**UNIVERSITY OF SARGODHA**

**DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES, COLLEGE OF AGRICULTURE**

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COURSE OUTLINE Spring 2020

Course Title: Introduction to Soil Science-II

Course Code: SAES-5802

Credit Hours: 3(2-1)

Instructor: Dr. Mukkram Ali Tahir

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| DESCRIPTION & OBJECTIVES |

To study the chemical properties of soil in relation to environment and plant growth. The knowledge attained by the students will help to tackle the soil problems. Moreover, students will learn about soil pollutants and their impact on human life. At the completion of this course, students will be able to understand;

1. Soil chemical properties and factors affecting it
2. Importance of soil organic matter
3. Essential nutrients and their available forms
4. Manufacturing of chemical fertilizers
5. Soil problems, causes and control
6. Impact of fertilizer on soil and environment.

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| READINGS |

1. Bashir, E. and R. Bantel. 2001. Soil Science. National Book Foundation, Islamabad.
2. Brady, N.C. and R.R. Weil. 2007. The Nature and Properties of Soils. 14th Ed. Pearson Education, Upper Saddle River, NJ, USA.
3. Brady, N.C. and R.R. Weil. 2009. Elements of the Nature and Properties of Soils. 3rd Ed. Pearson Education, Upper Saddle River, NJ, USA.
4. Hillel, D. 2008. Soil in the Environment: Crucible of Terrestrial Life. Elsevier Inc., Burlington, MA, USA.
5. Singer, M.J. and D.N. Munns. 2002. Soils- An Introduction. 5th ed. Prentice-Hall, Inc., Upper Saddle River, NJ, USA.

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| CONTENTS |

**Theory**

1. Soil colloids and clays: description and environmental significance
2. Sources of charges on soil colloids
3. Cation and anion exchange properties of soil and their significance; basic cation saturation percentage
4. Soil pH and its importance
5. Buffering of soil
6. Soil organic matter: sources, composition and significance
7. Elements essential for plant growth: macro and micro nutrients, organic and inorganic fertilizers
8. Salt-affected and waterlogged soils: types, reclamation and management
9. Soil erosion: causes and remedies: soil and water conservation
10. Environmental impact of agricultural and industrial wastes

**Practical**

1. Fertilizers: Identification, composition and calculation of nutrient percentage
2. Fertilizer analysis for N, P and K
3. Soil analysis for EC and pH
4. Determination of soil organic matter

