GEOG144, Principles of Meteorology [3 units], Spring 2019

Department of Geography, University of California, Berkeley

Course description: This course presents a wide variety of *introductory* material concerning atmospheric processes and various types of atmospheric phenomena and weather events. During the course, we will cover topics including composition and structure of the atmosphere, solar radiation, wind, cloud formation, precipitation processes, atmospheric circulation, fronts, midlatitude cyclones, and tropical storms. This course will also cover reading weather maps and techniques of weather forecasting. We will review recent weather occasionally. We will also talk about the weather in the San Francisco Bay Area if time permits. Course page: https://bcourses.berkeley.edu/courses/1477187

Objectives & prerequisites: This course is primarily designed for upper-division undergraduate students. An undergraduate-level understanding of geography and earth system science is assumed.

Lecture slides: If available, it will be posted on bCourses the night before the lecture.

Time & location: Tuesdays and Thursdays, 9:30-11:00 am, 145 McCone Hall

Instructor: Wenwen Kong, wenwen.kong@berkeley.edu

Reader: Sol Kim, solkim@berkeley.edu

Office Hours: Tuesdays and Thursdays 11:15 am -12:15 pm in 531 McCone Hall with Wenwen. You can also email Wenwen to make an appointment.

Textbook: *Understanding Weather and Climate (6th or 7th edition)* by Edward Aguado and James E. Burt. Two copies are placed on a 2-hr reserve in the Earth Science and Map Library @ McCone Hall (available until the end of the semester). Also available from the UCB book store.

Grading policy: Your course grade will be calculated as follows, and will be *curved*.

- Quick writes in class (10%) unannounced, no makeup
- Five homework sets (6% per homework, for a total of 30%)
- Midterm exam (30%) - Tue, March 12, 2019, in class
- Final exam (30%) - Wed, May 15, 2019, 11:30 a.m. to 2:30 p.m., 145 McCone Hall

Grade Disputes

- If you wish to dispute a grade, you *must document and explain in writing* why you believe your answer was unfairly graded.
- Only homework sets and exams completed in a *non-erasable* pen will be eligible for re-grades.
- Please be aware that a re-grade may result in a lower or higher grade.

Class policies

- *Taking the midterm and final exams* are required in order to pass the course. If, for any valid reason (such as student-athlete schedules, religious observances), you cannot take the midterm or final at the scheduled time, please inform the instructor as soon as possible. See the website on "Academic Calendar and Student Accommodations - Campus Policies and Guidelines."
- Please also notify the instructor *in writing as soon as possible* about any known or potential extracurricular conflicts.
- If you get sick, you must send the instructor an email before the start of the lecture.
- Racist, sexist, offensive, or otherwise inappropriate language or expressions will not be tolerated.
- Laptops, tablets, and other electronic devices are not permitted during class for non-course related activities.

Homework policies: Written homework will be due at the beginning of class. I will accept *two late homework* per person for the duration of the course.

- If it's due on a Tuesday in class, I'll accept late homework until the following Thursday in class.
- If it is due on a Thursday in class, then late homework is due by 5 p.m. on the following Friday in my office (531 McCone).

Accommodations for Students with Disabilities

- If you have been issued a letter of accommodation from the Disabled Students Program (DSP), please inform me as soon as possible to work out any necessary arrangements.
- If you need accommodation and have not yet seen a Disability Specialist at the DSP office, please do so as soon as possible.

Academic Honesty

- Collaboration on homework with other students currently enrolled in this course is encouraged, but each student must write their own original responses to the problems unless explicitly specified. Failure to write original responses is considered academic dishonesty. You are expected to respect each other and work together in a productive manner.
- Answers to questions on assessments such as quizzes and exams must be original responses. Copying will be treated as academic dishonesty and may result in a zero for that assignment and a referral to the Center for Student Conduct.

Harassment: The University of California strives to prevent and respond to harassment and discrimination. Engaging in such behavior may result in removal from class or the University. If you are the subject of harassment or discrimination, there are resources available to support you. Please contact the Berkeley PATH to Care Center for non-judgmental, caring assistance with options, rights, and guidance through any process you may choose. Survivors of sexual violence may also want to view the following website:`survivorsupport.berkeley.edu`. For more information about how the University responds to harassment and discrimination, please visit the Office for the Prevention of Harassment and Discrimination website: `ophd.berkeley.edu`.

