Syllabus for AOS 101: Fundamentals of Atmospheric Thermodynamics & Dynamics, Fall 2019

Class meetings: T/Th 10 – 11:50 am in MS 7124B
Discussion sessions: T 12 – 12:50 pm (1A) in 7124B and W 9 – 9:50 am (1B) in 7121

Instructor
Jasper Kok
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Office Location: MS 7142
Office Hours: W 2 – 3 pm; in break between classes; by appointment

Teaching Assistant
TBD
Email: TBD
Office Location: TBD
Office Hours: TBD

TWO IMPORTANT NOTES BEFORE CLASS STARTS:
1. Reserve your free loaner clicker before they run out from the clicker bank or from me (see below) so you don’t have to purchase one!
2. Please bring your clicker to the first day of class!

Prerequisites:
- Mathematics: MATH 3B, 31B, or LS30B
- Physics: PHYS 1B, 5B, 5C, or 6B

Course Description and Goals
AOS 101: Fundamentals of Atmospheric Thermodynamics & Dynamics will provide you with a basic understanding of the thermodynamics (flows of heat, energy, and work) and dynamics (winds) of the atmosphere. The goal is that, by the end of the course, you understand and can explain the main features of the atmosphere, such as the vertical profiles of temperature, density, and pressure, and the main atmospheric winds, such as the trade winds and the jet stream. You will also understand the processes that determine these features, such as the changes in density and moisture content of air as it cools or warms, for instance by moving vertically in the atmosphere.

Required Materials
In addition to the textbook (see below), we will use clickers for interactive lectures that research shows help you learn better. Interactive lectures are also more fun and engaging than traditional lectures!

1. **Textbook**: *A First Course in Atmospheric Thermodynamics*, by Grant Petty (ISBN 0972903321)
2. **iClicker2**: You are required to obtain an i>clicker2 remote for in-class participation. The i>clicker2 is a response system that allows you to respond to questions I pose during class, allowing for interactive lectures. The i>clicker2 is the standard UCLA clicker that you might have already used in other classes, and might use in further (AOS) classes.

There are two options for you to borrow an i>clicker2 for the quarter for free:
1. Use the UCLA clicker loan program from the Office of Instructional Development. You can read more about it here: [http://lendme.oid.ucla.edu/](http://lendme.oid.ucla.edu/). They can’t cover all eligible students, so reserve your clicker as soon as possible after they open! Last year, the clickers could be reserved online starting at 10 pm two days before the first day of instruction.
2. Because I realize that purchasing an i>clicker2 can be a strain on possibly already tight finances, I have a pool of ~10 clickers that I can loan out to students that were unable to get a clicker from the loan bank. I will send out an email about this before the first class.
Between these two options, my goal is that no student needs to actually purchase a clicker. However, should you find
yourself in that situation, clickers are available for purchase at the UCLA bookstore, and at ebay, amazon etc. Be sure to
purchase the i>clicker2 with ISBN 1429280476 (so not the i>clicker+, which cannot handle alphanumeric input).

Class website
We will be using Piazza for class discussion. The Piazza system is highly catered to getting you help fast and efficiently
from classmates, the TA, and myself. Rather than emailing questions to me or the TA, you should post your questions on
Piazza. I will also use Piazza for important announcements, and to post lecture slides and homework sets. So if you
weren’t already automatically enrolled by the first day of class, you need to sign up for Piazza, which you can do for free

Class organization and other important notes
• Each class will start with a quiz on the assigned reading for that day. Each quiz will be scored using the clickers, so it
  is critical that you bring it to class every day. You can drop 4 quiz scores from your final grade on the quizzes.
• All assigned readings (and the derivations) are part of the material covered by homework sets and exams.
• I will have clicker questions during each lecture to facilitate interactions and active engagement with the material.
• There will be a homework set every week (except when we have an exam and Thanksgiving), which will normally be
due at 5 pm on Friday. You can twice hand in a homework set late, up until the beginning of the class after which
  the homework set was due, without explanation required. Homework sets that are late beyond that will be
discounted at 5%/day for every weekday (rounded up), and 10% for over the weekend. If your homework set is late
  because of a personal problem then let me or the TA know and we will try to make accommodations.
• Each homework set will normally include a math-heavy and/or a Matlab (programming) problem for extra credit.
  Since I don’t curve, you do not need to complete these to do well in this class. However, if you are able to, I
  encourage you to complete these as they will help build your skill set. Since these problems are extra credit, the TA
  will only be able to provide very limited guidance. If a Matlab problem requires you to code, rather than only use
  pre-existing scripts, you are required to email the TA your code to get credit.
• You can work on your homework sets during the discussion sessions, when the TA will be there to help guide you.
  Because education research shows that students working collaboratively learn substantially more and obtain higher
  grades, you will be randomly assigned to a group of ~3 students. However, if you do not want to work in a group, let
  me know, and I will not assign you to one. However, the TA will prioritize answering questions from groups of
  students as it’s a more efficient use of time, though you would hopefully still get the help you need.
• In addition to the discussion sessions, the TA will hold some office hours in the form of a ‘homework party’
  (normally on Friday from 1-3 pm), during which time you can work on your homework set and get more help.
• In addition to the TA, there might also be Learning Assistants (former AOS 101 students that are trained in pedagogy
  and are helping support the class for credit) to help you learn the material.
• I would like to meet each of you individually for a few minutes in the second week of class, so that I can get to know
  you a little and can better understand what you’re hoping to get out of the course. Details to follow.
• Please turn your cellphones off or to silent mode during class. Please also no texting, chatting, listening to
  headphones, etc.
• It is your choice if you decide to use your laptop, tablet or phone in class. Research finds that laptop multitasking is
  likely to hinder not only your own learning, but also the learning of anyone who can see your laptop
  therefore ask that anyone who wants to use an electronic device for non-class related activities sit in the back row
  of the classroom.

