

# BIOL 335

## Limnology and Aquatic Ecology

Fall Term (2016-17)

### CALENDAR DESCRIPTION

Physics, chemistry and biology of freshwater lakes. Emphasis on: morphometry; light and temperature; water chemistry in relation to nutrients; physiological requirements; composition and interaction of algal and invertebrate populations; eutrophication; pollution; environmental change.

NOTE Field trip: estimated cost \$30. RECOMMENDATION BIOL 201/3.0 and BIOL 202/3.0 are highly recommended. PREREQUISITE CHEM 112/6.0

### SCHEDULE

**Lectures:** Tuesday, 12:30-13:30; Thursday, 11:30-12:30; Friday, 13:30-14:30. JEFF225.  
**Labs:** Tuesday, 8:30-11:30; Wednesday, 14:30-17:30; Friday, 14:30-17:30. BIOSCI. 3320.

<b>Instructor</b>	<b>Dr. B.F. Cumming</b>
<b>Instructor Contact</b>	<a href="mailto:cummingb@queensu.ca">cummingb@queensu.ca</a> Phone: 613-533-6153
<b>Office Hours</b>	After class or by appointment
<b>TA:</b>	See Course Website <a href="http://post.queensu.ca/~biol335/index.html">http://post.queensu.ca/~biol335/index.html</a>
<b>TA Contact Information</b>	See Course Website
<b>Office Hours</b>	By appointment

### Learning Objectives

The goals of Biology 335 are to provide students with an integrated overview of lake systems, with a focus on ecological and environmental issues.

Limnology is a large subject that covers geological, physical and chemical aspects of freshwater environments, as well as their biology and development. Obviously, in a half course we cannot attempt to examine all facets of limnology in depth. Instead we will attempt to present an overview, emphasizing fundamental interactions and processes. The objectives of this course are to provide you with a basic understanding of the physical, chemical, and biological processes in lakes, as well as an appreciation of the impact of human activities on these water bodies.

### Learning Hours

<i>Teaching method</i>		<i>Average hours per week</i>	<i>Number of weeks</i>	<i>Total hours</i>
In-class hours	Lecture	3	12	36
	Seminar			
	Laboratory	3	6	18
	Tutorial			
	Practicum			
	Group learning			

	Individual instruction			
Other	Online activity			
	Off-campus activity	8	1	8
	Private study			56
Total hours on task				118

### **Course Outline**

Course material will be presented using three approaches: formal lectures, laboratories, and a compulsory field trip to Lake Opinicon (one day; either Saturday, Oct. 1 or Sunday, Oct. 2). Although there is some overlap between these approaches, they are not redundant and contain different information that will require your own integration.

There is a strong practical component to this course beginning with the field trip where you will receive a crash course in limnological surveys. You will also receive an introduction to many facets of limnological methodology including chemical and biological sampling techniques, as well as plankton identification. In only a few of these aspects will you receive any further practice or amplification in later laboratory periods, and thus attending the field weekend is critical. You will be expected to answer questions on the final exam regarding the data you collect on the field trip and the additional information presented throughout the field week-end. The material will also form part of the Lab Exam in the last week of classes.

### **Lecture Topics:**

Introduction to Limnology and Aquatic Ecology

Origin of lakes and Physical Limnology (~6 lectures: Lake morphometry; Light in lakes; Heat in lakes; Water movements)

Chemical Limnology (~8 lectures: Oxygen; Salinity; Carbon; Nitrogen; Phosphorus; Sulfur and Silica)

Biological Limnology (~5 lectures: Phytoplankton and primary production; Zooplankton; Fish and trophic interactions)

Integrative Limnology and Applications (~10-12 lectures: Paleolimnology; Acidification; Lake remediation; Contaminants; Invasive species; Arctic and Antarctic lakes; Tropical lakes; Climate change; Multiples Stressors)

### **Textbooks/Readings**

Textbook: Wetzel, R.G. 2001. *Limnology: Lake and River Ecosystems* (3<sup>rd</sup> edition), Academic Press.

Reserve material: There is also a useful laboratory/field manual (Wetzel, R.G. and Likens, G.E. 1991. *Limnological Analyses*, Springer-Verlag, New York) on reserve in the library. This text provides additional supplementary material for many of our labs and the field weekend.

A number of scientific journal articles relevant to the material presented in the course will be posted on the BIOL335 website in PDF format. Most of these papers should also be available from the Queen's library system.

## **Grading Scheme**

<b>Component</b>	<b>Weight (%)</b>	<b>Date</b>
Assignment 1: Lake Models	10%	Section A: TBA Section B: TBA
Midterm exam	20%	TBA
Assignment 2: Paleoecology	15%	Section A: TBA Section B: TBA
Lab Exam	15%	TBA
Final Exam	40%	TBA

## **Grading Method**

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale.

When letter grades are employed, the following scale will be employed for purposes of calculating your course average:

### ***Arts & Science Letter Grade Input Scheme***

<b>Assignment mark</b>	<b>Numerical value for calculation of final mark</b>
A+	93
A	87
A-	82
B+	78
B	75
B-	72
C+	68
C	65
C-	62
D+	58
D	55
D-	52
F48 (F+)	48
F24 (F)	24
F0 (0)	0

Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale:

### ***Queen's Official Grade Conversion Scale***

<b>Grade</b>	<b>Numerical Course Average (Range)</b>
A+	90-100
A	85-89
A-	80-84

B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

### **Academic Integrity and Queen's Code of Conduct**

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and conduct conform to the principles of academic integrity. Information is available in the Arts and Science Calendar (see Academic Regulation 1 -

<http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>, on the Arts and Science website (see <http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity>), and at Biology's website (<http://biology.queensu.ca/academics/undergraduate/prepare-yourself>)

and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulations on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

### **Accommodation Policy, Exam Conflicts, and Other Conflicts**

Students who feel they need accommodations for disabilities or extenuating circumstances, or have a conflict between exams or other commitments should consult the Biology Department's website for details about how to proceed (<http://biology.queensu.ca/academics/undergraduate/prepare-yourself/>). In general, the earlier a course coordinator is apprised of an extenuating circumstance, the more likely an accommodation can be made. Students are encouraged to be proactive in anticipating difficulties, when it is possible to do so.

Students may apply to write a make-up or deferred exam if they have an exam conflict as defined in the Academic Regulations of the Faculty (See Arts and Science Calendar Regulation 8 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>). In this case, the student should report to the Exams Office first to verify that there is a genuine exam conflict. Biology professors will not consider your situation to be a conflict unless it meets the criteria set out by the Faculty of Arts and Sciences.

Students may request a make-up or deferred exam if they have an exam conflict with off-campus travel associated with a field course (e.g., BIOL-307/3.0 or 407/3.0) that is held during the fall or winter terms.

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**Accommodation of Disabilities**

*Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Disability Services Office (DSO) and register as early as possible. For more information, including important deadlines, please visit the DSO website at: <http://www.queensu.ca/accessibility/students/supports-and-services-students-disabilities>*