Soil Physics – Soil 465/665

Spring Semester, 2021

Soil Physics, as a scientific endeavor, deals with the state and movement of matter and with the fluxes and transformations of energy in the soil and related porous media (Soil Science Society of America). In layman's terms… The arrangement of soil materials and the movement of air, water, chemicals, and heat in soil.

Objectives: Students will…

1: Be able to define and explain basic concepts of soil physics
2: Be able to apply soil physics concepts as appropriate
3: Be able to recognize and describe soil physics when you see it outside the classroom
4: Enhance their overall scientific, quantitative, and computer skills

Instructor: Dr. Jacob Prater, 274 TNR, office phone: 346-4180; jprater@uwsp.edu.

Office hours: by appointment and online

When and where: Anywhere, anytime… this course is offered with an in-person lab and the lecture is asynchronous (online videos). However, I will be delivering some content in real time for those that can attend (it will be recorded for those that cannot). I will also be offering weekly discussion and office hour for those that can attend (again recorded for those who cannot attend).

Disabilities: Please address any special needs or accommodations with me at the beginning of the semester, or as soon as you become aware of them. Those seeking accommodations based on disabilities should obtain an Accommodation Request Form from Disability Services Room 609 Learning Resource Center phone: (voice) 715-346-3365 (TTY) 715-346-3362.

Textbook: *Soil Physics 6th edition*, by W. Jury and R. Horton, John Wiley and Sons Inc., 2004. You will be tested on material in this book, so I strongly recommend that you get a copy and **READ *it***.

My expectations of you: I expect academic integrity, and courtesy toward me and toward your fellow students. I expect you to attend and participate in lectures (as you are able), and to read the assigned readings before each lecture (see Quizzes, below). If you are going to miss a class, please let me know in advance (e-mail is fine) if you can. I expect you to submit assignments on time. Finally, I expect you to tell me when you don't understand material (I am happy to emulate my normal open door policy via being available on zoom for quick questions, just shoot me an e-mail and we'll set it up). Interrupting (courteously!) a lecture with a question tells me that you're awake, paying attention, and wanting to understand – how could I object? I expect excellence (not perfection, just your best).

My obligations toward you: Academic integrity, and courtesy. I am responsible for providing you with information, for helping you to learn the material, for fostering an environment conducive to learning, and for fairly and promptly evaluating your understanding of the material.

Difference between Soil 465 and 665: 465 is for undergraduates; 665 is for graduate students. Specifically, (a) their exams will have one or two additional questions, and (b) they must write a critical review article, and present it to the class, on a soil physics topic (mutually agreed upon by the student and the instructor).

Evaluation: Grades are weighted as shown:

Course	**465**	**665**
2 semester exams (Exam 2 will be in two parts and online)	100 pts each	100 pts each
1 Final exam	200 pts	200 pts
8 Quizzes (lowest 2 will be dropped)	60 pts	60 pts
10 Labs	300 pts	300 pts
4 Homeworks	160 pts	160 pts
Critical review article and presentation	NA	150 pts

Grading scale

***Expect the A,B,C,etc breakdown to follow the 90,80,70, etc. percent of total points earned (Plus/Minus will be used).

Exams (including the final) are comprehensive. You may use any resources you want/need.

Quizzes occur frequently (1 every 2 weeks). They are short, cover assigned reading and the previous lecture, and take about 10 minutes. Their purpose is to encourage you to read the assignments, and to keep up with lecture topics. There will be no make-up quizzes, but your 2 lowest quiz scores will not count towards your final grade. The quizzes will be on Canvas and will consist of a variety of question types.

Labs: lab grades are a combination of pre-lab quizzes and lab reports. Each lab has a video tutorial and a lab procedure handout, to be watched and read prior to taking the pre-lab quiz before coming to lab. There are no make-up pre-lab quizzes. Lab reports are generally due the following week unless otherwise indicated.

Homework may be done with others: this is often a good way to learn. Each person must submit their own paper, and provide the names of those with whom they worked. Assignments submitted late are docked 10% per day, starting at the end of the class period at which the assignment was due.

Critical Review Articles (665 students) must have a soil physics or closely related topic agreed upon by the instructor and student. Ideally they would complement the students' research or interest. The article should be written as if submitting for publication and should include: Abstract, Introduction, Discussion, and Conclusions/Future Directions. Additionally, the student should identify the top 3-5 papers on the subject of the article. The presentation to the class should be 12-15 minutes allowing 5 minutes for questions.

Course Outline: (subject to change)

Date	Topic	Reading in Jury and Horton Textbook
	First week no lab	
Week 1	Introduction	**xiii – xiv**
	Lab 1 Bulk Density and Particle Density	
Week 2	Soil as a porous medium	**1 - 28**
	Mass and volume relationships	**28 - 36**
	Lab 2 Specific Surface Area	
Week 3	Water	**37 - 46**
	Soil wetness and soil water	**47 - 52**
	Lab 3 Particle Size Distribution (texture)	
Week 4	Capillarity I	**52 - 61**
	Measuring particle sizes **Homework 1 due**	**Supplemental**
	Lab 4 Soil Compaction	
Week 5	Particle size distribution	
	Clay	**Supplemental**
	Lab 5 Hydraulic Conductivity	
Week 6	Geotechnics	**Supplemental**
	EXAM I	
	Lab 6 Water Retention	
Week 7	Soil structure I: particles	
	Saturated flow	**74 - 88**
	Lab 6 continued…	
Week 8	Capillarity II	
	Water and energy I	**61 - 73**
	Lab 7 Water Potential and Content	
Week 9	Pressure and saturation	
	Hysteresis **Homework 2 due**	
	No Lab	
Week 10	Measuring potential	**Supplemental**
	Unsaturated flow	**88 - 117**
	Lab 8 Infiltration	
Week 11	**EXAM II**	
	Infiltration I	**118 - 135**
Week 12	Soil structure II: pores	**135 - 153**
	Aeration and Permeability	**201 - 209**
Week 13	Air permeability and Gas-phase diffusion **HW 3 due**	**209 - 223**
Week 14	Liquid-phase diffusion	**170 – 172**

	Heat flow and thermal properties	**161 – 173 & 176 - 197**
	Lab 9 Soil Temperature and Thermal Properties	
Week 15	**Homework 4 due**	
	Evaporation	**155 – 158 & 173 - 175**
	Lab 10 Solute Transport	
Week 16	Solute movement	**225 - 273**
	Wrap-Up	
	FINAL EXAM	