What do I need to do to succeed in this class?
1. Do the assigned readings carefully for each class. Not only will this let you perform well on the quizzes at the
beginning of each class (see below), it will also let you get the most out of our class time. This will help you to
comprehend the material without requiring as much time on your own at home, and will thus save you time in
studying for exams and homework sets.
2. Come to class on time, because we start each class with a quiz on the reading material (see above).

3. Bring your clicker to each class. This is required for the quizzes and lets you engage with the clicker and in-class exercises.

4. Attend and participate in all the lectures. Since education research finds that most students learn best by thinking through problems themselves, not by watching the instructor do it for them, this course will involve more in-class participation than you might be used to. In lectures, we will be doing clicker questions and in-class exercises so that I can focus our class time on what you don’t understand (yet). Participation will also help you see what you need to study most and what you already understand.

5. Attend the discussion sessions and the weekly ‘homework party’. These are great opportunities to get help on the material and on your homework sets, either from the TA or by working with other students. In previous years, students that made extensive use of the discussions sessions and homework parties did substantially better than students that did not.

6. Find a study buddy! Educational research clearly shows that students who study with peers learn more and perform better than students that study by themselves, regardless of the ability level of you and your study buddy. It’s also more fun. If you do not know anyone in class, you can find study buddies at the discussion sessions, on the Piazza class site, or during the in-class exercises.

7. Carefully do the homework sets, which is where you will apply problem solving techniques from the lectures and textbook to complex problems. A great opportunity to work on the homework sets is during the discussion sections / ‘homework parties’, when the TA and LAs will be there to help you. I strongly encourage student collaboration on problem sets, as research shows that this enhances your learning. Of course, each student must turn in his/her own solution, but it is fine to work closely enough with a fellow student that your solutions are very similar; in that case, you should note the name of the student you worked with.

8. Keep up! I know this might be tough to do with all your classes and activities, but it will save you time over the course of the quarter.

9. Ask for help if you are having trouble with understanding any of the material. A great way to do this is by posting your question on Piazza, so your fellow students, TA, and I can provide help. The TA is also there to help you during the discussion sessions and the homework parties. The office hours of this course’s TA are noted above. If the TA cannot help you, please come see me, either after class, during my office hours, or by appointment.

**Final Grade Distribution**

Your grade is based on points as outlined below. You are guaranteed an A if >93%, A- if >90%, B+ if >87%, B if >83%, etc.. My goal is for you all to learn enough to get A’s. I do not curve, because educational research shows this undermines student collaboration and impedes learning (see for instance [here](#)). If necessary, I will include additional extra credit options.

**Quizzes:** 20% (you can drop 4 quizzes from your final score)

**Discussion session participation:** 5% (you will get 100% for attending each week’s discussion session; you can drop 2 scores from your final discussion session participation score)

**Homework sets:** 25% (you can twice hand in a homework set late, no questions asked)

**Midterm:** 20%

**Final exam:** 30%

I very rarely assign extra credit to individual students. The only exception would be an extenuating personal circumstance (which I will generally do my best to accommodate, so come see me if you have a personal situation).
Some students are not good at taking exams. In the rare instance that I’m convinced that your performance on the exams is far below your actual understanding of the material, I will consider raising your grade to what I think more accurately reflects your understanding.

Alternative grade option
Although research shows that most people learn best by being regularly tested (hence the daily quizzes) and through active learning (facilitated by clickers and in-class exercises), it might not work for everyone. Therefore, you have the option of not participating in (or coming to) class and not taking the quizzes, thus basing your grade solely on homework sets and exams. For this alternative grading option, the grade distribution is:

*Homework sets:* 25% (you can twice hand in a homework set late, no questions asked)
*Midterm:* 30%
*Final exam:* 45%

Because scores on quizzes and participation are usually much higher than on exams, using this option will very likely result in a lower grade. Please let me know if you’re planning to use this option.

Exam dates
Midterm: Thursday, November 7 from 10 – 11:50 am in 7124B (tentative).
Final Exam: Wednesday December 11th from 11:30 am – 2:30 pm in 7124B.

