

# SYLLABUS ATM601/CHEM601

## **Introduction to Atmospheric Sciences**

**Number:** ATM601/CHEM601

**Instructor:** Carmen N. Moelders, aka Nicole MÅ¶lders

**Email:** cmoelders@alaska.edu

**Office hours:** Thursday 1-2 pm on google hangout or zoom

**Office location:** Akasofu 309

**Phone:** +1 907 474 7910

**Delivery mode:** Online

**Phone conferences:** Up to three during the semester TBA (mandatory P/F)

**Zoom conferences:** As needed, may substitute phone conferences TBA (mandatory P/F)

**Slack discussion:** Asking and answering questions once a week (letter grade)

**Teaching assistant:** None

**Prerequisites:** Graduate standing in STEM fields (physics, chemistry, civil engineering, geological engineering, geography, geophysics, hydrology, technology engineering, mathematics) or permission of instructor

**Course Description:** Introduction to Atmospheric Sciences comprises the physical, chemical and dynamical processes of the troposphere. The governing conservation (balance) equations for trace constituents, dry air, water substances, total mass (equation of continuity), energy (1<sup>st</sup> law of thermodynamics), entropy (2<sup>nd</sup> law of thermodynamics), and momentum (Newton's 2nd axiom) are presented and explained.

### **Subjects Addressed:**

- Frontal systems, hurricanes, clouds
- Chemical processes taking place in the atmosphere
- Kinetic, synoptic and dynamic processes
- Thermodynamics of reversible and irreversible processes
- Photolytical and gas phase oxidation processes, aqueous chemistry, as well as gas-to-particle conversion
- Fundamentals of biogeochemical cycle
- Origin of the ozone layer
- Solar and terrestrial radiation, major absorbers, radiation balance, radiative equilibrium, radiative-convective equilibrium
- Basics of molecular, aerosol, and cloud adsorption and scattering
- Satellite imaginary
- Greenhouse gases (e.g., CO<sub>2</sub>, H<sub>2</sub>O, CH<sub>4</sub>, etc.)
- Optical phenomena like rainbows, halos etc. are included
- Interactions of the global energy, water, and trace gas cycles and their influence on general circulation and their role in the climate system

**Student Learning Outcome —ATM601/CHEM601:** By the end of the semester, all students will be able to

1. Develop skills to think as a scientist and master higher order thinking
2. Utilize the basic fundamentals such as, the governing conservation (balance) equations for aerosol and trace gas constituents, dry air, water substances, total mass (equation of continuity), energy (1<sup>st</sup> law of thermodynamics), entropy (2<sup>nd</sup> law of thermodynamics),

and momentum (Newton's 2<sup>nd</sup> axiom) and their special approximations, in preparation for other ATM classes. This includes

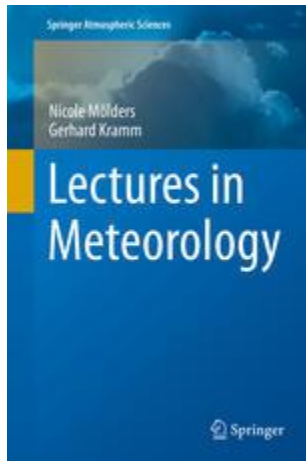
- Describe a process in terms of equations
  - Analyze and interpret weather maps, diagrams, and satellite images
  - Explain the basics of atmospheric thermodynamics, radiation, circulation, cloud- and precipitation formation, as well as atmospheric chemistry
3. Interpret chemical or other environmental measurements or model results in the framework of the meteorological situation
  4. Apply material learned to new problems
  5. Improve the quality of their presentations
  6. Put atmospheric sciences concepts together in a new context to solve a problem or very different problems
  7. Solve fundamental problems related to the basics of atmospheric sciences and discuss the results under different aspects
  8. Improve skills to discuss science in an effective manner
  9. Improve the quality of your presentations
  10. Develop atmospheric sciences based reasonable assumptions about missing terms, data, and information
  11. Recognize data that are not needed to solve the problem and discard them
  12. Judge in terms as is needed in thesis research
  13. Analyze the limits of validity of assumption and under which circumstance terms or processes can be neglected

**Student Protections and Services Statement:** Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: [www.uaf.edu/handbook/](http://www.uaf.edu/handbook/).

