:**Forth,H.D (2010) Fundamentals of soil science.8thedJohn wiley and sons.NewYork. P:360.Thompson,L.M and F,R.Troeh.(1978)Soil and soil fertility .4thed.Macmillan Publishing Company.INC .New York.P:516. Ward chesworth,(2015) Encyclopidia of soil science Published by Springer. PO Box 17, 3300 AA Dordrecht, The Netherlands .And any other **soil textbook** published in 21'*t* century.The core materials of the course consists of the above book, articles from media and Internet, and lecture's notes, make sure you read all the materials and prepare well before going for the exams. |
| **17. The Topics:** | **Lecturer's name** |
| **Week 1:** **history of soil science, .Soil as a medium for plant growth .Factors of plant growth .Support for Plants** **Week 2:****Introduction, of soil science, .and some terminology ?** **Weeks 3:****Soil profile and porosity** **Week 4:** **Soil structure and texture****Week 5:****Water content and hydraulics conductivity** **Week 6:** **Soil color*****Week7:******soil microclimate*** **Week 8:****soil pH and source of alkalinity** **Week 9:****buffer capacity** **Week 10:** **Salinity and basic elements****Week 11:****Organic matter** **Week 12:** **clay minerals****Week 13:** **soil biology**  | Lecturer's nameex: (2 hrs) |
| **18. Practical Topics (If there is any)** |  |
| In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture  | Lecturer's nameex: (3-4 hrs) |
| **19. Examinations:****Q1/ Fill the following blanks by convenient word?(25marks)**1. *The soil color 2.5YR 4/2 is given in the order of …………,…………, and ……………?*
2. *The physical and chemical weathering of rocks and minerals results in a wide range in size of particles classified according to two systems…………….and ………………..?*
3. *Soil genesis involves processes that develop layers or horizons in the soil profile. These processes involve ................, ................, ................ and ................ of material that compose the soil?*
4. *A typical soil component involved 25%.............,25%................,45%…………….and 5%.................?*
5. *The hydrolysis of calcium carbonate produces ………….ions, which contributes to alkalinity in soils and this reaction can produce a soil pH as high as 8.3.*
6. *A Pores that cannot retain water against gravity and are usually filled with air , rare called ………………,while Pores that are small enough to retain water against gravity will remain water filled after soil wetting by rain or irrigation, and are called ……………..?.*
7. *Most soils have a distinct profile or sequence of horizontal layers. Generally, these horizons result from the processes of ……………, ………………, ……………. and ……………?*
8. *Soil ……..………….. is defined as the ratio of dry mass of solids to bulk volume of the soil sample?*
9. *Dokuchaev considers the soil as a natural body having ………………and ……………….?*
10. *The CEC at the soils' current pH is called the ..……………….and commonly expressed as …………………..?*

**Q2/Answer the following in briefly? (25marks)**1. *Importance of Clay Minerals?*
2. *Why water is a* [*polar molecule*](http://en.wikipedia.org/wiki/Polar_molecule) *with an* [*electrical dipole moment*](http://en.wikipedia.org/wiki/Electrical_dipole_moment)*?*
3. *Sources of alkalinity ?*
4. *The Available water content ?*
5. *Factors effect lowering the soil*  *pH*

**Q3/ Explain the following by illustration ?(25marks)**1*-The Munsell notation distinguishes three characteristics of the color: hue, value, and chroma***. (7marks).***2- The pedosphere only develops when there is a dynamic interaction between the atmosphere and biosphere, lithosphere and the hydrosphere***.(8marks).***3- Major chemical processes and reactions in soils that supply ions to the ion pool of the soil solution.* **.(10marks).****Q4/** **Describe only the relationship between the following by using the inversely and directly terms :- ?(25marks)****1-Cation adsorption :***(concentration of a cation ), (energy of adsorption) , (valence )(distance from surface ) and (degree of hydration).* **2- Soil color :-***(Soil organic matter and dark brown to black color to the soil), (aerated soils and yellow or redish color surface soils) , (white soil color and evaporation) ,( dark color and water content) and( light gray or nearly white colors is and inherited from parent material)***3- Soil structure**(*irrigation), (aggregation),(aeration), (permeability ) and (availability of organic matter).* **4- Soil available water** *(Bulk density) , (pore space),( heavy soil) (well structure) and ( biological activity )***5- Hydraulic conductivity** *(particle size distribution)‚ (water content)‚ (bulk density), (clay minerals) and (organic matter concentration)***Typical answer** **Q1/****Fill the following blanks by convenient word?(25marks)**1. *The soil color 2.5YR 4/2 is given in the order* ***of hue, value, and chroma****. ?*
2. The physical and chemical weathering of rocks and minerals results in a wide range in size of particles classified according to ***USDA system and ISSS system.***
3. *Soil genesis involves processes that develop layers or horizons in the soil profile. These processes involve* ***additions, losses, transformations and translocations*** *of material that compose the soil ?*
4. A typical soil component involved ***25%.air****,****25%water****,****45% soil minerals*** *.and* ***5%organic matter****?*
5. The hydrolysis of calcium carbonate produces ***OH-*.**ions, which contributes to alkalinity in soils and this reaction can produce a soil pH as high as 8.3.
6. A Pores that cannot retain water against gravity and are usually filled with air , rare called ***Macropore***, while Pores that are small enough to retain water against gravity will remain water filled after soil wetting by rain or irrigation, and are called ***Micropore***?.
7. Most soils have a distinct profile or sequence of horizontal layers. Generally, these horizons result from the processes of ***chemical weathering, eluviation, illuviation, and organic decomposition***
8. Soil ***bulk density***. is defined as the ratio of dry mass of solids to bulk volume of the soil sample?
9. Dokuchaev considers the soil as a natural body having ***its own genesis and its own history of development.?***
10. The CEC at the soils' current pH is called the ***Effect cation exchange capacity (ECEC)***and commonly expressed as ***cmolc /kg***?