Registering your i>clicker2 remote
In order to receive credit on the quizzes, you need to register your i>clicker2 remote by the second day of class:

1. Log into class’ CCLE site at [https://ccle.ucla.edu/](https://ccle.ucla.edu/)
2. Locate the i>clicker block on the AOS 101 class site
3. Click on the “Remote Registration” link
4. Enter the i>clicker ID located on the back of the clicker.

i>clicker2 will be used every day in class, and you are responsible for bringing your remote daily.

If you lose or break your i>clicker2 remote, you will have to obtain another one. Please email me with your new Remote ID so that I can manually register your new remote.

Intended student learning outcomes

1. Demonstrate understanding of how the fundamental laws of thermodynamics determine the structure and thermodynamic state of the atmosphere
2. Demonstrate understanding of how the fundamental laws of thermodynamics determine the properties and water content of air as it moves around the atmosphere
3. Demonstrate ability to use atmospheric soundings to extract information about the state of the atmosphere and to predict the properties of air as it moves around the atmosphere
4. Demonstrate understanding of the fundamental equations of motion that govern atmospheric dynamics (wind), and how to estimate the wind by simplifying these equations for different conditions
5. Demonstrate understanding of how thermodynamics affects atmospheric dynamics (wind)
6. Demonstrate understanding of the origin of important atmospheric phenomena, such as thunderstorms, jet streams, and hurricanes
7. Develop quantitative problem-solving skills necessary for scientific inquiry, critical thinking, and useful in the job market
8. Develop improved critical thinking skills
9. Develop improved mathematical skills, including deriving equations
10. Optional: develop improved programming skills
## Course Topics and Readings (tentative)

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic(s)</th>
<th>Readings</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Overview of the atmosphere and its thermodynamic properties</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>The ideal gas law; hydrostatics of the atmosphere</td>
<td>Petty: 2.1; 2.2 until and including 2.2.1; 3 until 3.4; 4.1; 4.2.2; Appendix B</td>
<td>Hw set #1</td>
</tr>
<tr>
<td>2</td>
<td>First law of thermodynamics; Adiabatic processes</td>
<td>Petty: 5.1 until Eq. 5.9, 5.2, 5.3, and 5.7 until and including 5.7.2; 5.4, excluding 5.4.3</td>
<td>Hw set #2</td>
</tr>
<tr>
<td>3</td>
<td>Thermodynamic diagrams; thermodynamics of moist air</td>
<td>Petty: 1.4.4 and 5.4.3; 7.1, 7.4; 7.2, 7.5, 7.6, and 7.7</td>
<td>Hw set #3</td>
</tr>
<tr>
<td>4</td>
<td>Thermodynamics of moist air; stability and buoyancy</td>
<td>Petty: 7.8, 7.10.4; 3.5; 8 until 8.3, excluding 8.3.3</td>
<td>Hw set #4</td>
</tr>
<tr>
<td>5</td>
<td>Stability and buoyancy; convection</td>
<td>Petty: 8.3.3, 5.8.1, 7.10.5; 8.4 until and including 8.4.1; 8.4.2</td>
<td>Hw set #5</td>
</tr>
<tr>
<td>6</td>
<td>Intro to atmospheric dynamics; midterm (tentative)</td>
<td>Wallace &amp; Hobbs: 1.2, 1.3.5, 7.2.2</td>
<td>Midterm</td>
</tr>
<tr>
<td>7</td>
<td>Fundamental forces and equations of motion in the large-scale atmosphere</td>
<td>W &amp; H: 7.2, 7.2.1, 7.2.3</td>
<td>Hw set #6</td>
</tr>
<tr>
<td>8</td>
<td>Geostrophic and gradient wind; Thanksgiving</td>
<td>W &amp; H: 7.2.4 – 7.2.6</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>Thermal wind</td>
<td>W &amp; H: 7.2.7</td>
<td>Hw set #7</td>
</tr>
<tr>
<td>10</td>
<td>Primitive equations; review</td>
<td>W &amp; H: 7.3 - 7.3.3</td>
<td>Hw set #8</td>
</tr>
</tbody>
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### Instances of academic dishonesty

Instances of cheating will be taken seriously. The penalty for serious cheating, for instance on exams, can be severe and could result in suspension or dismissal from UCLA. This is especially true for students in the ROTC or on particular fellowships. Note that clicking in for another student on a quiz is a form of cheating; some students are tempted to ask a friend to do this when they are sick or cannot be in class for another reason. I allow you to drop four quizzes to accommodate illness and other personal reasons that prevent you from coming to class, so you should never find yourself in this situation. If you have reasons why you need to miss more than four classes, for instance due to a personal problem, please come see me and we can usually work something out.

A detailed description of forms of academic dishonesty, and ways to seek help when you are feeling overwhelmed, is at [https://www.deanofstudents.ucla.edu/portals/16/documents/studentguide.pdf](https://www.deanofstudents.ucla.edu/portals/16/documents/studentguide.pdf).

### Your Input is Important to me

I encourage your feedback at any time throughout the quarter about things that are helping you learn, things that aren’t helping, or things that I can improve. You will also have the opportunity to fill out evaluations midway into the class, in addition to the customary evaluation at the end.