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| EXC-01-02-02A | **Form Number** | **Form:**  **Course Syllabus** |
| 2/3/24/2022/2963  05/12/2022 | **Issue Number and Date** |
|  | **Number and Date of Revision or Modification** |
| 2/3/24/2023 | **Deans Council Approval Decision Number** |
| 23/01/2023 | **The Date of the Deans Council Approval Decision** |
|  | **Number of Pages** |

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| **1.** | **Course Title** | Environmental soil chemistry |
| **2.** | **Course Number** | 0644221 |
| **3.** | **Credit Hours (Theory, Practical)** | 3 hours |
| **Contact Hours (Theory, Practical)** | **Theory** :2 lectures a week, practical : 3 hours lab session per week |
| **4.** | **Prerequisites/ Corequisites** | 604101  303101 |
| **5.** | **Program Title** | Bachelor Land, Water and Environment |
| **6.** | **Program Code** | 4 |
| **7.** | **School/ Center** | Agriculture |
| **8.** | **Department** | Land, Water and Environment |
| **9.** | **Course Level** | Undergraduate-BSc |
| **10.** | **Year of Study and Semester (s)** | Fall 2023 /2024 |
| **11.** | **Other Department(s) Involved in Teaching the Course** | -------- |
| **12.** | **Main Learning Language** | English |
| **13.** | **Learning Types** | ☐ Face to face learning √ Blended ☐Fully online |
| **14.** | **Online Platforms(s)** | ☐Moodle √ Microsoft Teams |
| **15.** | **Issuing Date** | 4/7/2024 |
| **16.** | **Revision Date** | 9/7/2024 |

**17. Course Coordinator:**

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| Name: Areej AL Khreisat Contact hours: 12:30-13:30 Monday &Wednesday  Office number: 57 1st floor Phone number:22444  Email: [a.alkhreisat@ju.edu.jo](mailto:a.alkhreisat@ju.edu.jo) |

**18. Other Instructors: --------**

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**19. Course Description:**

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| Environmental Soil and Water Chemistry is a core course for the students of soil, water and environmental sciences and environmental engineering. The course deals with major physical and chemical features of liquid water and the chemical processes taking place in soil solutions or natural water bodies (e.g. ion-pair and complex ion formation, single ion activity, ion activity product and dissolution-precipitation principles and reactions), nature of inorganic and organic solids with which water is in equilibrium, models of chemical equilibria between solid and liquid phases (ion exchange and adsorption-desorption models). |

**20. Program Intended Learning Outcomes:** Land, Water and Environment BSc Program ILOS

1. Demonstrate comprehensive understanding of the scientific and theoretical knowledge of land, water and environment.
2. Contribute to agricultural development, as well as food and water security.
3. Demonstrate problem solving skills and well developed linguistic and communication skills while upholding professional ethics
4. Assess land characteristics and their suitability for different agricultural uses.
5. Tackle basic problems of water, land and agricultural environment.
6. Analyse and interpret soil and water quality parameters.
7. Use sound scientific principles for the determination of crop water requirement, and design of irrigation systems for the proper management of agricultural water.
8. Determine the optimal use of water and land to ensure the sustainability of resources and the environment.
9. Develop​ innovative solution for tackling the adverse effects of water scarcity caused by climate change and desertification​

**21. Course Intended Learning Outcomes:**

Chemical reactions of the aqueous/aquatic phase like natural water systems and chemical speciation of soluble ions.

Nature of clay minerals and amorphous materials concerning surface reactions, anion and cation exchange.

Solid-liquid phase equilibria e.g. dissolution/precipitation reactions.

Ion exchange and adsorption of chemical species onto the solid surfaces

Upon completion of the course, the student will achieve the following ***intended learning outcomes***:

**A. Knowledge and Understanding**

A1- Be able to understand the chemical reactions of the aqueous/aquatic phase.

A2- Be able to understand the chemical speciation of soluble ions.

**B. Intellectual, Analytical and Cognitive Skills:**

B1-Be familiar with the nature of inorganic and organic solids.

B2- Students will learn and recognize the ion exchange and adsorption-desorption models.

**C. Subject- Specific Skills:**

C1- recognize the chemistry of fertilizers and concepts of their bioavailability.

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| Course ILOs | The learning levels to be achieved | | | | | |
| Remembering | Understanding | Applying | Analysing | evaluating | Creating |
| 1.A1 | √ | √ | √ |  |  |  |
| 2.A2 | √ | √ | √ |  |  |  |
| 4 B1 | √ | √ |  |  |  |  |
| 5 B2 | √ | √ | √ |  |  |  |
| 6 C1 | √ | √ | √ | √ |  |  |

**22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Program ILOs  Course ILOs | ILO (1) | ILO (2) | ILO (3) | ILO (4) | ILO (5) | ILO (6) | ILO (7) | ILO (8) | ILO (9) |
| A1- | √ |  |  |  |  |  |  |  |  |
| A2- |  |  |  | √ |  | √ |  |  |  |
| B1- |  |  |  | √ |  | √ |  |  |  |
| B2 |  |  |  | √ |  | √ |  |  |  |
| C1- |  | √ |  | √ |  |  |  |  |  |

