| Programme | B.Sc. (Hons) Agriculture (Major: Soil Science) | Course Code | SS-301 | Credit Hours | 3(2-1) |
|---|---|---|---|---|---|
| **Course Title** | **PHYSICAL PROPERTIES OF SOIL** | | | | |

**Course Introduction**

Physical properties of soil and their role in water and nutrient holding and soil conditions in relation to plant growth will be covered. The students should be able to measure and interpret the soil physical properties and their significance in crop growth.

**Learning Outcomes**

- Students will be able to identify and describe the key physical properties of soils, including texture, structure, density, porosity, and color
- Students will understand how different physical properties influence soil behavior, such as water retention, drainage, and aeration
- Students will be able to apply various methods (sieve, hydrometer, pipette, feel) to determine soil texture and classify soil samples according to texture.

| | Course Content (Theory) | Assignments/Readings |
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| **Week 1** | **Unit 1**<br><br>1.1.Soil physical condition and plant growth<br>1.1.1. Soil Texture and Structure<br>1.1.2. Soil Compaction and Aeration<br>1.1.3. Water-Holding Capacity and Drainage | |
| **Week 2** | **Unit 2**<br><br>2.1. Soil texture, specific surface area and importance<br><br>2.1.1. Importance of soil texture<br><br>2.1.2. Specific surface | Write a reflective essay (1500-2000 words) that synthesizes the information from the readings and explores the connections between soil physical conditions and plant growth. |
| **Week 3** | **Unit 3**<br><br>3.1. Soil structure: development and description<br><br>3.1.1. Soil Structure Development | |

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| | 3.1.2. Soil Structure Description<br><br>3.1.3. Importance of soil structure | |
| **Week 4** | **Unit 4**<br><br>4.1. Soil crusting and surface sealing with role in seedling emergence<br><br>4.1.1. Soil crusting<br><br>4.1.2. Surface sealing<br><br>4.13. Management of soil crusting | Discuss the effects of soil crusting and surface sealing on seedling emergence. |
| **Week 5** | **Unit 5**<br><br>5.1. Particle and bulk density: description and significance<br><br>5.1.1. Particle density<br><br>5.1.2. Bulk density<br><br>5.1.3. Comparative significance of particle and bulk density | Highlight the importance of particle and bulk density in maintaining optimal conditions for plant growth. |
| **Week 6** | **Unit 6**<br><br>6.1. Total porosity and pore-size distribution and root development<br><br>6.1.1. Total porosity<br><br>6.12. Pore-size distribution<br><br>6.1.3. Impact of porosity on crop growth and development | |
| **Week 7** | **Unit 7**<br><br>7.1. Soil air composition and aeration<br><br>7.1.2. Soil Air Composition<br><br>7.1.3. Soil Aeration | Examine the causes of soil compaction and possible remedies. Discuss different soil tillage systems and their impact on soil tilth. |

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| | 7.1.4. Management and Improvement | |
| **Week 8** | **Unit 8**<br>8.1. Soil temperature and its management<br>8.1.2. Factors Affecting Soil Temperature<br>8.1.3. Management Strategies | |
| **Week 9** | **Unit 9**<br>9.1. Soil color: causes and significance<br>9.1.2. Causes of Soil Color<br>9.1.3. Significance of Soil Color | |
| **Week 10** | **Unit 10**<br>10.1. Soil consistency and strength and interpretation for soil mechanics<br>10.1.1. Soil consistency and strength<br>10.1.2. Interpretation for soil mechanics | How soil consistency is linked with crop growth? |
| **Week 11** | **Unit 11**<br>11.1. Soil water and water potential and plant available water<br>11.2. Soil water and its importance | |
| **Week 12** | **Unit 12**<br>12.1. Water and solute movement through soil | |
| **Week 13** | **Unit 13**<br>13.1. Soil compaction: causes and remedies<br>13.1.1. Impact of soil compaction<br>13.1.2. Possible stratigies to combat soil compaction | |

