

## COURSE SYLLABUS

<b>COURSE TITLE</b>	<b>BIOL 412 Limnology</b>		
<b>COURSE CODE:</b>	80020	<b>TERM:</b>	T1 2023/2024
<b>COURSE CREDITS:</b>	3.0	<b>DELIVERY:</b>	Lecture & Practicum (Lab)
<b>CLASS SECTION:</b>	01		
<b>LECTURE LOCATION:</b>	Geology Building, Room 165	<b>LAB LOCATION:</b>	Room G11
<b>LECTURE TIME:</b>	Mon., Wed., Fri., 12:30 – 1:20 p.m.	<b>LAB TIME:</b>	Friday 1:30 – 5:20 p.m.
<b>LECTURE START DATE:</b>	September 6 <sup>th</sup> 2023	<b>LAB START DATE:</b>	September 15 <sup>th</sup>
<b>WEBSITE:</b>	via Canvas	<b>FIELD TRIP:</b>	September 8 <sup>th</sup> and 9 <sup>th</sup> 2023
<b>INSTRUCTOR:</b>		<b>LABORATORY INSTRUCTORS:</b>	
<b>Dr. Neda Mehdipour</b>		<b>Akaash Bansal</b>	
Email: <a href="mailto:neda.mehdipour@usask.ca">neda.mehdipour@usask.ca</a>		Room: Carrel 120.28, main floor, CSRB	
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### Course Description

The biological, chemical and physical properties of lakes are examined at lake and watershed levels. Theoretical and applied topics, including human impacts (e.g., eutrophication, climate change, ultraviolet radiation, contaminants, and angling) are examined.

### Prerequisites

Prerequisite(s): Biol 121, Biol 228 and CHEM 112; or permission of the instructor. A course in statistics is recommended.

### Course Overview

Limnology is a multidisciplinary field that is broadly defined as the study of inland waters. The course is taught at the ecosystem level, i.e., ecosystem structure and function are emphasized. Human impacts will also be studied. Laboratories are designed to train students in field and laboratory techniques. This includes the use of sampling equipment and procedures to identify and quantify aquatic organisms and to characterize the physical and chemical properties of lakes (e.g., water quality). Laboratories will also emphasize experimental design. On completion of the course,

students will be prepared for advanced study in limnology (graduate level) or other aquatic disciplines. In addition, students will be better prepared for careers in the environment (e.g., water quality assessment, habitat assessment, and lake and fisheries management).

## **Learning Outcomes**

Through lectures, assigned readings, and laboratory exercises students will develop an understanding of:

- The diversity of biological, physical and chemical characteristics of lakes
- Lake ecosystem function (energy flow and biogeochemical cycling)
- The diversity and ecology of organisms in lakes
- The use of limnological equipment to characterize the biological, physical and chemical characteristics of lakes
- The influence of watershed characteristics on lake properties
- Human impacts on lakes (e.g., water quality) and remediation strategies
- Current and emerging scientific thinking in limnology
- Experimental design and the interpretation of scientific data.
- The role of ecosystem science in society

## **Treaty Acknowledgement**

At the University of Saskatchewan, we acknowledge we are on Treaty Six Territory and the Homeland of the Métis. We pay our respect to the First Nation and Métis ancestors of this place and reaffirm our relationship with one another.

## **Learning Charter**

The University of Saskatchewan Learning Charter is intended to define aspirations about the learning experience that the University aims to provide, and the roles to be played in realizing these aspirations by students, instructors and the institution. A copy of the Learning Charter can be found at <https://teaching.usask.ca/about/policies/learning-charter.php>.

## **Resources**

**Textbook:** There is **no required textbook** for this course. However, if you are interested in textbooks, we recommend using the following textbooks:

Wetzel R. G (2023). Wetzel's Limnology, Lake and River Ecosystem, 4<sup>th</sup> Edition, Edited by Ian D. Jones and John, P. Smol. Link for e-text: <https://shop.elsevier.com/books/wetzels-limnology/jones/978-0-12-822701-5>

Walter K. Dodds and Matt R. Whiles (2017) Freshwater Ecology, Concepts and Environmental Applications of Limnology, 3<sup>rd</sup> Edition, ScienceDirect. <https://www.sciencedirect.com.cyber.usask.ca/book/9780128132555/freshwater-ecology>

