**UNIVERSITY OF SARGODHA**

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

COURSE OUTLINE FALL 2020

Course Title: INTRODUCTION TO SOIL SCIENCE-I

Course Code: **SAES-5801**

Credit Hours: **3(2-1)**

Instructor: **Dr. MUKKRAM Ali TAHIR**

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| **DESCRIPTION & OBJECTIVES** |

**Aims of the course**: The aim of this course is basically to introduce students with soil and environment. This course is vital to develop understanding about the natural systems like soil and environment; and apply their knowledge to solving soil and environmental problems. Moreover, this course will help the students to understand the behavior of soils in supporting the growth of crops and maintaining a clean environment.

**Objectives of the course**:

At the completion of this course, students will be able to understand;

1. Soil forming processes and different factors involved.
2. Significance of physical properties of soil in crop growth.
3. The dominant soil parent material present and classification of Pakistani soils according to their use.
4. The methods of water quality assessment regarding its fitness for soil and crop growth.
5. Soil, water and air pollution and its impact on crop growth 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.
6. Das, D.K. 2011. Introductory Soil Science. 3rd ed. Kalyani Publ. New Delhi-110002, India.

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| **CONTENTS** |

**Theory**

1. Introduction to Soil and environment: definition of earth, geology and soil science; disciplines of soil science; lithosphere, hydrosphere and biosphere
2. Soil forming rocks and minerals: types and their formation.
3. Weathering of rocks and minerals: definition. Agents and classification
4. Parent materials: definition and types
5. Soil formation: definitions, processes and factors
6. Soil profile: definition and description
7. Physical properties of soil and their significance
8. Introduction to soil classification and land use capability classes
9. Soil, water and air pollution: sources and types

Practical:

1. Methods of soil sampling and handling
2. Preparation of saturated soil paste
3. Determination of soil water contents
4. Analysis of irrigation water, report writing and interpretation.
5. Textural analysis of soil

