

Course Code Number	Course Title	Credit Value
APBI 200	Introduction to Soil Science	3

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on in their culture, history, and traditions from one generation to the next on this site.

TERM 2 - 2022/23

Instructors:	Maja Kržić , office MCML 227, email: maja.krzic@ubc.ca - section 001 Sandra Brown , office MCML 229, email: sandra.brown@ubc.ca - section 002	
Lectures:	Monday, Wednesday, Friday: @10-11 am (section 001) @11am-12 noon (section 002) <i>Lectures for both sections 001 & 002 are in Earth Sci. Building, room 1012</i>	
Lab sections:	Lo1 – Monday @ 1-3 pm Lo2 - Monday @ 3-5 pm Lo3 – Tuesday @ 8-10 am Lo4 – Tuesday @ 10 am-12 noon Lo5 – Tuesday @ 1–3 pm Lo6 – Tuesday @ 3-5 pm Lo7 – Wednesday @ 8-10 am Lo8 – Wednesday @ 1-3 pm Lo9 – Wednesday @ 3-5 pm L10 – Thursday @ 10 am-12 noon <i>All lab sections are in MCML 102A</i>	
Instructor office hours	Maja Kržić Wednesday 4-5 pm Sandra Brown Friday 9-10 am	

COURSE OVERVIEW

The **objective** of this course is to give you a fundamental knowledge of soil science. If you are a student interested in forest, agricultural, urban, rangeland, and constructed ecosystems, a basic understanding of soils is essential for you. The soil provides an ideal system in which to observe practical applications for basic principals of biology, chemistry, and physics. In turn, these principles can be used to minimize the degradation of soil as one of fundamental natural resources.

Learning outcomes for this course are: (i) identify and characterize elementary aspects of soil formation, (ii) describe basic soil physical, chemical, biological, and morphological properties, (iii) characterize behavior of soils in managed and natural landscapes, and (iv) identify 10 soil orders in the Canadian soil classification system.

READINGS

- 1) **Required course reading material** is available in Canvas.
- 2) **Required lab reading – lab manual** is available in Canvas
- 3) **Supplemental reading**
 - textbook by Brady N.C., and R.R. Weil (2019) Elements of the nature and properties of soils (3rd or 4th ed.). Pearson Education (Prentice Hall), Upper Saddle River, NJ. 742 pp.
 - textbook Digging into Canadian Soils: An introduction to Soil Science (2021), by the Canadian Society for Soil Science, <https://openpress.usask.ca/soilscience/> [available free of charge!]
 - SoilWeb200. 2014. On-line resource for the APBI200 course (<http://soilweb200.landfood.ubc.ca/>)

GRADING

1. Assignments*	55%
2. Mid-Term Exam (March 1, 2023)	15%
4. Final Exam	30%

** Up to 2 bonus assignments can be submitted by each student for up to 10 points towards your lab assignment mark (details will be posted in Canvas assignments)*

All assignments should be submitted on time. **A 10% mark subtraction per day** may be applied to late assignments; **assignments past day 4 will not be accepted**. IF you have extenuating circumstances, contact your instructor and a one time extension may be granted.

You must obtain **a minimum of 40% on the final exam to pass the course**.

Note for auditors - For Auditor status to be entered on the transcript you will have to attend at least 75% of the lectures and to submit all assignments.

ACADEMIC HONESTY

Note about plagiarism - As a university student, you are expected to submit original work and give credit to other peoples' ideas; hence, plagiarism will not be tolerated. If you are unclear on the concept, please see <http://learningcommons.ubc.ca/resource-guides/avoid-plagiarism/>

Academic Honesty is a core value of scholarship. Cheating and plagiarism (including both presenting the work of others as your own and self-plagiarism) are serious academic offences that are taken very seriously at UBC. By registering for courses at UBC, students have initiated a contract with the University that they will abide by the rules of the institution. It is the student's responsibility to inform themselves of the University regulations. Definitions of Academic Misconduct can be found at <https://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,54,0,0> If you are unsure of whether you are properly citing references, please ask your instructor for clarification before the assignment is submitted.

APBI 200 Lectures, Labs and Assignments (JAN-APR 2023)

