CH-221 Soil Chemistry

Credit Hours: 2-1

Pre-requisite: Nil

Course Objectives

1. This course aims to provide students with a foundational understanding of soil chemistry, including soil composition, formation, and chemical properties. Students will explore key concepts such as soil texture, structure, colloids, pH, cation/anion exchange capacity, and nutrient cycling. The course also addresses soil contamination by heavy metals and pesticides, as well as strategies for salinity management and environmental remediation.

Course Contents

2. Soil Chemistry; Soil composition, properties, solution and remediation. Soil formation processes. Soil components: minerals, organic matter, water, air. Soil texture and structure. Soil colloids. Isomorphous substitution. Cation/anion exchange capacity (CEC/AEC). Soil- ion interactions. Soil oxidation and reduction. Minerals stability. Soil solution composition. Ionic equilibria. Solubility product. Precipitation-dissolution reactions. Soil pH. Buffering capacity. Acid/alkaline/saline/sodic soils. Salinity management. Active vs potential acidity. Function of organic matter in soil. Soil organic matter composition. Humification. Nutrient cycling. Macro/micronutrient chemistry. Fertilizers. Soil contamination: heavy metals, pesticides. Environmental remediation.

Course Outcomes

By the end of this course, the students will be able to:

3. Explain and analyze the chemical composition and fundamental properties of soils.
4. Evaluate soil solution chemistry and its impact on soil acidity, salinity, and overall soil health.
5. Assess the role of soil organic matter and environmental interactions

in nutrient cycling, soil contamination, and remediation.

Relevant Experiments

1. Soil texture analysis. pH and Electric conductivity measurement; EC. Cation exchange capacity (CEC). Organic matter estimation. Sodium absorption ratio (SAR). Nutrient availability: Nitrogen, Phosphorous and Potassium; NPK. Adsorption isotherm modeling. Soil sampling techniques. Soil moisture content.

Recommended Books

1. Strawn, D. G., Bohn, H. L., & O'Connor, G. A. (2019). *Soil Chemistry* (2nd ed.). John Wiley & Sons. ISBN: 978-1-119-51525-8.
2. Ahamed, M. I., Boddula, R., & Altalhi, T. (Eds.). (2021). *Applied Soil Chemistry* (1st ed.). John Wiley & Sons. ISBN: 9781119711520.
3. Sposito, G. (2008). *Chemistry of Soils* (2nd ed.). Oxford University Press. ISBN: 9780195313697.
4. Sparks, D. L., Singh, B., & Siebecker, M. G. (2023). *Environmental Soil Chemistry* (3rd ed.). Elsevier. ISBN: 978-0-443-14034-1.
5. Tan, K. H. (2010). *Principles of Soil Chemistry* (4th ed.). CRC Press. ISBN: 9780429184406.
6. Weil, R. R., Brady, N. C., & Weil, R. R. (2017). *Nature and Properties of Soils* (15th ed.). Pearson. ISBN: 0-13-325448-8.
7. Current Literature and Reviews.