**Class Delivery:** Research showed that teaching someone and active learning else are the best ways to learn (e.g. [here](#)). This class is taught **online**. This means you will have to do reading assignments, watch videos, take notes and have to answer the questions and solve the assigned problems by the respective deadlines. Doing so is part of your grade. I will grade the equation sheets, answers to questionnaires, problem tasks and the summary as homework. Note that this class is stacked meaning it can be taken at the upper undergraduate and the graduate level. Make sure that you have signed up at the level you want to take this class. The application assignments are tailored to the different student groups (ATM401, ATM601, CHEM601). However, in the discussion group the students at both levels are in the same cohort. There might be up to three phone conference during the semester where I will call you to discuss class material.

**Suggested Readings/Textbooks:** All reading and application assignments as well as questionnaires and quizzes will be posted on the [class webpage](#). All reading assignments will require using

Müller, N., Kramm, G. 2014. *Lectures in Meteorology, Springer Atmospheric Sciences Series, Heidelberg*



Reading the material assigned at your class level, watching the videos and taking notes are also homework assignment, i.e. inevitable. You will not be able to fill out the questionnaires, solve the problems assigned at the graduate level, discuss your results as assigned and/or write the summary of the material without having done the reading or watched the videos. You also will not be able to seek clarification, and will not be able to participate efficiently in the discussion projects without having watched the videos and read all the material. It saves time and is safer to do the assignments using the recommended books or provided class material. The final examination is related to this material.

**Difference between ATM401 and ATM601/CHEM601:** I try to balance the interests of undergraduate and graduate students. Therefore, I will assign special tasks for graduate students that probe the material assigned at the graduate level. The same applies for the undergraduate level. This means there are distinct differences in the degree of difficulty in the assignments in accord with the different goals of the learning outcome. This means among other things that over the time frame of the class, graduate students 1) will have additional reading and/or video watching assignments to achieve the learning outcomes at the graduate level, 2) will be required to discuss results under a given aspect (while undergraduate students are not asked to do so), 3) will be required to read a research review paper relevant to the topic of the respective unit, 4) will always be assigned different or additional homework problems at a higher degree of difficulty that will probe applying methods discussed in the additional readings/videos, and/or 5) will have to answer additional or different questions on the questionnaires, 6) will be required to summarize the material in less than 200 words in the questionnaire, 7) will be asked to program simple concepts, and 8) will get quizzes and exams that also probe for the material related to the additional learning outcomes. In other words, tasks designed for graduate students will require skills that undergraduate students usually do not have yet (e.g. programming) and/or that are not an expected learning goal at the undergraduate level (e.g. making reasonable assumptions, justify assumption, testing of the limits of assumptions, identify data not needed to solve the question, just to mention a few points). Exams and quizzes will have additional tasks to be solved at the graduate level. Thus, make always sure you solve the tasks assigned for graduate students to be best prepared for the

quizzes and exams. Note that (just) solving the problems at the undergraduate level will not prepare you sufficiently to pass the quizzes and exams at the graduate level.

**Difference between CHEM601 and ATM601:** There is no difference between the grading of the completeness, correctness, and understanding of quizzes and the exam. I try to balance the interests of chemistry and atmospheric sciences students and the importance of the material taught for their discipline by assigning applications relevant for their discipline as much as possible. Thus, I will occasionally assign ATM601 and CHEM601 students different kind applications, or parts of exams or quizzes. Students can gain extra credit for also doing the tasks not assigned to them. A difference on an application task could be that ATM601 students have to plot the results of a problem for various quantities, while CHEM601 students have to discuss what the results of the problem mean for the chemical distribution in the atmosphere.

**Required technology software:** This class has a strong online component. Students need a laptop, PC, Mac or tablet with a browser, a UAF email address to access the questionnaires and quizzes, and access to the internet. On the device software to watch mp4 videos has to be installed. I expect that you can handle and work with Adobe reader, google

forms, google doc, google sheets, and excel. You can [download them from the OIT software catalog](#). You can find what [software you can use to open the MP4 videos](#) at the link. You can access [google here](#). Contact [OIT for support](#) in installing the required software. Students also will need an old-fashioned (offline) calculator for the exam.