Week	Lecture	Date	Lecture title	Lab	Assignment
Week 1	1	Jan 9 (M)	Course introduction		
	2	Jan 11 (W)	<i>Soil in perspective:</i> <ul style="list-style-type: none"> • Importance of soil • Soil science terminology • Soil components 		
	3	Jan 13 (F)	<i>Weathering and soil formation:</i> <ul style="list-style-type: none"> • Weathering processes (physical, chemical and biological) • Five factors of soil formation 		
				No lab for week 1	No assignment for week 1
Week 2	4	Jan 16 (M)	<i>Soil physics - solids 1. Background and terminology:</i> <ul style="list-style-type: none"> • Soil as a 3-phase system • Mass and volume relationships • Soil particles and texture 		
	5	Jan 18 (W)	<i>Soil physics - solids 2. Particle mineralogy and its effects on physical properties:</i> <ul style="list-style-type: none"> • Properties of mineral soil particles • Phyllosilicate clay minerals 		
	6	Jan 20 (F)	<i>Soil physics - solids 3. Particle mineralogy and its effects on physical properties:</i> <ul style="list-style-type: none"> • Phyllosilicate clay minerals – cont. • Inter-particle forces, flocculation and dispersion 		
				Lab for week 2 – Parent material	Week 2 assignment – <u>due 7 days after your lab</u>
Week 3	7	Jan 23 (M)	<i>Soil physics - solids 4. Soil consistency and structure:</i> <ul style="list-style-type: none"> • Soil structure: formation, stabilization, classification and significance • Soil consistency; plastic and liquid limits 		
	8	Jan 25 (W)	<i>Soil organic matter (SOM):</i> <ul style="list-style-type: none"> • Introduction of basic SOM terms • Physical properties of SOM • Components of SOM 		

			<ul style="list-style-type: none"> Chemical properties of SOM 		
	9	Jan 27 (F)	<i>Soil physics - water 1. Soil water:</i> <ul style="list-style-type: none"> Energy concepts Water potential 		
				Lab for week 3 – Soil texture & bulk density	Week 3 assignment – <u>due 7 days after your lab</u>
Week 4	10	Jan 30 (M)	<i>Soil physics - water 2. Soil water:</i> <ul style="list-style-type: none"> Soil matric potential and its relationship to soil water content Water retention characteristics 		
	11	Feb 1 (W)	<i>Soil physics - water 3. Soil water flow:</i> <ul style="list-style-type: none"> Inferring the direction of water flow Water potential gradient Soil hydraulic conductivity 		
	12	Feb 3 (F)	<i>Soil physics - water 4. Qualitative description of soil wetness:</i> <ul style="list-style-type: none"> Max. retentive capacity Field capacity Permanent wilting point Available water storage capacity Hygroscopic coefficient 		
				Lab for week 4 – Water retention	Week 4 assignment – <u>due 7 days after your lab</u>
Week 5	13	Feb 6 (M)	<i>Soil physics. Soil thermal behavior and properties:</i> <ul style="list-style-type: none"> Thermal behavior (Fourier's Law) Soil thermal properties 		
	14	Feb 8 (W)	<i>Soil physics. Soil aeration:</i> <ul style="list-style-type: none"> Nature of soil aeration; diffusion (Fick's Law) Solute transport processes (mass flow and diffusion) 		
	15	Feb 10 (F)	<i>Soil chemistry - part 1.</i> <ul style="list-style-type: none"> Soil pH and acidity Soil salinity Ion adsorption & ion exchange reactions 		
				No lab for week 5	Week 5 assignment – <u>due Feb 12</u>

Week 6	16	Feb 13 (M)	<i>Soil chemistry - part 2. Ion adsorption and exchange:</i> <ul style="list-style-type: none"> • Cation exchangeable capacity • Base saturation • Exchangeable cations • Anion exchange capacity 		
	17	Feb 15 (W)	<i>Soil chemistry - part 3. Soil organic matter (SOM):</i> <ul style="list-style-type: none"> • Mineralization and immobilization • Significance of C/N ratio • Chelates • Significance of SOM 		
	18	Feb 17 (F)	<i>Soil chemistry - part 4. SOM:</i> <ul style="list-style-type: none"> • Organic soils • Organic horizons in soils 		
				Lab for week 6 - Soil chemistry (pH, OM, soil P)	Week 6 assignment – <u>due 7 days</u> <u>after your lab</u>
		Feb 20 (M)	<i>Family Day – UBC closed</i>		
		Feb 22 (W)	<i>Spring break – no classes this week</i>		
		Feb 24 (F)	<i>Spring break – no classes this week</i>		
Week 7	19	Feb 27 (M)	PRACTICE EXAM SESSION NO.1 Division of students for the exam practice session no.1 for both sections is as follows: <ul style="list-style-type: none"> • Students with last names starting with A-H please go to ESB 1012 • Last names I-R please go to SCRF206 • Last names S-Z please go to SCRF208 		
	20	Mar 1 (W)	Midterm exam		
	21	Mar 3 (F)	<i>Soil biology - part 1.</i> <ul style="list-style-type: none"> • Major groups of soil organisms and their roles 		
				No lab for week 7	No assignment for week 7
Week 8	22	Mar 6 (M)	<i>Soil biology - part 2.</i> <ul style="list-style-type: none"> • Abundance of soil organisms • Soil food web • Biochemical transformations (biological N fixation) 		