Kalff, J. and J. Downing (2002). Limnology: Inland Water Ecosystems. Link for e-text: [https://www.amazon.com/Limnology-Inland-Ecosystems-Jacob-Kalff-ebook/dp/B01GFEPZT0/ref=mt\\_kindle?encoding=UTF8&me](https://www.amazon.com/Limnology-Inland-Ecosystems-Jacob-Kalff-ebook/dp/B01GFEPZT0/ref=mt_kindle?encoding=UTF8&me)

## Course Structure and Other Details

The BIOL 412 will be delivered entirely with in-person lectures and labs. The course follows a weekly Monday, Wednesday, and Friday lecture schedule with a lab on Friday afternoon. Course material will be prepared and posted to the course management system Canvas in advance of most scheduled lectures, such that students are encouraged to access this material before, and during each lecture. (Note that these materials belong to your instructors and the University of Saskatchewan and are copyright-protected. You are permitted to download session videos and materials for your own academic use but, accordingly, you should not copy, share, or use them for any other purposes without explicit permission from the instructors). In addition to lecture sessions, where you can ask questions, the office hours are set up on Fridays from 11:00 a.m. to 12 p.m. If this time doesn't work for you, email me to set up an alternative.

The labs are broken into three categories that contrast both lakes: the first illustrates the use of the equipment and the collection and interpretation of field data (profile lab); the second includes an experiment to determine the type and degree of nutrient limitation in these lakes (algal fertilization lab); and the third, aims to help you develop a knowledge of algal, zooplankton, and benthic invertebrate taxonomy.

Please review carefully the course schedule presented in the table below, particularly dates (e.g., for lab assignments). Note that lab materials (e.g., instructional documents, photos and videos) will be provided in advance of the lab date. This permits students to review and start their labs in advance and post questions to the Canvas discussion board, or via direct email for further assistance. See the course schedule below for exact dates.

## Course Schedule

Week/ Dates	Lecture Topic	Laboratory Topic and Assignments Due Dates
Week 1 Sept. 6  Sept. 8 Sept. 9 Sept. 10	- Course Introduction  - Sept 8 lecture merged into the field trip	Sept 8 (Blackstrap Lake Field Trip 12:20 pm to 6 pm) Sept 9 (Martin's Lake 8:30 am to 5 pm)  Sept 10, from 1 pm to 4 pm, Lake water processing and experiment initiation
Week 2 Sept. 11  Sept. 13 Sept. 15	- Characteristics of Water  - Inland water types, origins, and morphometry	Sept. 15 Water column profile data  <b>(Water column profile assignment due date: Oct. 6)</b>
Week 3 Sept. 18  Sept. 20 Sept. 22	<b>Physical Limnology</b>  -Light, Temperature, Heat, Colour, Water movement	Sept. 22, Algal fertilization experiment outline  <b>(Algal fertilization assignment due date: Nov. 13)</b>

<p>Week 4 Sept. 25</p> <p>Sept. 27</p> <p><b>Sept. 29</b></p>	<p>-Surface waves, seiches and circulation patterns, Stratification, and mixing</p> <p><b>National Day for Truth and Reconciliation (in lieu) – University Closed</b></p>	
<p>Week 5 Oct. 2</p> <p>Oct. 4</p> <p><b>Oct. 6</b></p>	<p><b>Chemical Limnology</b></p> <p>Salinity, the oxygen cycle, Redox reactions in the water column and sediment, the phosphorus cycle, the nitrogen cycle, carbon dioxide cycle</p>	<p>Oct. 6 Algal fertilization experiment data <b>Oct. 6 Water Profile Data Assignment Due Date</b></p>
<p>Week 6 <b>Oct. 9</b> Oct. 11 Oct. 13</p>	<p><b>Thanksgiving Day University Closed</b></p> <p>-pH and acid-neutralizing capacity The sulfur and silica cycle</p>	<p>Oct. 13 Water Analysis</p>
<p>Week 7 <b>Oct. 16</b> Oct. 18 Oct. 20</p>	<p><b>Midterm EXAM (12:30 to 1:20 pm)</b></p> <p><b>-Biological Limnology</b> with a focus on Canadian biodiversity, Invasive and Introduced Species, Endangered Species</p> <p>-Viruses, bacteria, bacterial Production</p>	<p>Oct. 20 Water Analysis</p>
<p>Week 8 Oct. 23 Oct. 25 Oct. 27</p>	<p>-Algal communities, primary production, eutrophication, algal blooms conditions</p> <p>-Invasive and introduced species</p>	<p>Oct. 27 Plankton taxonomy lab</p>
<p>Week 9 Oct. 30 Nov. 1 Nov. 3</p>	<p>-Zooplankton communities (Secondary production)</p> <p>-Zoobenthos Communities</p> <p>-Zebra mussel challenges</p>	<p>Nov. 3 Algal fertilization experiment Q &amp; A</p>