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| **COURSE SCHEDULE** | | | | | |
| **Week** | **Topics and Readings**: *Give Reading No from your list of readings above and its Page Nos. relevant to the topic(s) covered each week* | | | | **Dates** |
| **Lecture** | **Topics** | **Pages** | **Book** |
| 1 | 1 | Introduction to Soil and Environment: Soil colloids, Definition and types (mineral and organic colloids) Soil clays (mineral colloids). Definition of clay and clay minerals | 316-324 | The Nature and Properties of Soils by Brady and Weil | 02-03-2020 to  06-03-2020 |
| 2 | Basic units of structure, i.e. Si-tetra- and Al-Octahedral. |
| 2 | 1 | Comparative characters such as particle size, shape, banding, specific surface area, CEC and swelling/shrinkage of: 1:1, 2:1 and 2:1:1 type clay minerals | 324-328 | The Nature and Properties of Soils by Brady and Weil | 09-03-2020 to  13-03-2020 |
| 2 | Clay minerals found in Pakistan. List of methods of identification of clay minerals | 67-102 | Soil Science NBF |
| 3 | 1 | Sources of charges on clays and humus | 336-339 | The Nature and Properties of Soils by Brady and Weil | 16-03-2020 to  20-03-2020 |
| 2 | Permanent and pH dependent charges; functional groups; Curve showing the effect of pH. | 336-338 |
| 4 | 1 | Cation and anion exchange, Definition. | 341-345, | The Nature and Properties of Soils by Brady and Weil | 23-03-2020 to  27-03-2020 |
| 2 | Distribution of soluble and exchangeable cations on exchange complex. | 352-353  339-349 |
| 5 | 1 | CEC: Definition and units; factors affecting | 345-348 | The Nature and Properties of Soils by Brady and Weil | 30-03-2020 to  03-04-2020 |
| 2 | Importance of CEC |
| 6 | 1 | BCSP: Definition, explanation & importance | 176-182 | Soil Science by NBF | 06-04-2020 to  10-04-2020 |
| 2 | Soil pH: Definition, computation, pH scale and significance |
| 7 | 1 | Soil buffering capacity and its importance | 369-376 | The Nature and Properties of Soils by Brady and Weil | 13-04-2020 to  17-04-2020 |
| 2 | Organic matter: Definition, sources and composition & importance | 498-500 |
| 8 | 1 | C:N ratio and its importance, Definition of humus | 506-521 | The Nature and Properties of Soils by Brady and Weil | 20-04-2020 to  24-04-2020 |
| 2 | Manures: FYM, Green manure and Compost: Definition, composition and benefits | 388-396 | Soil Science by NBF |
| **Mid -term Examination** | | | | | 27-04-2020 to  01-05-2020 |
| 9 | 1 | Essential elements: Definition, Criteria and list, Ionic forms of nutrients absorbed by plants | 45-78 | Soil fertility and fertilizers (Tisdale et al.) | 04-05-2020 to  08-05-2020 |
| 2 | Function and deficiency symptoms of macronutrients | 41-52 | Fertilizers and Their use in Pakistan (NFDC) |
| 10 | 1 | Nitrogen cycle: Definition, processes and sketch, N-transformations | 546-549 | The Nature and Properties of Soils by Brady and Weil | 11-05-2020 to  15-05-2020 |
| 2 | BNF: Definition and processes  Names of the important N-fixers | 564-572 |
| 11 | 1 | N-losses: Definition and processes involved | 554-564 | 18-05-2020 to  22-05-2020 |
| 2 | N-balance sheet | 554-572 |
| 12 | 1 | Phosphorus: Status and sources (organic and inorganic) | 601-608 | The Nature and Properties of Soils by Brady and Weil | 25-05-2020 to  29-05-2020 |
| 2 | Factors affecting P availability (inorganic) Role of MO in P availability | 609-612 |
| 13 | 1 | Fertilizer: Definition and importance  Types of fertilizers. | 58-65 | Fertilizers & their Use in Pakistan (2003) NFDC | 01-06-2020 to  05-06-2020 |
| 2 | Nutrient percentage in fertilizers available in Pakistan | 58-59 |
| 14 | 1 | Salt-affected soils: Definition, sources and extent in Pakistan | 471-499 | Soil Science (NBF) | 08-06-2020 to  12-06-2020 |
| 2 | Types of salt-affected soils, reclamation & management | 419-428 | The Nature and properties of Soils by Brady and Weil |
| 15 | 1 | Waterlogged soil: Definition, causes, extent, | 499-503 | Soil Science (NBF) | 15-06-2020 to  19-06-2020 |
| 2 | Remedies and management of waterlogged soil | 499-503 |
| 16 | 1 | Soil erosion: Definition, types, causes and remedies, Water Conservation: Water conservation practices | 509-536 | Soil Science (NBF) | 22-06-2020 to  26-06-2020 |
| 2 | Environmental impact of agricultural and industrial wastes: Sources, impact and management | 797-837 | The Nature and Properties of Soils by Brady and Weil |
| **Week** | **Practical** | **Topics** | **Suggested readings** | | **Date** |
| 1 | 1 | Identifications of N, P and K fertilizers | Hand outs will be provided | | 02-03-2020 to  06-03-2020 |
| 2 | 2 | Fertilizer nutrient percentage | Hand outs will be provided | | 09-03-2020 to  13-03-2020 |
| 3 | 3 | Conversion factors and current prices | Hand outs will be provided | | 16-03-2020 to  20-03-2020 |
| 4 | 4 | Determination of Nitrogen from CAN fertilizer | Hand outs will be provided | | 23-03-2020 to  27-03-2020 |
| 5 | 5 | Determination of nitrogen %age from (NH4)2SO4 fertilizer | Hand outs will be provided | | 30-03-2020 to  03-04-2020 |
| 6 | 6 | Determination of nitrogen percentage from KNO3 fertilizer | Hand outs will be provided | | 06-04-2020 to  10-04-2020 |
| 7 | 7 | Determination of available P from phosphorus fertilizer | Hand outs will be provided | | 13-04-2020 to  17-04-2020 |
| 8 | 8 | Determination of total P from phosphorus fertilizer | Hand outs will be provided | | 20-04-2020 to  24-04-2020 |
| 9 | 9 | Determination of K from potassium fertilizer | Hand outs will be provided | | 04-05-2020 to  08-05-2020 |
| 10 | 10 | Soil analysis (soil paste) | ACARDA MANUAL | | 11-05-2020 to  15-05-2020 |
| 11 | 11 | Collection of extract from soil paste | ACARDA MANUAL | | 18-05-2020 to  22-05-2020 |
| 12 | 12 | Determination of moisture percentage from soil paste | ACARDA MANUAL | | 25-05-2020 to  29-05-2020 |
| 13 | 13 | Determination of ECe | ACARDA MANUAL | | 01-06-2020 to  05-06-2020 |
| 14 | 14 | Determination of soil pH | ACARDA MANUAL | | 08-06-2020 to  12-06-2020 |
| 15 | 15 | Determination of soil pH | ACARDA MANUAL | | 15-06-2020 to  19-06-2020 |
| 16 | 16 | Organic matter determination from soil | ACARDA MANUAL | | 22-06-2020 to  26-06-2020 |

1. ***Note****: You can reserve one week for sessional or mid-term exam, and if you wish, one week for student presentations of the assigned research project*

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| **RESEARCH PROJECT** |

1. Collection of various sources of N, P and K fertilizers
2. Models of 1:1 type, 2:1 type clay minerals

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| ASSESSMENT CRITERIA |

Sessional: 08 (project, presentation, participation)

Project: 04

Presentation: 02

Participation: 02

Mid exam: 12

Practical exam: 20

Final exam: 20

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| RULES AND REGULATION |

75% class attendance is compulsory.

No class assignments after due date will be entertained.