	23	Mar 8 (W)	<i>Soil biology - part 3. Biochemical transformations and interactions of soil microbes with plant roots:</i> <ul style="list-style-type: none"> Biochemical transformations (mineralization/immobilization, denitrification) Interactions of soil microbes with plant roots (rhizosphere and mycorrhizae) 		
	24	Mar 10 (F)	<i>Soil fertility - part 1. Nutrients and availability:</i> <ul style="list-style-type: none"> Plant nutrients Retention and release of nutrients Transport to roots and nutrient uptake by roots Nutrient cycles: N, S 		
				Lab for week 8 – Forest floor	Week 8 assignment - due 7 days after your lab
Week 9	25	Mar 13 (M)	<i>Soil fertility - part 2. Nutrients and availability:</i> <ul style="list-style-type: none"> Nutrient cycles: P, K 		
	26	Mar 15 (W)	<i>Soil fertility - part 3. Nutrients and availability:</i> <ul style="list-style-type: none"> Nutrient cycles: Ca and Mg 		
	27	Mar 17 (F)	PRACTICE EXAM SESSION NO.2 Division of students for the exam practice session no.1 for both sections is as follows: <ul style="list-style-type: none"> Students with last names starting with A-H please go to SCRF1005 Last names I-R please go to ESB 1012 Last names S-Z please go to SCRF1023 		
				No lab for week 9	Week 9 assignment - due Mar 19
Week 10	28	Mar 20 (M)	<i>Pedology - part 1. Classification concepts:</i> <ul style="list-style-type: none"> Soil forming processes Soil classification Soil horizons 		
	29	Mar 22 (W)	<i>Pedology - part 2. Canadian System of Soil Classification:</i> <ul style="list-style-type: none"> The Canadian system of soil classification Soil orders (Regosol, Brunisol, Chernozem, Solonetz, Luvisol, Gleysol) 		
	30	Mar 24(F)	<i>Pedology - part 3. Canadian System of Soil Classification:</i>		

			<ul style="list-style-type: none"> Soil orders (Podzol, Organic, Cryosol, Vertisol) 		
				Lab for week 10 – Soil Classification	Week 10 assignment – <u>due 7 days after your lab</u>
Week 11	31	Mar 27 (M)	<i>Urban Soils</i>		
	32	Mar 29 (W)	<i>Soil erosion</i> : overview of processes, prevention and control		
	33	Mar 31 (F)	PRACTICE EXAM SESSION NO.3 Division of students for the exam practice session no.1 <u>for both sections</u> is as follows: <ul style="list-style-type: none"> Students with last names starting with A-H please go to SCRF1023 Last names I-R please go to SCRF1005 Last names S-Z please go to ESB 1012 		
				Lab for week 11 – Soil description, field trip	Week 11 assignment – <u>due 7 days after your lab</u>
Week 12	34	Apr 3 (M)	Soil ecosystem services (i.e., summary of why are soils important)		
	35	Apr 5 (W)	Course summary – serious		
		Apr 7 (F)	<i>Good Friday – UBC closed</i>		
		Apr 10 (M)	<i>Easter Monday – UBC closed</i>		
	36	Apr 12 (W)	Course summary – fun... <i>Soil Science Trivial Pursuit</i>	No lab for week 12	No assignment for week 12

GRAPHYC SYLLABUS, showing 4 course units & associated lecture topics

<p><u>SOIL COMPONENTS</u></p> <ul style="list-style-type: none"> ▶ Soil solids <ul style="list-style-type: none"> ▪ Mineral particles (sand, silt, clay), their size & composition ▪ Soil organic matter ▶ Soil water ▶ Soil air ▶ <i>Important properties of soil components</i> <ul style="list-style-type: none"> ▪ Soil texture ▪ Bulk density & particle density ▪ Porosity, pore size distribution, and aggregation (i.e. soil structure) ▪ Presence of charge on soil particles & ion adsorption ▪ Water retention ▪ Thermal properties ▪ Soil reaction ▪ Salinity 	<p><u>SOIL BIOLOGY & NUTRIENTS</u></p> <ul style="list-style-type: none"> ▶ Soil organisms <ul style="list-style-type: none"> ▪ Major groups of soil organisms ▪ Biochemical transformations carried out by organisms: <ul style="list-style-type: none"> ○ Biological N fixation ○ Mineralization & immobilization ○ Denitrification ▪ Interactions of soil microbes with plant roots (rhizosphere and mycorrhizae) ▶ Nutrient cycles <ul style="list-style-type: none"> ▪ N cycle ▪ S cycle ▪ P cycle ▪ K cycle ▪ Ca and Mg
<p><u>SOIL CLASSIFICATION</u></p> <ul style="list-style-type: none"> ▶ Soil formation & weathering <ul style="list-style-type: none"> ▪ Five factors of soil formation ▪ Soil formation processes (additions, translocations, transformations, losses) ▶ Soil horizons & forest floor ▶ Canadian system of soil classification & 10 soil orders: <ul style="list-style-type: none"> ▪ Regosol ▪ Brunisol ▪ Luvisol ▪ Gleysol ▪ Organic soil ▪ Chernozem ▪ Solonetz ▪ Podzol ▪ Cryosol ▪ Vertisol 	<p><u>SOIL MANAGEMENT</u></p> <ul style="list-style-type: none"> ▶ Urban soils ▶ Soil degradation <ul style="list-style-type: none"> ▪ Soil erosion and its control ▶ Soil quality ▶ Soil ecosystem services