Faculty of Agricultural and Food Sciences, Department of Soil Science, University of Manitoba  
Physical Properties of Soils (SOIL 4060)  
Winter 2021 Course Information and Schedule

<table>
<thead>
<tr>
<th>General Course Objective</th>
<th>Senior undergraduate students will have an understanding of physical properties of soil, will be able to measure these properties and are able to relate soil physical properties to soil processes and plant growth.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>Soils and Landscapes in our environment (SOIL 3600), Transport Phenomena (BIOE 2110).</td>
</tr>
<tr>
<td>Course Duration</td>
<td>January 18, 2021 to April 16, 2021.</td>
</tr>
<tr>
<td>Course Credits</td>
<td>3</td>
</tr>
<tr>
<td>Class Hours</td>
<td>Classes will be recorded.</td>
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</tbody>
</table>

**Remote Learning link:**

**Mondays, Wednesdays, Fridays: 9:30 am -10:20 am**

Join Zoom Meeting

https://zoom.us/j/93115905845?pwd=UTRlWFVKQzdHM1NQUVNvVGNMNNwpNQT09  
Meeting ID: 931 1590 5845  
Passcode: 8XBFOX  
One tap mobile  
+13017158592,,93115905845#,,,,,*294538# US (Washington D.C)  
+13126266799,,93115905845#,,,,,*294538# US (Chicago)

Dial by your location
  +1 301 715 8592 US (Washington D.C)  
  +1 312 626 6799 US (Chicago)  
  +1 346 248 7799 US (Houston)  
  +1 646 558 8656 US (New York)  
  +1 669 900 9128 US (San Jose)  
  +1 253 215 8782 US (Tacoma)

Meeting ID: 931 1590 5845  
Passcode: 294538  
Find your local number: https://zoom.us/u/ayohgvBK9

**Thursdays: 2:30-5:25**

Join Zoom Meeting

https://zoom.us/j/93115905845?pwd=UTRlWFVKQzdHM1NQUVNvVGNMNNwpNQT09  
Meeting ID: 931 1590 5845  
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Meeting ID: 931 1590 5845
Passcode: 294538
Find your local number: [https://zoom.us/u/ayohgvBK9](https://zoom.us/u/ayohgvBK9)

### Contact information

<table>
<thead>
<tr>
<th>Instructor: Dr. Afua Adobea Mante</th>
<th>Email: <a href="mailto:Afua.Mante@umanitoba.ca">Afua.Mante@umanitoba.ca</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Soil Science, University of Manitoba</td>
<td>Office Hours: Send an email to set up appointment.</td>
</tr>
<tr>
<td></td>
<td>Location: Remotely</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching Assistant: Takudzwa Nawu</th>
<th>Email: <a href="mailto:nawut@myumanitoba.ca">nawut@myumanitoba.ca</a></th>
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<tbody>
<tr>
<td>Department of Soil Science, University of Manitoba</td>
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### Other information

<table>
<thead>
<tr>
<th>Voluntary Withdrawal Date:</th>
<th>March 31, 2021</th>
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<tbody>
<tr>
<td>Last Day of Classes</td>
<td>April 16, 2021</td>
</tr>
<tr>
<td>Winter Term Final Exam Period</td>
<td>April 19 to May 1, 2021</td>
</tr>
<tr>
<td>Holiday and Closures</td>
<td>February 15, 2021 (Louis Riel Day); February 16 to February 19, 2021 (Winter break); April 2, 2021 (Good Friday)</td>
</tr>
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</table>

### Textbook

- Environmental Soil Physics - Daniel Hillel - Academic Press (On reserve at the Ag. Library)
- Introduction to Environmental Soil Physics - Daniel Hillel - Academic Press (On reserve at the Ag. Library)
- Soil Physics - Agricultural and Environmental Application - H. Don Scott - Iowa State University Press.
- Introduction to Soil Physics - Daniel Hillel - Academic Press
- Soil Physics - (Sixth Edition) - W.A. Jury, and Robert Horton - John Wiley & Sons
- Soil Physics with Hydrus - Radcliffe and Simunek

### Course Web Site

UMLearn

### Course Assessments

<table>
<thead>
<tr>
<th>Class Assignments (10)</th>
<th>25%</th>
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</thead>
<tbody>
<tr>
<td>Midterm 1</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm 2</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>45%</td>
</tr>
<tr>
<td>---------------------------</td>
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### Grading Scale for Course

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percentage out of 100</th>
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<tbody>
<tr>
<td>A+</td>
<td>≥ 90</td>
</tr>
<tr>
<td>A</td>
<td>80 - 89</td>
</tr>
<tr>
<td>B+</td>
<td>75 - 79</td>
</tr>
<tr>
<td>B</td>
<td>70 - 74</td>
</tr>
<tr>
<td>C+</td>
<td>64 - 69</td>
</tr>
<tr>
<td>C</td>
<td>55 - 63</td>
</tr>
<tr>
<td>D</td>
<td>46 - 54</td>
</tr>
<tr>
<td>F</td>
<td>≤ 45</td>
</tr>
</tbody>
</table>

### Policies

**Late assignments**
Assignments are due one week after they are assigned. Assignments submitted after the due date will be deducted 10% per school day. Assignments will not be accepted after providing feedback.

**Attendance and Participation**
You are required to attend all classes and to complete all of your assigned readings and assignments. Always notify me if you are unable to attend class.

**Classroom and email conduct**
Your full attention is requested during lectures and all class discussions. In accordance with university policy, all email communication for this course shall be conducted using your University of Manitoba email address only.

**Copyright/Academic integrity**
Students do not have ownership rights to materials developed for the course. Posting or any other means of publishing these materials is prohibited. Refer to link below to know more about academic integrity at the University of Manitoba:
https://umanitoba.ca/student-supports/academic-supports/academic-integrity

**Course Details**
Subject to change
Lectures

Overview of Soil
- What is soil Physics
- Essence of soil; Soil as three-phase system; Soil profile; Soil profile and soil formation
- Basic relationship among soil phases

Assignment 1

Soil solid phase
- Characterization of soil solid phase: Soil texture; Particle size distribution; Specific surface

Assignment 2
- Nature and behaviour of clay: What is clay; Structural unit of clay; Types of clay; Properties of Clay: Electrostatic double-layer concept; Cation exchange capacity; Hydration, swelling and shrinkage; Dispersion and flocculation
- Soil structure: Application of soil structure; Types of soil structure; Aggregated soil structure; Factors that influence aggregation; Vulnerability of aggregates; Aggregate size distribution

Assignment 3

Midterm 1

Soil liquid phase
- Hydrological cycle
- Soil water: Essence of soil water; Expressing soil wetness; Soil wetness determination

Assignment 4
- Energy state of soil water: Soil-water potential; Components of soil-water potential; Soil-moisture characteristic curve

Assignment 5

Assignment 6

Soil Aeration
- Essence of soil aeration; movement of soil gases; causes of impeded aeration; impact of impeded aeration
- Characterizing soil aeration
- Gas transport in soil: Convection; Diffusion

Assignment 7

Midterm 2

Soil Temperature
- Essence of soil temperature; Factors that influence soil temperature; Determination of soil temperature

Heat Transfer in Soil
- Heat transport processes; Heat transfer mechanisms in soil; Thermal properties of soil; Management of soil heat

Assignment 8
Entry of Water into Soil

- Infiltration; Mode of water supply; Factors that influence infiltrability; Profile moisture distribution during infiltration; Methods for measuring infiltration; Equations for infiltrability

Assignment 9

Soil Water Availability to Plants

- Plant need for soil water; Available soil water; Factors that influence soil water availability

Assignment 10