**Other course resources:** Please realize that when students enroll in university-level courses they may need to employ skills that are not directly related to the course content. As a student, you might be required to learn something new to succeed in class even though that skill/material will not specifically be on the final exam. Thus, students should expect to learn [techniques/tools](#) that are needed to fulfill the requirements listed in this course syllabus.

**Writing etiquette:** I expect that you use correct English grammar and spelling in all questionnaires, quizzes, in the exams, and emails to me. This expectation is to practice being professional in your communication.

**Examinations:** There will be one major examination and one mid-term examination. It is the student's responsibility to find out when and where the examination will take place and to be there in time. Only the *Lectures in Meteorology* are allowed as hard copy during the exam as well as your notes. A calculator is allowed, but not a calculator on a phone or other internet accessible device. Only in case of emergency, I will allow you to start later on the exam. There is usually another exam scheduled in this classroom right after your own exam so the room has to be free in time. This means that I cannot give you extra time if you arrive late. The exam is scheduled for finals week. It is open book. However, if students bring a reasonable scheduling conflict to my attention by the **end of the first week of classes** (e.g., absence for field work, attendance of a conference during finals week) I will work with the student for arrangements. **I will not do the exam prior to AGU as that would take off 14 days of class material.**

**Course Policies:** As part of this course, you will be asked to participate in public spaces on the internet. For example, you will be asked to write a blog post, comment on someone else's blog post, or post on online services like YouTube. You will create an account and a screen name for each of these services; it's important to understand that the screen name

you choose will be public to the world. If you do not wish to use your real name, we suggest using your university username (your login username for Blackboard or you may choose to use a nickname alias instead). If you are working in WordPress, from the Dashboard edit your profile and set your display name to the nickname of your choice. Contact your instructor directly if you have questions or concerns.

Each unit gets graded. You will have to do your reading, video watching, questionnaire, and problem assignments as posted and/or stated in [schedule](#). Participation in the google group discussions are mandatory and part of your grade. Excused late submissions are approved in advance (prior to the due date) or due to a documented emergency. Such documentation must be made immediately upon the student's being able to access the internet. However, unexcused late submissions lead to an **F** on the units you missed. Please understand that this is a college course – you are expected to submit your assignments on time.

All problems have to be solved in readable style, scanned in and submitted by email with clear identification of the unit number and your name. "Readable style" means either clear hand writing or typed, double-spaced, using at least a 12-point font, one-inch margins, and in hard copy format. Latex is a great software to write equations. If you have not met these stipulations, I will return it to you ungraded. Submission will not be accepted via fax unless you make prior arrangements with me. When programming tasks are assigned the code has to be submitted as part of the assignment, i.e. it is not sufficient to just submit the results. I want to see how you got there. All results of problem tasks will have to be discussed what they mean for the water cycle.

It is the student's responsibility to submit the assignments and participate in the discussion group in time. I strongly suggest that you plan and schedule your work and start working on your assignments before it is due. I recommend having backup systems in place so you can have all work completed on schedule. Getting work done on time is a key to early success in your business or scientific career. A major complaint of employers is that faculty do not instill a sense of responsibility in students.

I encourage teamwork, as teamwork will be the way to work in future work places. Research also showed that students working together typically become better presenters (a goal of this class) and are more successful in class. If you co-work in groups, everybody of the group must submit the work and it has to be stated as group work with a disclosure of the team and a brief summary of the discussion. The latter is to ensure that nobody takes group work as a free ride.

### **Additional policies:**

1. No weapons allowed in the final examination or during office hours.
2. Due dates are firm, with the exceptions mentioned above as well as documented emergencies.
3. If you have a disability and require any auxiliary aids, services or accommodations under the Americans with Disabilities Act, please contact me after class, see me in the my office, or call me during the first week of the semester to be able to define specific accommodation needs and have enough time for any necessary preparation. Also

contract [UAF's Office of Disability Services](#). If you have any kind of a physical or learning disability you must tell me about it. All disabilities are documented by [UAF's Center for Health & Counseling](#) and instructors receive a formal letter requesting that accommodation are made for any student with disabilities.