**Q2/Answer the following in briefly? .(25marks).**1. .    ***Importance of Clay Minerals:***

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| --- |
| 1. The clay minerals and soil organic matter are colloids.
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| 1. The most important property of colloids is their small size and large surface area. The total colloidal area of soil colloids may range from 10m2/g to more than 800 m2/g depending the external and internal surfaces of the colloid.
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| 1. Soil colloids also carry negative or positive charges on their external and internal surfaces. The presence of charge influences their ability to attract or repulse charge ions to or from surfaces.
 |
| 1. Soils colloids play a very important role in the chemical reaction which take play in soil and influence the movement and retention of contaminants, metals, and nutrients in the soil.
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1. ***Why water is a*** [***polar molecule***](http://en.wikipedia.org/wiki/Polar_molecule) ***with an*** [***electrical dipole moment***](http://en.wikipedia.org/wiki/Electrical_dipole_moment)***:***

**Water** is a chemical substance with the chemical formula H2O. Its molecule contains one oxygen and two hydrogen atoms connected by covalent bonds. Since the water molecule is not linear and the oxygen atom has a higher [electro negativity](http://en.wikipedia.org/wiki/Electronegativity) than hydrogen atoms, it carries a slight negative charge, whereas the hydrogen atoms are slightly positive***.******c- Sources of Alkalinity in soil.*****Carbonate Hydrolysis** The hydrolysis of calcium carbonate produces OH-, which contributes to alkalinity in soils: Calcium carbonate is only slightly soluble, and this reaction can produce a soil pH as high as 8.3, **Mineral Weathering** The weathering of many primary minerals, however, contributes to alkalinity. This is the result of the consumption of H + and the production of OH - . For example, the hydrolysis of anorthite, (calcium feldspar), produces a moderately strong base:***d- The Available water content ?***The amount of water actually available to the plant is the amount of water stored in the soil at field capacity minus the water that will remain in the soil at permanent wilting point.***e-*** ***Factors effect lowering the soil***  ***pH*** Leaching process. Fertilizers containing sulfur and nitrogen. Vegetation influenced soil pH in complex ways because it produce organic matter and influence leaching . The addition of organic matter to a soil results in the formation the organic acids **Q3/ Explain the following by illustration ?(25 marks )****1-The Munsell notation distinguishes three characteristics of the color: hue, value, and chroma.(7marks).**munsell**2- The pedosphere only develops when there is a dynamic interaction between the atmosphere and biosphere, lithosphere and the hydrosphere.(8marks).**00000000AtmosphereHydrosphereBiosphereLithospherePedosphere**3- Major chemical processes and reactions in soils that supply ions to the ion pool of the soil solution. .(10marks).****Q4/ Describe only the relationship between the following by using the inversely and directly terms :- ?(25marks)****1-**

|  |  |  |
| --- | --- | --- |
| **Term** | **Terms** | **Relationship** |
| **Cation adsorption**  | *(concentration of a cation )* | Directly  |
| **Cation adsorption**  | *(energy of adsorption)*  | Directly  |
| **Cation adsorption**  | *(valence )* | Directly  |
| **Cation adsorption**  | *(distance from surface )* | Inversely |
| **Cation adsorption**  | *(radius of hydration).*  | Inversely  |

**2-**

|  |  |  |
| --- | --- | --- |
| **Term** | **Terms** | **Relationship** |
| **Soil color** | *(Soil organic matter and dark brown to black color to the soil),* | Directly  |
| **Soil color** | *(aerated soils and yellow or redish color surface soils)* | Directly  |
| **Soil color** | *(white soil color and evaporation)* | Directly  |
| **Soil color** | *,( bright color and water content)* | Inversely |
| **Soil color** | *( light gray or nearly white colors is and inherited from parent material)* | Directly |

**3-**

|  |  |  |
| --- | --- | --- |
| **Term** | **Terms** | **Relationship** |
| **Soil structure** | (*irrigation)* | Inversely |
| **Soil structure** | *(aggregation),* | Directly  |
| **Soil structure** | *(aeration),* | Directly  |
| **Soil structure** | *(permeability*) | Directly |
| **Soil structure** | *(availability of organic matter).* | Directly  |

**4-**

|  |  |  |
| --- | --- | --- |
| **Term** | **Terms** | **Relationship** |
| **Soil available water** | *(Bulk density)* | Inversely |
| **Soil available water** | *(pore space)* | Directly |
| **Soil available water** | *( heavy soil)* | Directly |
| **Soil available water** | *(well structure)* | Directly |
| **Soil available water** | *( biological activity )* | Directly |

**5-**

|  |  |  |
| --- | --- | --- |
| **Term** | **Terms** | **Relationship** |
| **Hydraulic conductivity**  | *(particle size distribution)‚* | Inversely |
| **Hydraulic conductivity** | *(water content)‚* | Directly  |
| **Hydraulic conductivity** | *(bulk density),* | Directly |
| **Hydraulic conductivity** | *(clay minerals)* | Inversely |
| **Hydraulic conductivity** | *(organic matter concentration)* | Inversely |

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| **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 پێداچوونه‌وه‌ی هاوه‌ڵ**   |