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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/ Practical** | **Topics** | **Chapter/Pages** | | **Book** |
| 1 | 1 | Introduction to Soil and Environment  Disciplines of soil and environmental sciences, Materials of earth: Lithosphere, hydrosphere | 1/1-2  1/9 | | K. H. Tan  Soil: Basic Concepts and Principles | **16-11-2020 to**  **20-11-2020** |
| 2 | Atmosphere and biosphere; Soil forming minerals. Definition of minerals and their types and formation | 1/9-10  2/27-32 | | Soil Science. NBF  The Nature and Properties of Soils |
| 3 | Analysis of irrigation water for  - Electrical conductivity, pH and TSS |  | | Notes will be given |
| 2 | 1 | Common physical properties of minerals: Cleavage, fracture, hardness, Color, luster, streak, | 2/33 | | Soil Science. NBF | **23-11-2020 to**  **27-11-2020** |
| 2 | Form, specific gravity and tenacity Definition of primary and secondary minerals.  Rock: Definition and types i.e. Igneous, sedimentary and metamorphic rocks | 2/33  2/32  2/27-32 | | Soil Science. NBF  The Nature and Properties of Soils (13th Ed.) |
| 3 | Presentations |  | |  |
| 3 | 1 | Formation and division of igneous rock, Weathering: Definition: Weathering agents including temperature, water, wind, ice and living organisms | 2/27-28 2/37-44 | | Soil Science. NBF  The Nature and Properties of Soils | **30-11-2020 to**  **04-12-2020** |
| 2 | Classification of weathering;  Mechanical (disintegration)  - Freezing and thawing | 2/38-39  2/34-40 | | Soil Science. NBF  The Nature and Properties of Soils |
| 3 | Analysis of irrigation water for carbonates and bicarbonates determination |  | | Notes will be given |
| 4 | 1 | Mechanical weathering(disintegration)   * Expansion and contraction, grinding & abrasion by running water or glaciers, Mechanical (disintegration) | 2/36  2/38-39 | | The Nature and Properties of Soils  Soil Science-NBF | **07-12-2020 to**  **11-12-2020** |
| 2 | Action of living organisms | 2/43 | | Soil Science-NBF |
| 3 | Analysis of irrigation water for chloride determination |  | | Notes will be given |
| 5 | 1 | Chemical weathering (Synthesis and resynthesis)  - Hydrolysis, hydration, carbonation, Oxidation and reduction | 2/40-43  2/34-40 | | Soil Science-NBF  The Nature and Properties of Soils | **14-12-2020 to**  **18-12-2020** |
| 2 | Parent materials: Definition; Material deposited by water  - Alluvial (Flood plains) | 2/48  2/40-42 | | Soil Science-NBF  The Nature and Properties of Soils |
| 3 | Analysis of irrigation water for Ca2+ + Mg2+ determination |  | | Notes will be given |
| 6 |  | **Winter Vacations** |  | |  | **21-12-2020 to**  **25-12-2020** |
| 7 | **Mid-term examination** | | | | | **18-01-2021 to**  **22-01-2021** |
| 8 | 1 | Material deposited by water  - Alluvial fans and deltas  - Marine and lacustrine  - Material deposited by wind (Aeolian): | 2/48  2/40-67 | | Soil Science-NBF | **28-12-2020 to**  **01-01-2021** |
| 2 | Loess, adobe, sand dunes and volcanic ash; Material deposited from ice (glacial); Sediments moved by gravity (colluvial) | 2/40-67 | | The Nature and Properties of Soils |
| 3 | Analysis of irrigation water for sodium determination |  | | Notes will be given |
| 9 | 1 | Processes of soil formation(Addition, losses, transformations and translocation   * Soil forming factors and their role in soil formation: | 2/64-66,  2/54-62 | | The Nature and Properties of Soils | **04-01-2021 to**  **08-01-2021** |
| 2 | - Climate, biotic and topography Factors & their role in soil formation:  - Parent material and time | 2/61  2/62-63 | | The Nature and Properties of Soils |
| 3 | Report writing regarding fitness of irrigation water |  | | Notes will be given |
| 10 | 1 | Soil morphology, profile and definitions  Description of a typical soil profile with a sketch | 925  2/69 | | The Nature and Properties of Soils | **11-01-2021 to**  **15-01-2021** |
| 2 | Soil development processes:  - Calcification | 2/59-60 | | Soil Science – NBF |
| 3 | Method of soil sampling, preparation, labeling and storage |  | | Notes will be given |
| 11 | 1 | Soil development processes:   * Decalcification, podzolization (silication), desilication (laterization) | 2/60-62  16/473-475 | **08** | | **25-01-2021 to**  **29-01-2021** |
| 2 | Physical properties of soil: definition and names; Soil texture: Definition, soil separates and their diameter ranges (ISSS & USDA systems) | 4/123-25, 475  4/114-115 | The Nature and Properties of Soils  Soil Science – NBF | |
| 3 | Particle-size analysis, Stoke’s law, textural classes and significance in plant growth; Soil structure: Definition, types and importance |  | Handouts will be given | |
| 12 | 1 | Soil development processes:  Gleization, salination, desalination and sodication | 4/127-133  4/133-136  4/117-129 | The Nature and Properties of Soils  Soil Science – NBF | | **01-02-2021 to**  **05-02-2021** |
| 2 | Particle density: Definition, units and average value in soil; Bulk density, definition, importance & calculation units and average value in soil | 4/130-133 | Soil Science – NBP | |
| 3 | Textural analysis of soil |  | Notes will be given | |
| 13 | 1 | Pore space: Definition, types, importance and calculation  Soil aeration: Definition, significance | 4/133-136  7/272-286 | Soil Science – NBF  The Nature and Properties of Soils | | **08-02-2021 to**  **12-02-2021** |
| 2 | Composition of soil & atmospheric air Soil water: Soil water potential, water retention forces, classification (Gravitational, plant available, field capacity, permanent wilting percentage); Methods for measurement (list only) | 5/147-163 | Soil Science – NBF | |
| 3 | Textural analysis of soil |  | Notes will be given | |
| 14 | 1 | Soil colour, its notations and factors affecting  Soil temperature: Factors influencing modification and importance, | 4/136-140 4/140-142 | Soil Science – NBF | | **15-02-2021 to**  **19-02-2021** |
| 2 | Soil classification; Soil taxonomy: Definition; Categories and bases of differentiation | 14/405-419 | Soil Science – NBF | |
| 3 | Presentations |  |  | |
| 15 | 1 | Names of orders and those found in Pakistan; Diagnostic horizons: Epi and endopedons | 14/407-411 | Soil Science – NBF | | **22-02-2021 to**  **26-02-2021** |
| 2 | Properties of those found in Pakistan Land capability classification: Brief description of all classes particularly encountered in Pakistan. | 17/787-789 | The Nature and Properties of Soils | |
| 3 | Textural analysis of soil by feel method |  | Notes will be given | |
| 16 | 1 | Soil pollution, air pollution | 11/349 | K. H. Tan | | **01-03-2021 to**  **05-03-2021** |
| 2 | Sources and types of soil pollution | 11/349 | K. H. Tan | |
| 3 | Preparation of saturated soil paste |  | Notes will be given | |
|  | Final Terms | | |  | |  |

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| **RESEARCH PROJECT** |

Short research projects and laboratory assignments will be assigned to the students during the semester

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| **ASSIGNMENT CRITERIA** |

Sessional: 20 % of the total theory marks (Project, Presentation, Participation and Assignment)

Project: -

Presentation: -

Participation: -

Mid Exam: 30 % of the total theory marks

Final Exam: 50 % of the total theory marks

Practical Exam: 100 % of the total practical marks

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| **RULES AND REGULATIONS** |

75% attendance is mandatory for the students to appear in the final examination.

No class assignments after due date will be entertained.