4. Any student who is an UAF sponsored athletic or who has other personal or situational difficulty that might affect class performance is invited to contact me in the first week of the semester (or as soon as such matters emerge) so that ways of accommodating the difficulty may be anticipated.
5. If you intend to go to AGU or another scientific conference or on a field trip, you must tell me this in the first week of class. It is your responsibility to make up for the classes missed.
6. Switch your cell phones off during the exams.
7. I do not answer emails Saturday to Sunday, i.e. I answer within 24 h to emails on Monday to Friday afternoon only between 1000 and 1700. When I am on university related travel, I do not answer to emails as I cannot guarantee email access.

All students in the class were informed about the policies at the beginning of the class and in the syllabus, and it would be unfair to everyone else to give one person an exception.

**Required Technology Software:** Students must have regular access to a computer and the Internet to access online materials on this classroom page. Students need a laptop, PC, Mac or tablet with a browser, a UAF email address to access the questionnaires and quizzes, and access to the internet. On the device software to watch mp4 videos has to be installed. I expect that you can handle and work with Adobe reader, google forms, google doc, google

sheets, and excel. You can [download them from the OIT software catalog](#). I expect that you can handle and work with Adobe reader, google forms, google doc, google sheets, and

excel. You can [download them from the OIT software catalog](#). You can find what [software you can use to open the MP4 videos](#) at the link. You can find information on the [google accessibility](#) and the [wordpress accessibility](#) at the links. Students will be expected to download course material as well as upload assignments. Students also will need an old-fashioned (offline) calculator for the exam.

**Other Course Resources:** Please realize that when students enroll in university-level courses they may need to employ skills that are not directly related to the course content. As a student, you might be required to learn something new to succeed in class even though that skill/material will not specifically be on the final exam. Thus, students should expect to learn [techniques/tools](#) that are needed to fulfill the requirements listed in this course syllabus.

**Other Important Information:** It is essential that you (1) keep up with the reading of the book, paper and video materials, (2) budget your time wisely to complete all of your reading and viewing assignments, and (3) seek clarification on any material, which you do not understand, during office hours or on the class discussion board. Note there is a **Quiz Your Professor** section on the right sidebar of our class page where you can contact me. If I am not covering subjects adequately, or the problems are confusing or difficult, or if you do not understand the questions in your problem assignment, quiz or examination, and you



didn't find a solution in the FAQ or discussion board, please let me know. I want you to understand the material and that you can apply the material to solve problems. Please use the office hours to seek clarification.

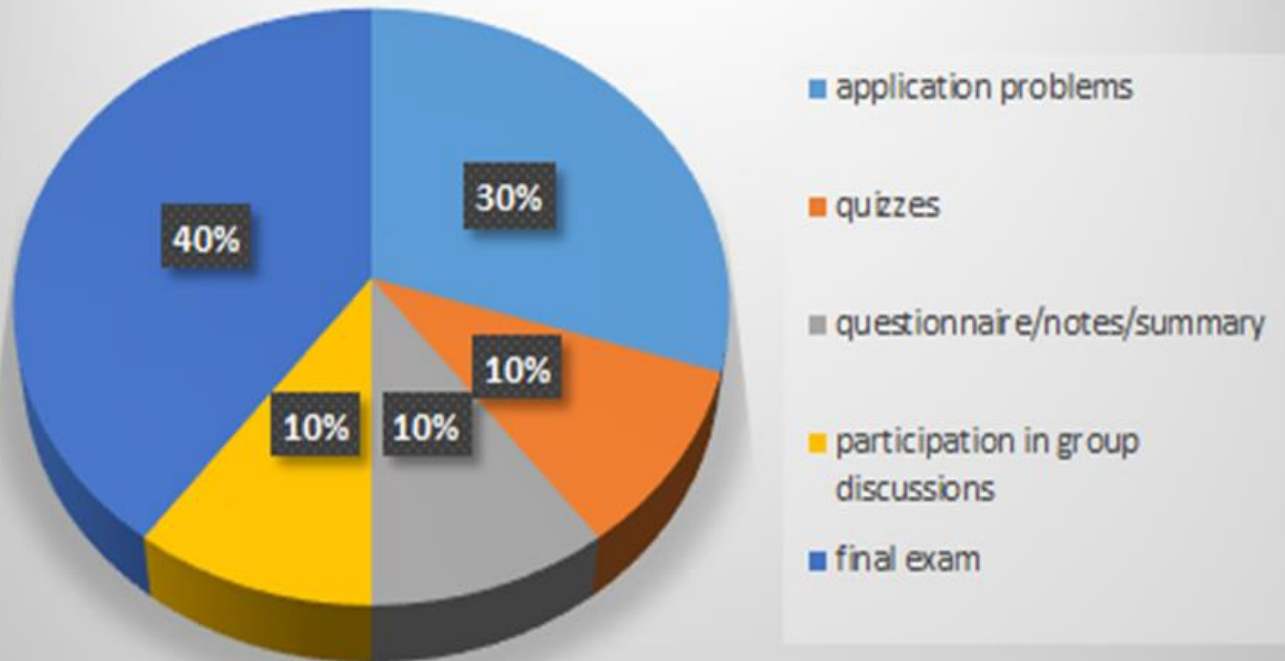
**Expectation of Student Effort:** Students should expect to spend 10-12 hours per week on this class. Students are expected to complete the weekly assignments by their due dates. If circumstances arise that cause you to need extra time on any assignment(s), email your instructor for guidance. Extensions of due dates may be granted, but your instructor expects to be informed in advance if you are not able to submit your assignment on time. (Emergency situations will be dealt with as needed.) Students are expected to maintain a working backup plan to be implemented in the event of a computer malfunction or an interruption of their normal Internet service during the course.

