

Department of Soil and Water Science

College of Agricultural Engineering Sciences

University of Salahaddin- Erbil

Subject: Soil Technology

Course Book - (Year 4)

Lecturer's name: Dr. Aram Ali

Academic Year: 2023/2024

**Course Book**

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| **1. Course name** | **Soil Technology** |
| **2. Lecturer in charge** | **Dr. Aram Mohemed Ali**  |
| **3. Department/ College** | **Soil & water/ Agricultural Engineering Sciences** |
| **4. Contact** | **e-mail: Aram.Ali@su.edu.krd** |
| **5. Time (in hours) per week**  | **Theory: 2 hr.**  |
| **6. Office hours** | **15 hours** |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | **Dr. Aram Ali****- PhD in Soil Physics and Pedometrics (2021); University of Southern Queensland, Australia.****- MENS. In Agricultural Engineering (Soil Sciences) (2014); University of Southern Queensland, Australia.****- BSc. In Soil and Water Science (2008-2009); Salahaddin University-Erbil, College of Agricultural Engineering Sciences, Soil and Water Department**  |
| **9. Keywords** | **Soil Technology, Precision Agriculture, Smart technologies, Soil Aerial Images, Soil Platform, Soil Digital Mapping.**  |
| **10. Course overview:** Soil, often referred to as the "skin of the Earth," is a fundamental natural resource that plays a pivotal role in global food production, environmental sustainability, and climate regulation. The course in Soil Technology, adapted for undergraduate students, offers an in-depth exploration of the involved world of soil science and the revolutionary technologies reshaping the way we understand, manage, and utilise soils. By providing students with comprehensive knowledge and hands-on experience, this course equips them to confront the complicated challenges confronting agriculture, environmental conservation, and land-use management. |
| **11. Course objective:** * **Technology Integration:** Students will board on a journey through cutting-edge technology, exploring how robotics, sensors, Geographic Information Systems (GIS), remote sensing, and more are redefining soil data collection, analysis, and management. They will learn to harness these tools to extract valuable insights from the soil.
* **Practical Application**: The course integrates practical components, monitoring, and analysis using state-of-the-art equipment and software. These experiences foster a deep understanding of the real-world applications of soil technology.
* **Problem Solving:** Throughout the course, students will improve their problem-solving skills by tackling real-world agricultural and environmental challenges. By applying soil technology, they will develop solutions to issues such as soil degradation, erosion control, and optimising crop yields.
* **Sustainability:** Sustainability is at the core of this course. Students will examine how technology can play a pivotal role in responsible land use, water conservation, and minimising the environmental impact of agriculture. They will learn to become stewards/conservatives of the land.
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| **12. Student's obligation**Students are strongly encouraged to attend all the Lectures and exercises, Quizzes, exams, and class participation. Preparing the reports for the subject will take from the class like exercises and applying the methods using technologies in soil testing and estimation. Preparing reports for the scientific field trips. Working as a group (group work).The final exam will be comprehensive and will cover the lecture material but will do so in more depth than the quizzes. |
| **13. Forms of teaching** **Lectures:** 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, analyse 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, lecturer’s 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 hand-outs. Try as much as possible to participate in classroom discussions, preparing the assignments given in the course. |
| **14. Assessment scheme****Course assessment will be**There will be quizzes and exams during the semester, given during regular lecture periods. The course grade will be based on the exams, quizzes, and Report as shown below:* Theory Exam 20%
* Theory Quiz 5%
* Theory Attendance 5%
* Report 10%
* The total will be 40%

