UNIVERSITY OF SARGODHA

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES, UNIVERSITY COLLEGE OF AGRICULTURE

COURSE OUTLINE SPRING 2020

Course Title: Advance soil chemistry

Course Code: SES-7115

Credit Hours: 3(3-0)

Instructor: Dr. Mukkram Ali Tahir

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| **DESCRIPTION AND OBJECTIVES** |

This course is designed to give the post doctorate students an insight about the chemical thermodynamics of soils: Processes and variables, chemical potentials: Metal oxides, hydroxides and silicates clays, Kinetics of soil chemical reactions, Precipitation and dissolution in soil environment, Surface electro-chemistry of colloids: Sorption of trace metal ions; Selectivity and pH, Inter-particles attraction: Solid-solid and solid-liquid interaction, Chemistry of submerged soils, Chemical transformations of selective elements in soils, Contamination of soils with organic and inorganic pollutants, Risk assessment of trace metals in soil and water, Integrated management of polluted environment, Sorption theory: Description and application for decontamination of soils and water, Recent developments in soil and environmental chemistry and systems for waste water treatment: Physical, chemical and bio-chemical.

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| **INTENDED LEARNING OUTCOMES** |

After learning this course students will be able to know about the chemistry of soil along with chemical thermodynamics of soil under normal and submerged conditions. Nutrient cycling under different soil chemical conditions will be taught.

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| **COURSE CONTENTS** |

Theory

1. Chemical thermodynamics of soils: Processes and variables

2. Chemical potentials: Metal oxides, hydroxides and silicates clays

3. Kinetics of soil chemical reactions

4. Precipitation and dissolution in soil environment

5. Surface electro-chemistry of colloids: Sorption of trace metal ions; Selectivity and pH

6. Inter-particles attraction: Solid-solid and solid-liquid interaction

7. Chemistry of submerged soils

8. Chemical transformations of selective elements in soils

9. Contamination of soils with organic and inorganic pollutants

10. Risk assessment of trace metals in soil and water

11. Integrated management of polluted environment

12. Sorption theory: Description and application for decontamination of soils and water

13. Recent developments in soil and environmental chemistry

14. Systems for waste water treatment: Physical, chemical and bio-chemical

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| **READINGS** |

1. Conklin, Jr. A.R. 2005. Introduction to Soil Chemistry Analysis and Instrumentation. John Wiley & Sons, Inc., Hoboken, NY, USA.
2. Kumar, A. 2004. Environmental Contamination and Bio-reclamation. APH Publishing Corporation, New Delhi, India.
3. Schjonning, P., S. Elmholt and B.T. Christensen. 2004. Managing Soil Quality Challenges in Modern Agriculture. CABI Publisher Cambridge, MA, USA.
4. Sparks, D.L. 2003. Environmental Soil Chemistry. 2nd Ed. Academic Press, Inc., San Diego, CA, USA.
5. Sposito, G. 2008. The Chemistry of Soils. Oxford University Press, NY, USA.
6. Viessman, J.W. and M.J. Hammer. 2009. Water Supply and Pollution Control. 8th Ed. Prentice Hall NY, USA.

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| **COURSE SCHEDULE** | | | |  |
| **Week** | **Topics and Readings** | | **Books with Page No.** | **Dates** |
|  | Chemical thermodynamics of soils: Processes and variables | | Environmental Soil Chemistry, page 11-40 | 02-03-2020 to  06-03-2020 |
|  | Chemical potentials: Metal oxides, hydroxides and silicates clays | | Environmental Contamination and Bio-reclamation | 09-03-2020 to  13-03-2020 |
|  | Kinetics of soil chemical reactions | | Introduction to Soil Chemistry Analysis and Instrumentation | 16-03-2020 to  20-03-2020 |
|  | Precipitation and dissolution in soil environment | | The Chemistry of Soils | 23-03-2020 to  27-03-2020 |
|  | Surface electro-chemistry of colloids: Sorption of trace metal ions; Selectivity and pH | | The Chemistry of Soils, page 400-410 | 30-03-2020 to  03-04-2020 |
|  | Inter-particles attraction: Solid-solid and solid-liquid interaction | | The Chemistry of Soils, page 420-430 | 06-04-2020 to  10-04-2020 |
|  | Chemistry of submerged soils | | The Chemistry of Soils, page 45-460 | 13-04-2020 to  17-04-2020 |
|  | Chemical transformations of selective elements in soils | | Introduction to Soil Chemistry Analysis and Instrumentation | 20-04-2020 to  24-04-2020 |
|  | Mid term | | | 27-04-2020 to  01-05-2020 |
|  | Contamination of soils with organic pollutants | | Water Supply and Pollution Control | 04-05-2020 to  08-05-2020 |
|  | Contamination of soils with inorganic pollutants | | Water Supply and Pollution Control | 11-05-2020 to  15-05-2020 |
|  | Risk assessment of trace metals in soil and water | | Water Supply and Pollution Control | 18-05-2020 to  22-05-2020 |
|  | Integrated management of polluted environment | | Environmental Soil Chemistry | 25-05-2020 to  29-05-2020 |
|  | Sorption theory: Description and application for decontamination of soils and water | | Environmental Contamination and Bio-reclamation | 01-06-2020 to  05-06-2020 |
|  | Recent developments in soil and environmental chemistry | | Introduction to Soil Chemistry Analysis and Instrumentation | 08-06-2020 to  12-06-2020 |
|  | Systems for waste water treatment: Physical, chemical and bio-chemical | | Environmental Soil Chemistry | 15-06-2020 to  19-06-2020 |
|  | Chemical thermodynamics of soils: Processes and variables | | Environmental Contamination and Bio-reclamation | 22-06-2020 to  26-06-2020 |
|  | | **RESEARCH PROJECT/PRACTICAL/LABS/ASSIGNMENTS** | | |

1. Description and application for decontamination of soil and water
2. Sorption theory
3. Risk assessment of various trace elements in soil and water

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| **ASSESSMENT CRITERIA** |

Sessional: 12(project, presentation, participation)

Project: 06

Presentation: 03

Participation: 03

Mid exam: 18

Final exam: 30