**23. Topic Outline and Schedule:**

| **Week** | **Lecture (1.0 hr.)** | **Topic (Number and contents)** | **ILO of the course** | **Learning Methods**  **(Platform)** | **Synch. / Asynch. Lecturing** | **Evaluation Methods\*** | **Resources** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | Review of pertinent concepts of analytical chemistry. and Chemical units and SI units | A | Face to face | - | Interactive questions, quizzes and homeworks | R1,R2 &R3 |
| 1 | 2 | Introduction to soil chemistry | A&B | Face to face |  | Interactive questions, quizzes and homeworks | R1,R2 &R3 |
| 2 | 3,4 | Ion water interaction. And Solute -solute interactions | A&B | Face to face |  | Interactive questions, quizzes and homework | R1,R2 &R3 |
| 3 | 5,6 | Thermodynamic background of mean and single ion activity coefficients (γ±, γion). | A&B | Face to face |  | Interactive questions, | R1,R2 &R3 |
| 4 | 7,8 | Chemical, electrochemical and physical properties of liquid water | A&B | Face to face |  | Interactive questions, | R1,R2 &R3 |
| 5 | 9,10 | Ligands and metal‑ligand complexes | A&B | Face to face |  | Interactive questions, ,quizzes and homeworks | R1,R2 &R3 |
| 6 | 11,12 | Complex ions and ion pairs. | B | Face to face |  | QUIZ, Interactive questions, | R1,R2 &R3 |
| 7 | 13,14 | Hydrolysis and deprotonation | A&B | Face to face |  | Interactive questions | R1,R2 &R3 |
| 8 | 15,16 | Applications of the exchange models to arid zone soils. | A&B | Face to face |  | Interactive questions | R1,R2 &R3 |
| 9 | 17,18 | Primary minerals in soil: | A&B | Face to face |  | Interactive questions, ,quizzes and homeworks | R1,R2 &R3 |
| 10 | 18,20 | Types of Crystals and crystal chemistry of orthosilicate minerals | A,B &C | Face to face |  | Interactive questions, ,quizzes and homeworks | R1,R2 &R3 |
| 11 | 21,22 | X-ray diffraction and identification of orthosilicate minerals | B | Face to face |  | Interactive questions, and homeworks | R1,R2 &R3 |
| 12 | 23 | **Mid-term exam** | A,B &C | **At UOJ** |  |  |  |
| 13 | 24,25 | Soil organic matter | A,B &C | Face to face |  | Interactive questions, ,quizzes and homeworks | R1,R2 &R3 |
| 14 | 26,27 | Theory of ion distribution in the solid liquid interphase: Helmholtz, Gouy and Chapman, and Diffuse double layer models | A&B | Face to face |  | Interactive questions and homeworks | R1,R2 &R3 |
| 15 | 28 | Mineral weathering: Physical and chemical weathering | A | Face to face |  | Interactive questions, ,quizzes and homeworks | R1,R2 &R3 |
| 15 | 29 | Nature and formation of acid, saline, sodic, and alkaline soils. Major physico‑chemical properties of arid zone soils. | A,B &C | Face to face |  | Interactive questions, ,quizzes and homeworks | R1,R2 &R3 |
| 16 | 30 | **Final Hour Exam** | A,B &C | **At UOJ** |  |  |  |

**24. Evaluation Methods:**

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

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| --- | --- | --- | --- | --- | --- |
| **Evaluation Activity** | **Mark** | **Topic(s)** | **ILO/s Linked to the Evaluation activity** | **Period (Week)** | **Platform** |
| Quizzes, homework | 10 | All topics | All | During semester | At University |
| Mid-term exam | 30 | Beginning to X-ray diffraction | A,B,C | 12 | At University |
| Lab reports | 5 | All lab experiments | All | During semester | At University |
| Final Lab exam | 15 | All lab experiments | All | 16 | At University |
| Final Exam | 40 | All topics | All | 16 | At University |

**25. Course Requirements:**

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| Students should have internet access and an account on Microsoft team’s platform. |

**26. Course Policies:**

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| A- Attendance policies:  B- Absences from exams and submitting assignments on time:  C- Health and safety procedures:  D- Honesty policy regarding cheating, plagiarism, misbehavior:  E- Grading policy:  F- Available university services that support achievement in the course: |

**27. References:**

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| **A- Required books:**  R1- Sparks, D.L. 2001. Environmental Soil Chemistry. 2nd Edition. Academic Press. NY.  R2- McBride, M.B. 1994. Environmental Chemistry of Soils. Oxford Univ. Press. New York, NY.  R3- All handed material.  **B- Recommended materials and media:**   * Essington, M. E. 2004. Soil and water Chemistry: An Integrative Approach. CRC Press. USA * Sposito, G. 1989. Chemistry of Soils, Oxford Univ. Press, New York, NY * Essington, M.E. 2014. Soil and Water Chemistry, An Integrative Approach. 2 nd ed (1st is ok). CRC Press. Boca Raton. |

**28. Additional information:**

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| 1- Attendance is obligatory.  2- Any disturbance to class lectures will result in expulsion of the student and considering him absent from the lecture. Repetition of this behavior will subject the student for further actions according to UOJ regulations. |

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| Name of the Instructor or the Course Coordinator:    **Areej AL Khreisat Areej** | Signature: | Date:  **7/7/2024** |
| Name of the Head of Quality Assurance Committee/ Department  …………………………………………………. | Signature:  …………...……………… | Date:    ……..………… |
| Name of the Head of Department  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |
| Name of the Head of Quality Assurance Committee/ School or Center  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |
| Name of the Dean or the Director  …………………………………………………. | Signature:  …………...……………… | Date:  ……..………… |