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| **15. Student learning outcome:**Students should learn the following:-Proficiency in Advanced Soil Technology: Master the use of cutting-edge tools such as sensors, GIS, and remote sensing for soil analysis.-Application of Knowledge to Real-world Challenges: Apply soil science and technology to address agricultural and environmental issues.-Hands-on Experience and Practical Skills: Develop practical skills in soil data collection, interpretation, and management through laboratory work and field exercises.-Emphasis on Sustainability: Understand and promote sustainable soil management practices and environmentally responsible land use.-Insight into Emerging Technologies: Recognize the potential of emerging technologies like nanosensors and bioremediation in revolutionizing soil science.-Critical Thinking and Problem-solving Skills: Analyse complex soil-related challenges and propose effective solutions.-Effective Communication and Presentation Skills: Clearly communicate findings and insights through written reports and oral presentations.-Research and Application of Emerging Technologies: Conduct research and presentations on emerging soil technologies, staying adaptable in a changing field.-Commitment to Sustainable Agriculture and Environmental Stewardship: Advocate for sustainable agriculture and responsible land management practices. |
| **17. The Topics:** This includes lectures on different topics covered in the theory as follows: | **Lecturer's name** |
|  **Module 1. Automated Soil Sampling*** Introduction to soil sampling methods
* Robotic systems for automated soil sampling
* Depth-specific soil sampling techniques
* Sampling precision and accuracy
* Case studies on the use of automated sampling in research and agriculture

**Module 2. Digital Agriculture Platforms/Soil Information Systems*** Overview of digital agriculture and its importance
* Soil data management and storage systems
* Soil data sharing and collaboration tools
* Integrated platforms for precision agriculture
* Case studies on successful soil information systems

**Module 3. Soil Sensors and Monitoring*** Types of soil sensors (moisture, temperature, nutrient)
* Principles of real-time soil monitoring
* Sensor calibration and deployment
* Data interpretation and decision-making
* Practical exercises with soil sensors

**Module 4. Precision Agriculture and Soil Mapping*** Precision agriculture principles and benefits
* GPS technology in precision agriculture
* Drone technology for soil mapping
* Sensor-based soil mapping techniques
* Creating and using precision soil maps for crop management

**Module 5. Geospatial Analysis and GIS Applications*** Introduction to GIS and geospatial analysis
* Soil property mapping using GIS
* Erosion prediction and prevention with GIS
* Land use planning and soil management
* Hands-on GIS exercises for soil analysis

**Module 6. Remote Sensing Techniques*** Basics of remote sensing in agriculture
* Satellite imagery for soil monitoring
* Aerial photography and drones in agriculture
* Vegetation health assessment from remote sensing data
* Remote sensing case studies in soil management

**Module 7. Digital Soil Mapping*** Methods of data integration for digital soil mapping
* Statistical modelling for soil property prediction
* Geostatistics in soil mapping
* Creating high-resolution soil property maps
* Fieldwork involving digital soil mapping techniques.

**Module 8. Soil Health Assessment Tools*** Assessing soil microbiology and biodiversity
* Chemical analysis for soil health assessment
* DNA sequencing for soil microbial communities
* Soil health indices and interpretation
* Lab experiments and soil health assessment practice

**Module 9. Soil Proximal Sensing*** Principles of proximal sensing
* Electromagnetic induction (EM38) for soil mapping
* DUALEM and other proximal sensing techniques
* Interpretation of proximal sensing data
* Field exercises using proximal sensing equipment.

**Module 10. Precision Irrigation Systems*** Water management in agriculture
* Types of precision irrigation systems
* Soil moisture-based irrigation scheduling
* Water conservation and crop yield optimization
* Practical implementation of precision irrigation

**Module 11. Soil Simulation Models*** Introduction to soil simulation modelling
* Modelling nutrient cycling in soils
* Erosion modelling and prevention strategies
* Using simulation models for crop planning
* Developing and running soil simulation models

**Module 12. Developing Technologies in Soil Science*** Nanosensors for soil monitoring
* Bioremediation techniques for soil improvement
* Bioinformatics in soil research
* Case studies on emerging soil technologies
* Discussion on the future of soil science and technology
 | **Dr. Aram Ali** |
| **18. Practical Topics (not include)** |  |
| **19. Examinations:** The theoretical exams are focused on material studied in lectures, plus the required reports and quizzes, the formats will be including short answer, definition, multiple choice, and differences. The quiz will be similar to the exams in terms of the type and difficulty of questions, but shorter. ***1. Compositional:*** Includes the comparison between the different materials, the definitions, explanation, discussion, and the selecting materials. ***2.Questions that need to be calculated:*** |
| **20. Extra notes:** |
| **21. Peer review ‌**  |