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| **Week 14** | **Unit 14**<br>14.1. Soil tillage systems and tilth | |
| **Week 15** | **Unit 15**<br>15.1. Soil physical environment and root architecture<br>15.1.1. Physical environment of rhizosphere | |
| **Week 16** | 15.1.2. Root architecture and its link with soil | |
| **Course Content (Practical)** | | **Assignments/Readings** |
| **Week 1** | **Unit 1**<br>1.1.Textural analysis: sieve, hydrometer, pipette and feel methods-Lecture<br>1.1.1. Sieve Method for Soil Texture Analysis<br>1.1.2. Principles and procedure of sieve analysis<br>1.1.3. Hydrometer Method for Soil Texture Analysis<br>1.1.4. Principles and procedure of hydrometer analysis | |
| **Week 2** | 1.1.5. Textural analysis: sieve, hydrometer, pipette and feel methods-Practical | Practical notebook completion |
| **Week 3** | **Unit 2**<br>2.1. Determination of bulk and particle density<br>2.1.1. Concepts of bulk and particle density<br>2.1.2. Laboratory techniques for measurement | |
| **Week 4** | 2.1.3. Determination of bulk and particle density-Practical | Practical notebook completion |
| **Week 5** | **Unit 3**<br>3.1. Total soil porosity estimation<br>3.1.2. Relationship between bulk density and porosity<br>3.1.3. Techniques for estimating soil porosity | |
| **Week 6** | 3.1.4. Total soil porosity estimation-Practical | Practical notebook completion |

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| **Week 7** | **Unit 4**<br>4.1. Aggregate stability estimation<br>4.1.1. Importance of aggregate stability<br><br>4.1.2. Methods for measuring aggregate stability | |
| **Week 8** | **Unit 5**<br>5.1. Measurement of soil water contents<br>5.1.1. Methods for measuring soil moisture | Practical notebook completion |
| **Week 9** | 5.1.2. Practical exercises on soil water content measurement | |
| **Week 10** | **Unit 6**<br>6.1. Measurement of soil temperature<br>6.1.2. Importance of soil temperature<br><br>6.1.3. Techniques for measuring soil temperature | Practical notebook completion |
| **Week 11** | **Unit 7**<br>7.1. Soil color and its interpretation<br>7.1.1. Soil color as an indicator of soil properties<br><br>7.1.3. Methods for determining and interpreting soil color | |
| **Week 12** | 7.1.4. Soil color and its interpretation-Practical | Practical notebook completion |
| **Week 13** | **Unit 8**<br><br>9.1. Determination of soil strength/soil penetrometer resistance<br><br>9.1.2. Principles of soil strength and penetrometer resistance<br><br>9.1.3. Techniques for measuring soil strength | |
| **Week 14** | 9.1.4. Determination of Soil Strength-Practical | Practical notebook completion |
| **Week 15** | 9.1.5. Hands-on Review: Texture and Density<br><br>9.1.6. Review and practice of sieve, hydrometer, pipette methods<br><br>9.1.7. Practice with bulk and particle density determination | |

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| **Week 16** | 9.1.8. Hands-on Review: Porosity and Stability<br><br>9.1.9. Review and practice of total soil porosity estimation<br><br>9.1.10. Practice with aggregate stability estimation | Practical notebook completion |

**Textbooks and Reading Material**


1. 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.
2. 2. Hillel, D. 2004. Introduction to Environmental Soil Physics. Elsevier, San Diego, CA, USA.
3. 3. Hillel, D. 2008. Soil in the Environment: Crucible of Terrestrial Life. Elsevier Inc., Burlington, MA, USA.
4. 4. Jury, W. A. and R. Horton. 2004. Soil Physics. 6th Ed. John Wiley & Sons. Inc., NY, USA


**Teaching Learning Strategies**

1. Multimedia
2. White Board
3. Group discussion
4. Quiz/Assignments
5. Demonstration/Activity

**Assignments: Types and Number with Calendar**

1. Write a reflective essay (1500-2000 words) that synthesizes the information from the readings and explores the connections between soil physical conditions and plant growth.
2. Discuss the effects of soil crusting and surface sealing on seedling emergence.
3. Examine the causes of soil compaction and possible remedies. Discuss different soil tillage systems and their impact on soil tilth.
4. How soil consistency is linked with crop growth?
5. Practical notebook completion

| Assessment | | | |
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| **Sr. No.** | **Elements** | **Weightage** | **Details** |
| 1. | Midterm Assessment | 35% | Written Assessment at the mid-point of the semester. |
| 2. | Formative Assessment | 25% | Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc. |
| 3. | Final Assessment | 40% | Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc. |