<b>Week 10</b> Nov. 6 Nov. 8 Nov. 10	<b>NO CLASSES - Midterm Break</b>	<b>No lab scheduled this week</b>
Week 11 Nov. 13  Nov 15. Nov. 17	-Phytobenthic communities  (Macroalgae and Aquatic plant communities)	<b>Nov 13. Algal fertilization assignment due date</b>  <b>Nov. 17 Benthic Invertebrate taxonomy lab</b>
Week 12 Nov. 20  Nov. 22  Nov. 24	-Fish communities  -Food web dynamics	
Week 13 Nov. 27  Nov. 29  Dec. 1	-Impacts of Human Activities on inland ecosystems (climate change, contaminants, angling)	
Week 14 Dec. 4  Dec. 6 <b>Dec. 8</b>	-Sustaining freshwater resources -Sustaining freshwater ecosystems  <b>-Last day. Catch up and Review</b>	

There will be minor changes to the schedule. I will provide advanced consultation with the class about such changes.  
[The last day to withdraw from Fall Term classes with 75% tuition credit is Tuesday, September 26, 2023.](#)  
[The last day to withdraw from Fall Term classes with 50% tuition credit is Wednesday, Oct. 4, 2023.](#)

## **Relevant Library Resources**

### **Example of Journals with Limnological Content**

- Canadian Journal of Fisheries and Aquatic Sciences
- Limnology and Oceanography
- Freshwater Biology
- Journal of Great Lakes Research
- Journal of Plankton Research
- Aquatic Sciences

- Water Research
- Ecology
- Hydrobiologia

### **Texts Resources:**

- Bronmark, C. and L.A. Hansson. 2017. The biology of lakes and ponds. 3<sup>rd</sup> Edition. New York, Oxford University Press.
- Lampert, W. and U. Sommer. 2007. Limnoecology. 2<sup>nd</sup> Edition. Oxford University Press.
- Wetzel, R. G. (2001). Limnology: lake and river ecosystems. San Diego, Academic Press.
- Dodson, S. 2005. Introduction to Limnology. New York. McGraw-Hill.
- Moss, B. (1998). Ecology of fresh waters: man and medium, past to future. Oxford, Blackwell Science.
- Wilderer, P. 2011. Treatise on water science. Volumes 1-4. Amsterdam, Elsevier.
- Likens, G. 2009. Encyclopedia of inland waters. Volumes 1-3. Boston, Elsevier.
- Lynn, K and Cech, T. (2010). Introduction to Water Resources and Environmental Issues. Cambridge, Cambridge University Press.
- Carpenter, S. R. and J. F. Kitchell (1993). The trophic cascade in lakes. Cambridge, Cambridge University Press.
- O'Sullivan and C. Reynolds. 2004. The Lakes Handbook. Volumes 1-2. Malden, MA, Blackwell.
- Fassett, N. C. (1957). A manual of aquatic plants. Madison, University of Wisconsin Press.
- Cooke, G., E. Welch, S. Peterson, and S. Nichols. 2005. Restoration & management of lakes & reservoirs, 3rd Ed. Boca Raton. Taylor and Francis,
- Kerr, S. R. and L. M. Dickie (2001). The biomass spectrum: a predator-prey theory of aquatic production. New York, Columbia University Press.
- Smol, J. P. (2002). Pollution of lakes and rivers: a paleoenvironmental perspective. London, Arnold.
- North American Lake Management Society and the Terrene Institute. (2001). Managing lakes and reservoirs. Madison, WI
- Thorp, J. H. and Covich, A. P. 2001. Ecology and classification of North American freshwater invertebrates. San Diego, Academic Press.
- Reynolds, C.S. 2007. Ecology of Phytoplankton. Cambridge, Cambridge University Press.
- Miller, T. G. and S. Spoolman (2020). Living in the Environment. Link for e-text: <https://www.cengage.ca/c/etextbook-living-in-the-environment-20e-miller-spoolman/9780357705407/?searchIsbn=9780357705407>
- Wehr, J. D., Sheath, R. G., and J. Patrick Kociolek (2015). Freshwater Algae of North America. Ecology and Classification. Elsevier
- Kernan, M, Battarbee, R. W., and Brian R. Moss (2011) Climate Change Impacts on Freshwater Ecosystems. Wiley-Blackwell.

