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 - 2024/25

Instructors:	**Maja Kržić**, office MCML 227, email: maja.krzic@ubc.ca - section 002 **Sandra Brown**, office MCML 229, email: sandra.brown@ubc.ca - section 001
Lectures:	Monday, Wednesday, Friday: @10-11 am (section 001) – ***HEBB, room 100*** @11am-12 noon (section 002) - ***Earth Sci. Building, room 1012***
Lab sections:	L01 – Monday @ 1-3 pm L02 - Monday @ 3-5 pm L03 – Tuesday @ 8-10 am L04 – Tuesday @ 10 am-12 noon L05 – Tuesday @ 1–3 pm L06 – Tuesday @ 3-5 pm L07 – Wednesday @ 8-10 am L08 – Wednesday @ 1-3 pm L09 – Wednesday @ 3-5 pm L10 – Thursday @ 10 am-12 noon ***All lab sections are in MCML 102A***
Intructor office hours	**Maja Kržić** Wednesday 4-5 pm **Sandra Brown** Tuesday 4-5 pm

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*	30%
2.	Mid-Term Exam (*in person on February 26, 2025*)	30%
4.	Final Exam (*in person*)	40%

***** *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**.

If your final exam grade is 10% better than your midterm grade, we will shift the weighting to 20% midterm and 50% final

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 *https://academicintegrity.ubc.ca/student-start/*
- **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://academicintegrity.ubc.ca/regulation-process/academic-misconduct/*
- The use of **generative AI tools, including ChatGPT and other similar tools,** to complete or support the completion of any form of assignment or assessment in this course is **not allowed** and would be considered academic misconduct. All answers in your assignments must be written in your own words.

APBI 200 Lectures, Labs and Assignments (JAN-APR 2025)

Week	Lecture	Date	Lecture title	Lab	Assignment
Week 1	1	Jan 6 (M)	Course introduction		
	2	Jan 8 (W)	*Soil in perspective*: • Importance of soil • Soil science terminology • Soil components		
	3	Jan 10 (F)	*Weathering and soil formation:* • 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 13 (M)	*Soil physics - solids 1. Background and terminology*: • Soil as a 3-phase system • Mass and volume relationships • Soil particles and texture		
	5	Jan 15 (W)	*Soil physics - solids 2. Particle mineralogy and its effects on physical properties*: • Properties of mineral soil particles • Phyllosilicate clay minerals		
	6	Jan 17 (F)	*Soil physics - solids 3. Particle mineralogy and its effects on physical properties*: • Phyllosilicate clay minerals – cont. • Inter-particle forces, flocculation and dispersion		
				Lab for week 2 – Parent material	Week 2 assignment – *due 7 days after your lab*
Week 3	7	Jan 20 (M)	*Soil physics - solids 4. Soil consistency and structure:* • Soil structure: formation, stabilization, classification and significance • Soil consistency; plastic and liquid limits		
	8	Jan 22 (W)	*Soil organic matter (SOM):* • Introduction of basic SOM terms • Physical properties of SOM • Components of SOM		

			• Chemical properties of SOM		
	9	Jan 24 (F)	*Soil physics - water 1. Soil water*: • Energy concepts • Water potential		
				Lab for week 3 – Soil texture & bulk density	Week 3 assignment – *due 7 days after your lab*
Week 4	10	Jan 27 (M)	*Soil physics - water 2. Soil water:* • Soil matric potential and its relationship to soil water content • Water retention characteristics		
	11	Jan 29 (W)	*Soil physics - water 3. Soil water flow:* • Inferring the direction of water flow • Water potential gradient • Soil hydraulic conductivity		
	12	Jan 31 (F)	*Soil physics - water 4. Qualitative description of soil wetness:* • Max. retentive capacity • Field capacity • Permanent wilting point • Available water storage capacity • Hygroscopic coefficient		
				Lab for week 4 – Water retention	Week 4 assignment – *due 7 days after your lab*
Week 5	13	Feb 3 (M)	*Soil physics. Soil thermal behavior and properties*: • Thermal behavior (Fourier's Law) • Soil thermal properties		
	14	Feb 5 (W)	*Soil physics. Soil aeration*: • Nature of soil aeration; diffusion (Fick's Law) • Solute transport processes (mass flow and diffusion)		
	15	Feb 7 (F)	*Soil chemistry - part 1.* • Soil pH and acidity • Soil salinity • Ion adsorption & ion exchange reactions		
				No lab for week 5	Week 5 assignment – *due Feb 10*