**Academic Integrity, Honor Code and Plagiarism:** I expect students to submit own original work and reference all other work and intellectual ideas with appropriate reference and citation. As described by UAF, scholastic dishonesty constitutes a violation of the university rules and regulations and is punishable according to the procedures outlined by UAF. Scholastic dishonesty includes, but is not limited to, cheating on an exam, plagiarism, and collusion. Cheating includes providing answers to or taking answers from another student. Plagiarism includes use of another author's words or arguments without attribution. Collusion includes unauthorized collaboration with another person in preparing written work for fulfillment of any course requirement. Scholastic dishonesty is punishable by removal from the course and a grade of "F." For more information go to [Student Code of Conduct](#).

**Grading Policy:** This class is a success-oriented course. My aim is for all students to meet their individual learning and grade goals. Of course, this does not mean that you can avoid working hard or work hardly. Instead, it means that (1) all students who do well in the assignments, group discussions, and final examination as well as regularly answer peer questions on the discussion board will be rewarded accordingly, and (2) the grade distribution will not be adjusted to make sure it fits a bell-shaped curve. I expect that (1) you aim to give your personal best in the course, and (2) use the peer-questions, questionnaires, quizzes, problems and the final examination as an opportunity to demonstrate your understanding of the material. To obtain an "A" grade you will need to produce work that far exceeds my normal expectations. My normal expectations are hard work evidence of time spent with the material and an ability to demonstrate knowledge of the material and ability to apply the material.

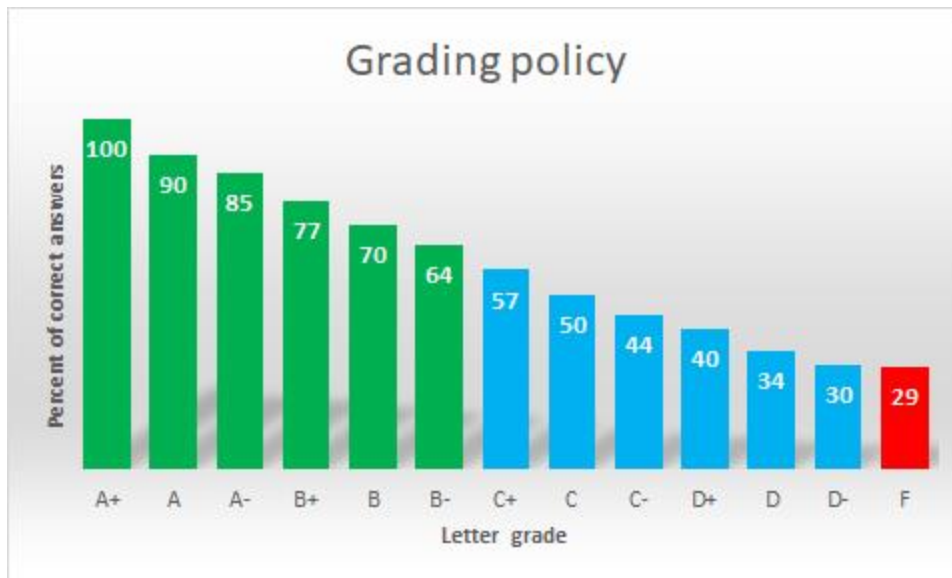
Grading for this class will follow the [UAF guidelines](#). Your grade will be 10% questionnaires, notes/summary, 30% applications problems, and 40% final exam, 10% participation in group discussions, and 10% quizzes.