### **Course Website & Supplementary Resources**

Students are required to read the course syllabus.

The instructor may provide a copy of their lecture notes on CANVAS to you as a courtesy. You are not required to download or print these notes. If notes are posted on CANVAS, then the instructor will endeavour to have lecture notes posted sometime in advance of the lectures; however, they will not guarantee this.

### Grading and Assessment Scheme

Course Evaluation	Mark	Lab Assignments: Mark Breakdown	Mark
Mid-term exam	20%	Lake profiles assignment	10%
Final exam	40%	Algal fertilization assignment	18%
Lab assignments	40%	Algal taxonomy assignment	6%
		Benthos taxonomy assignment	6%
<b>Total</b>	<b>100%</b>		<b>40%</b>

**Note: The field trip (Sept. 08-10) must be attended to pass this course**

#### Midterm (Lecture) Exam:

**Value:** 20% of final course grade

**Date:** This lecture exam **will be held on Monday, October 16<sup>th</sup>**. Students with a legitimate reason for requiring an alternative writing time for the midterm exam must make a request (by email) to Dr. Mehdipour 2 weeks before the exam day.

**Length:** 50 minutes

**Format:** 40 multiple-choice and/or short-answer questions

**Description:** Based on lecture material prior to October 16<sup>th</sup>. Calculators and all other electronic devices are not allowed.

#### Final (Lecture) Exam:

**Value:** 40% of final course grade

**Date:** Consult Final Exam Schedule

**Length:** 100 minutes

**Format:** 80 multiple-choice questions (machine marked) and/or short answer questions  
The number and type of questions on the exam are under review at this time, but this information will be provided by the last scheduled lecture period.

**Description:** The exam is comprehensive in that it will cover all lecture material. However, lecture material delivered after the midterm exam will be emphasized. Calculators and all other electronic devices are not allowed.

#### Final Examination Schedules

Midterm and final examinations must be written on the date scheduled. Final examinations may be scheduled at any time during the examination period; therefore, students should avoid making prior travel, employment, or other commitments during the examination period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students who miss the final exam must contact the College of Arts & Science and apply for a deferred final exam promptly. Deferred exams may utilize a different format than the regular exam,

at the sole discretion of the course instructors. Students are encouraged to review all University examination policies and procedures: <http://students.usask.ca/academics/exams.php>

### **Criteria That Must Be Met to Pass**

The Laboratory Exam and Lecture Final Exam are required elements, and therefore must be completed by a student to be eligible to pass this course.

### **University of Saskatchewan Grading System**

Students in BIOL 412 are reminded that the University has established a grading system to be used in all courses. Information on literal descriptors for grading at the University of Saskatchewan (reproduced below) can be found at: <http://students.usask.ca/academics/grading/grading-system.php>

For information regarding appeals of final grades or other academic matters, please visit the Student Conduct and Appeals section of the University Secretary's webpages: <https://secretariat.usask.ca/student-conduct-appeals/appeals-in-academic-matters.php>

### **Student Feedback**

Exam questions will not be posted after an exam. Students will be encouraged to meet with the instructor to review their performance anytime during the course by appointment.

### **Use of Video and Recording of the Course**

Students are not allowed to record any aspect of this course, except with the permission of the instructor or as provided for by arrangements with AES. Any recording made under AES provisions is to only be used for the personal learning of the student who made the recording.

Please remember that course recordings belong to your instructor, the University, and/or others (like a guest lecturer) depending on the circumstance of each session and are protected by copyright. Do not download, copy, or share recordings without the explicit permission of the instructor.

For questions about recording and use of sessions in which you have participated, including any concerns related to your privacy, please contact your instructor. More information on class recordings can be found in the Academic Courses Policy <https://policies.usask.ca/policies/academic-affairs/academic-courses.php#5ClassRecordings>.