Week 6	16	Feb 10 (M)	*Soil chemistry - part 2. Ion adsorption and exchange:* • Cation exchangeable capacity • Base saturation • Exchangeable cations • Anion exchange capacity		
	17	Feb 12 (W)	*Soil chemistry - part 3. Soil organic matter (SOM):* • Mineralization and immobilization • Significance of C/N ratio • Chelates • Significance of SOM		
	18	Feb 14 (F)	*Soil chemistry - part 4. SOM*: • Organic soils • Organic horizons in soils		
				Lab for week 6 - Soil chemistry (pH, OM, soil P)	Week 6 assignment – *due 7 days after your lab*
		Feb 17 (M)	*Family Day – UBC closed*		
		Feb 19 (W)	*Spring break – no classes this week*		
		Feb 21 (F)	*Spring break – no classes this week*		
Week 7	19	Feb 24 (M)	**PRACTICE EXAM SESSION NO.1** Division of students for the exam practice session no.1 is as follows: • Students with last names starting with A-M please go to HEBB 100 (section 001) or to ESB 1012 (section 002) • Last names N-Z please go to SCRF 207 (true for both sections)		
	20	Feb 26 (W)	**Midterm exam (in-person, during class time)**		
	21	Feb 28 (F)	*Soil biology - part 1.* • Major groups of soil organisms and their roles		
				No lab for week 7	No assignment for week 7
Week 8	22	Mar 3 (M)	*Soil biology - part 2.* • Abundance of soil organisms • Soil food web		

			• Biochemical transformations (biological N fixation)		
	23	Mar 5 (W)	*Soil biology - part 3. Biochemical transformations and interactions of soil microbes with plant roots:* • Biochemical transformations (mineralization/immobilization, denitrification) • Interactions of soil microbes with plant roots (rhizosphere and mycorrhizae)		
	24	Mar 7 (F)	*Soil fertility - part 1. Nutrients and availability:* • 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 10 (M)	*Soil fertility - part 2. Nutrients and availability:* • Nutrient cycles: P, K		
	26	Mar 12 (W)	*Soil fertility - part 3. Nutrients and availability:* • Nutrient cycles: Ca and Mg		
	27	Mar 14 (F)	**PRACTICE EXAM SESSION NO.2** Division of students for the exam practice session no.2 is as follows: • Students with last names starting with A-M please go to SCRF 1003 (section 001) and SCRF 1023 (section 002) • Last names N-Z please go to HEBB 100 (section 001) or ESB 1012 (section 002)		
				No lab for week 9	Week 9 assignment – *due Mar 17*
Week 10	28	Mar 17 (M)	*Pedology - part 1. Classification concepts:* • Soil forming processes • Soil classification • Soil horizons		
	29	Mar 19 (W)	*Pedology - part 2. Canadian System of Soil Classification:*		

			• The Canadian system of soil classification • Soil orders (Regosol, Brunisol, Chernozem, Solonetz, Luvisol, Gleysol)		
	30	Mar 21 (F)	*Pedology - part 3. Canadian System of Soil Classification:* • Soil orders (Podzol, Organic, Cryosol, Vertisol)		
				Lab for week 10 – Soil Classification	Week 10 assignment – *due 7 days after your lab*
Week 11	31	Mar 24 (M)	*Forest grazing (Maja both classes)*		
	32	Mar 26 (W)	*Urban soils (Sandra both classes)*		
	33	Mar 28 (F)	*Soil erosion*: overview of processes, prevention and control		
				Lab for week 11 – Soil description, field trip	Week 11 assignment – *due 7 days after your lab*
Week 12	34	Mar 31 (M)	Getting involved in soil science		
	35	Apr 2 (W)	**PRACTICE EXAM SESSION NO.3** Division of students for the exam practice session no.3 is as follows: • Students with last names starting with A-L please go to HEBB 100 (section 100) or ESB 1012 (section 002) • Last names M-Z pls go to SCRF 1005 (true for both sections)		
	36	Apr 4 (F)	Course summary	No lab for week 12	No assignment for week 12
Week 13	37	Apr 7 (M)	Course summary – fun… *Soil Science Trivial Pursuit*	No lab for week 13	No assignment for week 13

GRAPHYC SYLLABUS, showing 4 course units & associated lecture topics

SOIL COMPONENTS

- **Soil solids**
  - Mineral particles (sand, silt, clay), their size & composition
  - Soil organic matter
- **Soil water**
- **Soil air**
- ***Important properties of soil components***
  - 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

SOIL BIOLOGY & NUTRIENTS

- **Soil organisms**
  - Major groups of soil organisms
  - Biochemical transformations carried out by organisms:
    - Biological N fixation
    - Mineralization & immobilization
    - Denitrification
  - Interactions of soil microbes with plant roots (rhizosphere and mycorrhizae)
- **Nutrient cycles**
  - N cycle
  - S cycle
  - P cycle
  - K cycle
  - Ca and Mg

SOIL CLASSIFICATION

- **Soil formation & weathering**
  - Five factors of soil formation
  - Soil formation processes (additions, translocations, transformations, losses)
- **Soil horizons & forest floor**
- **Canadian system of soil classification & 10 soil orders:**
  - Regosol
  - Brunisol
  - Luvisol
  - Gleysol
  - Organic soil
  - Chernozem
  - Solonetz
  - Podzol
  - Cryosol
  - Vertisol

SOIL MANAGEMENT

- Urban soils
- Soil degradation
  - Soil erosion and its control
- Soil quality
- Soil ecosystem services