## Final grade



To get a "C" grade, 50% of the points in each category have to be earned. I will give +/- grades with the following UAF rules A 4.0, A- 3.7, B+ 3.3, B 3.0, B- 2.7, C+ 2.3, C 2.0, C- 1.7, D+ 1.3, D 1.0, D- 0.7, and F 0.0, respectively. Thus, 90% and better is an A, 85-89% is A-, 77-84% is B+, 70-76% is B, 64-69% is B-, 57-63% is C+, 50-56% is C, 44-49% is C-, 40-43% is D+, 34-39% is D, 30-33% is D-, less than 30% is F. Grades of "incomplete" will be given only in cases where an extraordinary, exceptional reason, submitted in writing by the student and judged valid by me. See UAF policies for [details](#).





### Explanation of NB/I/W grades

This course adheres to the UAF regarding the granting of NB Grades. The NB grade is for use only in situations in which the instructor has No Basis upon which to assign a grade. In general, the NB grade will not be granted.

Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy: “The letter “I” (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C or better) the majority of work in a course but for personal reasons beyond the student’s control, such as sickness, he has not been able to complete the course during the regular semester. Negligence or indifference are not acceptable reasons for an “I” grade.”

Successful, timely completion of this course depends on committing yourself early and maintaining your effort. Failure to submit assignments in a timely manner may result in faculty-initiated Withdrawal from the course, which can result in a W on your transcript.

**Instructor response time:** It generally takes me about a week or so to grade written assignments after submission. There are voluntary quizzes that provide immediate feedback. In addition to your grade, you will receive feedback from me either in the comment box, or as an attachment. Each unit has a FAQ section as well.

**Support services:** Go to the Student Handbook for things like academic advising, tutoring, library and academic support, disability services, computing and technology, veteran and military support, academic complaint and appeals, late withdrawals, “classroom” behavior expectations and more.

UAF eCampus Student Services helps students with registration and course schedules, provides information about lessons and student records, assists with the examination process, and answers general questions. Our Academic Advisor can help students communicate with instructors, locate helpful resources, and maximize their distance learning experience. Contact the UAF eCampus Student Services staff at 907.455.2060 or toll free 1.800.277.8060 or contact staff directly — for directory listing see: <https://ecampus.uaf.edu/contact>

UAF Help Desk: Go to <https://www.alaska.edu/oit/> to see about current network outages and technology news. For technical questions, contact the Help Desk at: e-mail at [helpdesk@alaska.edu](mailto:helpdesk@alaska.edu), phone: 450.8300 (in the Fairbanks area) or 1.800.478.8226 (outside of Fairbanks)

### **Effective communication**

Students who have difficulties with oral presentations and/or writing are strongly encouraged to get help from [UAF Department of Communication's Speaking Center](mailto:speak@uaf.edu) (907.474.5470, [speak@uaf.edu](mailto:speak@uaf.edu)) and/or [UAF English's Department's Writing Center](mailto:writing@uaf.edu) (907.474.5314, Gruening 8<sup>th</sup> floor); [CTC's Learning Center](mailto:ctc@uaf.edu) (604 Barnette st, 907.455.2860)

**COVID-19:** Since there is only limited capacity for proctoring due to COVID-19, we will discuss at the beginning of the semester how students prefer to take their exams. Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

**Notice of non-discrimination:** UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: [www.alaska.edu/titleIXcompliance/nondiscrimination](http://www.alaska.edu/titleIXcompliance/nondiscrimination).

Goto the [class schedule](#)

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