

DEPARTMENT OF GEOGRAPHY
University of Toronto

COURSE OUTLINE

COURSE: **GGR203F – Introduction to Climatology**

INSTRUCTOR: Danny Harvey
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LOCATION: SS1074

OFFICE HOURS: MF11-1, W11-4 or by appointment

Outline

The course provides an overview of the physical processes responsible for determining global and regional climate, including: radiative energy transfer; the atmospheric and surface energy balances; energy and mass exchanges at the surface; the atmospheric general circulation; the role of the oceans and the cryosphere. A scientific, explanatory approach rather than a purely descriptive approach is emphasized.

Text:

The required textbook is *Weather and Climate: An Introduction* by Sheila Loudon Ross. A softcover edition can be purchased at the Koeffler Centre bookstore on campus, and an electronic edition can be purchased at <http://www.coursesmart.com/weather-and-climate-an-introduction/ross/dp/9780199000661>. The electronic edition costs \$80, vs a list price of \$150 for the softcover edition.

Requirements:

4 mathematical problem sets worth a total of 30% of the final mark.
A 15-minute quiz at the start of class on Sept 28th, worth 5% of the final mark
A 15-minute quiz at the start of class on Oct 9th, worth 5% of the final mark
A 50-minute test, covering Chapters 2, 3, and 4.1-4.8, worth 20% of the final mark on Nov 2nd
A 2-hour final exam that covers the entire course, worth 40% of the final mark.

The term test and midterm will deal with concepts and logical, cause-effect explanations but with no calculations. However, some questions will be devoted to asking what you did to solve particular problems in the problem sets and asking what principles are illustrated.

Office Hours: 11-1 MF, 11-3 W, or before class by appointment

Grade

Problem Sets:	30%
2 quizzes	10%
Mid-term test:	20%
Final exam:	40%

Penalty for late work:

5% per week day (work will not be accepted after the assignments have been returned, which will be as soon after the due date as the marker can get them marked)

If you miss term test: Notify me **within 24 hours** and present medical documentation. Only cases of severe illness or other extreme situations will be accepted.

Geography Math Help Centre

Another resource for this course is the department's new Math Help Centre. Geography TAs will be available to help refresh and explain mathematical concepts and techniques that may come up in your GGR courses. This includes working with formulas, graphing data, completing calculations, and so forth. It does not matter how basic your questions are! No appointment is required, just drop by. There will also be table space available in the room, allowing students to get math help as they work through assignments. Details on location and TA times posted here:

<http://geography.utoronto.ca/undergraduate/math-help/>

GGR 203 - Introduction to Climatology

Outline of Lecture Topics

1. Introduction
2. Radiation
 - 2.1 What are electromagnetic waves?
 - 2.2 The electromagnetic spectrum
 - 2.3 Emission of electromagnetic radiation
 - 2.4 Absorption of electromagnetic radiation
 - 2.5 Radiation and climate
3. Thermodynamics
 - 3.1 Pressure
 - 3.2 Conservation of energy
 - 3.3 Atmospheric stability
 - 3.4 Origins of inversions
 - 3.5 Water vapour
 - 3.6 Moist stability
4. Dynamics
 - 4.1 Newton's second law of motion
 - 4.2 Scales of motion
 - 4.3 Divergence
 - 4.5 Effects of earth's rotation
 - 4.6 Geostrophic wind
 - 4.7 Gradient wind
 - 4.8 Thermal wind and the Westerly jet
 - 4.9 Vorticity
 - 4.10 Planetary-scale waves in the atmosphere
 - 4.11 Extra-tropical cyclones
 - 4.12 Tropical cyclones
 - 4.13 Global circulation and pressure patterns
5. Surface processes
 - 5.1 Surface energy budget
 - 5.2 Surface-air heat, moisture, and momentum fluxes
 - 5.3 Estimation of vertical fluxes
 - 5.4 Role of snow and ice
6. Earth-atmosphere energy balance
7. Climatic change due to human activities

GGR 203: Optional readings from the textbook					
Lecture Notes	Topic	Textbook Section	Lecture Notes	Topic	Textbook Section
1.3	Overview of atm	1.6, 12.2-12.3	4.1.2	Pressure gradient force	11.1.1
1.5	Physical units	1.5	4.5	Effect of Earth's rotation	11.1.2
			4.6	Geostrophic wind	11.2.1
Ch 2	Radiation	Ch 5, 6.2-6.3	4.7	Gradient wind	11.1.3, 11.2.2
			4.8	Thermal wind	11.3
Ch 3	Thermodynamics		4.9	Vorticity	12.4
3.1	Pressure	3.1-3.6	4.10.1	Rosby Waves	12.5
3.2	Conservation of energy	4.1-4.3	4.11	Extra-tropical cyclones	13.5-13.8, 14.2
3.3	Atmospheric stability	Ch 8	4.12	Tropical cyclones	14.3
3.5	Water vapour	Ch 7	Ch 5	Surface Processes	4.4, 6.6
			Ch 6	Energy Balance	6.4-6.5
4.1.1	Representation of pressure	3.7	Ch7	Anthropogenic climatic change	17.3