### **Copyright**

Course material created by your professors and instructors is their intellectual property and cannot be shared without written permission. This includes exams, PowerPoint/PDF lecture slides and other course notes. If materials are designated as open education resources (with a creative commons license) you can share and/or use them in alignment with the [CC license](#). Other copyright-protected materials created by textbook

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## **Academic Integrity**

The University of Saskatchewan is committed to the highest standards of academic integrity. <https://academic-integrity.usask.ca/>

Students are urged to read the [Regulations on Academic Misconduct](#) and to avoid any behaviours that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence.

For help developing the skills for meeting academic integrity expectations, see: <https://academic-integrity.usask.ca/students.php>

Students are encouraged to ask their instructors for clarification on academic integrity requirements.

All students are encouraged to be aware of the rules for courses set out in the [Academic Courses Policy on Class Delivery, Examinations, and Assessment of Student Learning](#).

Artificial intelligence text generator tools (also known as large language models) **are not** permitted to be used in any assessments for this course. Any use of such tools will be considered academic misconduct in this course.

Students wanting to connect their assessment in this course to assessments they have completed in another course must get explicit permission of the instructor in order to avoid potential academic misconduct of self-plagiarism.

## **Access and Equity Services (AES) for students**

Access and Equity Services (AES) is available to provide support to students who require accommodations due to disability, family status, and religious observances.

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals at any time. Those students who are registered with AES with mental health disabilities and who anticipate that they may have responses to certain course materials or topics, should discuss course content with their instructors prior to course add / drop dates.

Students who require accommodations for pregnancy or substantial parental/family duties should contact AES to discuss their situations and potentially register with that office.

Students who require accommodations due to religious practices that prohibit the writing of exams on religious holidays should contact AES to self-declare and determine which accommodations are appropriate. In general, students who are unable to write an exam due to a religious conflict do not register with AES but instead submit an exam conflict form through their PAWS account to arrange accommodations.

Any student registered with AES, as well as those who require accommodations on religious grounds, may request alternative arrangements for mid-term and final examinations by submitting a request to AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

For more information or advice, visit <https://students.usask.ca/health/centres/access-equity-services.php>, or contact AES at 306-966-7273 (Voice/TTY 1-306-966-7276) or email [aes@usask.ca](mailto:aes@usask.ca).

## **Student Supports**

### **Academic Help – University Library**

Visit the [University Library](#) and [Learning Hub](#) to find supports for undergraduate and graduate students with first-year experience, study skills, learning strategies, research, writing, math and statistics. Students can attend [workshops](#), access [online resources and research guides](#), book [1-1 appointments](#) or hire a [subject tutor](#) through the [USask Tutoring Network](#)

Connect with library staff through the [AskUs](#) chat service or visit various [library locations](#) on campus.

Enrolled in an online course? Explore the [Online Learning Readiness Tutorial](#).

### **Teaching, Learning and Student Experience**

Teaching, Learning and Student Experience (TLSE) provides developmental and support services and programs to students and the university community. For more information, see the students' website <http://students.usask.ca>.

### **College Supports**

Students in Arts & Science are encouraged to contact the Undergraduate Student Office and/or the Trish Monture Centre for Success with any questions on how to choose a major; understand program requirements; choose courses; develop strategies to improve grades; understand university policies and procedures; overcome personal barriers; initiate pre-career inquiries; and identify career planning resources. Contact information is available at: (<http://artsandscience.usask.ca/undergraduate/advising/>)

### **Financial Support**

Any student who faces unexpected challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central <https://students.usask.ca/student-central.php>.

### **Gordon Oakes Red Bear Student Centre**

The Gordon Oakes Red Bear Student Centre) is dedicated to supporting Indigenous student academic and personal success. The Centre offers personal, social, cultural and some academic supports to Métis, First

Nations, and Inuit students. The Centre is an intercultural gathering space that brings Indigenous and non-Indigenous students together to learn from, with and about one another in a respectful, inclusive, and safe environment. Visit <https://students.usask.ca/indigenous/index.php> or students are encouraged to visit the ASC's website <https://students.usask.ca/indigenous/gorbsc.php>

### **International Student and Study Abroad Centre**

The International Student and Study Abroad Centre (ISSAC) supports student success and facilitates international education experiences at USask and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange, and English as a Second Language students in their transition to the University of Saskatchewan and to life in Canada. ISSAC offers advising and support on matters that affect international students and their families and on matters related to studying abroad as University of Saskatchewan students. Visit <https://students.usask.ca/international/issac.php> for more information.