Detailed course outline			
Lectures	**Dates**	**Topic**	**Reading**
	Week 1	**Introduction**	
L1	Jan 22	Course overview	no reading
L2	Jan 24	Composition and Structure of the Atmosphere	1.3 - 1.7, 1.9
	Week 2	**Solar Radiation & Seasons**	
L3	Jan 29	Energy and heat transfer processes	2.1 - 2.2
		Radiation, Stefan-Boltzmann law, Wien's law	
L4	Jan 31	Solar constant, Earth's tilt, Seasons	2.3 - 2.5
	Week 3	**Energy Balance & Temperature**	
L5	Feb 5	*Weather review on the Midwest cold snap*	
		Weather review on a rainstorm hitting the Bay Area	
		Atmospheric effects on incoming solar radiation	3.1 - 3.3
		Energy transfer between the surface and the atmosphere	
L6	Feb 7	Earth's equilibrium temperature w/o atmosphere	3.4 - 3.6, 3.9
		Greenhouse effect	
		Global distribution of surface temperature	
	Week 4	**Atmospheric Pressure & Wind**	
L7	Feb 12	Air pressure, pressure gradient, hydrostatic balance	4.1 - 4.5
L8	Feb 14	*Weather review on an atmospheric river event*	
		Geopotential heights, Coriolis effect, friction	4.6 - 4.9
		Geostrophic balance, anticyclones, cyclones	
	Week 5	**Atmospheric Moisture**	
L9	Feb 19	Hydrologic cycle, evaporation, condensation, saturation	5.1 - 5.3, 5.5 - 5.6
		Vapor pressure, specific humidity, dew point, etc.	
L10	Feb 21	Diabatic and adiabatic processes	5.8 - 5.9
	Week 6	**Cloud development & forms**	
L11	Feb 26	Four mechanisms that lift air, static stability	6.1 - 6.3
L12	Feb 28	Inversions, limitations on rising air, types of clouds	6.4 - 6.6
	Week 7	**Precipitation processes & midterm review**	
L13	Mar 5	Growth of cloud droplets, forms of precipitation	7.1 - 7.2
	Mar 7	Midterm review	

	Week 8	**Exam & Precipitation processes**	
	Mar 12	Midterm exam	
L14	Mar 14	Forms of precipitation (continued), cloud seeding, floods	7.2 - 7.5
	Week 9	**Circulation & pressure distribution**	
L15	Mar 19	Scales of atmospheric phenomena	8.1 - 8.3
		Single-cell model, three-cell model	
L16	Mar 21	Semipermanent pressure cells, jet stream, rossby waves	8.4 - 8.5
Week 10 Spring break			
	Week 11	**Week 9 continued & Air masses**	
L17	Apr 2	Rossby waves (continued), monsoons	8.5 - 8.7
		Santa Ana winds, land-sea breeze, valley-mountain breeze	
L18	Apr 4	ENSO, Air masses	8.8, 9.1 - 9.3
	Week 12	**Guest lecture & Fronts**	
L19	Apr 9	Science on a Sphere at Lawrence Hall of Science	by Prof. John Chiang
L20	Apr 11	Fronts	9.1-9.3
	Week 13	**Midlatitude cyclones**	
L21	Apr 16	Polar front theory, the life cycle of mid-latitude cyclones	10.1 - 10.3
		Rossby waves and vorticity	
L22	Apr 18	Divergence and convergence along troughs & ridges	10.3,10.4, 10.6
	Week 14	**Severe weathers**	
L23	Apr 23	Lightning, thunderstorms, tornadoes	11.1, 11.3, 11.5, 11.6
L24	Apr 24	Tropical storms and hurricanes	12.1 - 12.7
	Week 15	**Forecast & final review**	
L25	Apr 30	Weather forecast and analysis	13.2 - 13.3, 13.6 - 13.8
L26	May 2	Final review (class ends)	
Final exam on May 15, 11:30 a.m. - 2:30 p.m., 145 McCone			

Retyped by Wenwen Kong in November 2019