



North Carolina Agricultural and Technical State University

College of Science & Technology

Department of Physics

Atmospheric Thermodynamics

Course Syllabus

Course Information

<i>Course Number/ Section:</i>	ASME 231
<i>Term:</i>	Spring 2020
<i>Semester Credit Hours:</i>	3
<i>Times and Days:</i>	12:30-1:45 TR
<i>Class Location:</i>	Gibbs 302

Instructor Contact Information

<i>Instructor</i>	Dr. Yuh-Lang Lin
<i>Office Location</i>	302H Gibbs Hall
<i>Office Phone</i>	336-285-2127
<i>Email Address</i>	ylin@ncat.edu
<i>Teaching Assistant</i>	Justin Riley (jgriley@aggies.ncat.edu)

Student Hours: 12:30-3:00 MWF, stop by for short discussion, or by appointment

Note: Students are responsible for reading, understanding, and following their syllabi.

Course Pre-requisites: PHYS 241 (General Physics) or equivalent

Course Description

This course covers the general aspects of thermodynamic physical processes occurring within the atmosphere. Topics included are thermodynamics systems, equation of state for ideal gases, Charles' law, Boyle's law, mixture of gases, first law of thermodynamics, internal energy, specific heats and enthalpy, adiabatic processes, potential temperature, Carnot's cycle, second law of thermodynamics, entropy, moisture variables, phase transitions, Clausius-Clapeyron equation, moist air adiabats, thermodynamic diagrams, hydrostatic equation, geopotential, scale height and the hypsometric equation, thickness and heights of constant pressure surfaces, Reduction of pressure to sea level, dry and moist adiabatic lapse rates, parcel method, potential or convective instability, slice method of stability analysis, entrainment into cumulus clouds, bubble and plume theories, introduction to numerical cloud modeling

Required Textbooks and Materials

Required Text and Manual

"Lecture Notes" by Yuh-Lang Lin, NCAT

Useful Reading/reference (not required)

- (1) Introduction to Theoretical Meteorology by S. L. Hess, Krieger Publishing Co., Reprint Ed. 1979
- (2) A First Course in Atmospheric Thermodynamics by W. Petty, Sundo Publishing Co., 2008
- (3) An Introduction to Atmospheric Thermodynamics by A. A. Tsonis, Cambridge, 2007, 2nd Ed.

Grading Allocation

(1) Labs	30%
(2) Midterm	30%
(3) Final Exam	40%

Grading Scale

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Scores	94-100	90-93	87-89	83-86	80-82	77-79	73-76	70-73	67-69	60-66	0-59

Assignments & Academic Calendar (Subjected to change)

Presentation Schedule

Date	Pres. #	Presentation Title	Remarks (Sec.)
1/14	1	Introduction to the Course and Labs	1.1
1/16	2	Basic Concepts	1.2
1/21	3	Equation of State of an ideal Gas	2.1
1/23	4	Mixture of Ideal Gases	2.2
1/28	5	Work	3.1
1/30	6	Heat	3.2a
2/4	7	Kinetic Theory of Gases	3.2b
2/6	8	First Law of Thermodynamics	3.3
2/11	9	Internal Energy, Heat Capacity & Enthalpy	3.2
2/13	10	Adiabatic Process	3.5
2/18	11	Carnot Cycle	4.1
2/20	12	Carnot Cycle	4.1
2/25	13	Second Law of Thermodynamics	4.2
2/27		Midterm	
3/2-6		Spring Break	
3/10	14	Entropy	4.3
3/12	15	Water-Air System – Isotherms on the Phase Diagram	5.1
3/17	16	Thermal Properties of Water Substance	5.2
3/19	17	Equation of State for Moist Air	5.3
3/24	18	Phase Change & Latent Heat	5.4
3/26	19	The Clausius-Clapeyron Equation	5.5
3/31	20	Saturated Adiabatic Process	5.6
4/2	21	Moisture Variables - I	5.7
4/7	22	Moisture Variables - II	5.7
4/9	23	Thermodynamic Diagrams	6.1
4/14	24	Thermodynamic Diagrams	6.1
4/16	25	Thermodynamic Diagrams	6.1
4/21	26	Thermodynamic Diagrams	6.1
4/23	27	Hydrostatic Equilibrium	7.1
4/28	28	Geopotential & Scale Height	7.2
4/30	29	Hypsometric Equation	7.3
5/4-8		Final Exam	

Course Policies

Make-up exams

No make-up mid exams are allowed. With advanced & excused absences with evidence, the homework and final exam with appropriate weights will be used to evaluate the overall grade.

Extra Credit

No Extra Credit

Late Work

Late submission of homework and model projects must be within a reasonable period of time permitted by the instructor.

Special Assignments

Not applicable

Academic Integrity

Enrollment in the class means that you agree to abide by the expectations of North Carolina A&T State University about academic integrity. For specific information refer to your Student Handbook. Also, refer to the most current Undergraduate Bulletin for the academic dishonesty policy. The North Carolina A&T State University's Academic Honor Code will be enforced.

Your responsibilities in the area of honor include, but are not limited to, avoidance of cheating, plagiarism and improper or illegal use of technology. Your presentations, assignments, and quizzes are expected to be your own work. Any questions about these should be directed to the professor. It is permissible to request assistance from a librarian when doing database research as long as the selection and organization of the research for the presentation is in your own work.

Class Attendance

Class Attendance is Strongly Encouraged

As there is a strong correlation between class attendance and performance in the course, class attendance in Physics 241 is strongly encouraged. As attendance will be taken in the first 20 minutes of the class, any student not in class by 20 minutes after the class starts will be considered absent. Absence without excuse for more than 9 days may result in a grade of F for the course. Dishonesty in recording attendance by signing in for someone else, or other means, will be considered cheating and will result in a grade of F for the course. Make-up examinations will be given in accordance with University policy (2017-2018 Undergraduate Bulletin).

Classroom Citizenship: Courtesy, civility and respect must be the hallmark of your interactions.

Compliance with the Americans with Disabilities Act

North Carolina A&T State University is committed to complying with the Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973 by providing equal access to the programs, services and benefits to qualified students with disabilities. All reasonable efforts must be made to accommodate the needs of students with documented disabilities. **If a student has a disability that qualifies under the American with Disabilities Act Amendments Act (ADAAA) and requires accommodations, he/she should contact or visit the Office of Accessibility Resources (OAR) located in Murphy Hall, Suite 01 or at (336) 334-7765 for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact the Office of Accessibility Resources if they are not certain whether a medical condition/disability qualifies. Please note that approved accommodations must be adhered to by law, but cannot be performed retroactively!**

Title IX

North Carolina A&T State University is committed to providing a safe learning environment for all students, is free of all forms of discrimination and harassment. Sexual misconduct and relationship violence in any form are inconsistent with the university's mission and core values, violate university policies, and may also violate federal and state law. Faculty members are considered "Responsible Employees" and are required to report incidents of sexual misconduct and relationship violence to the Title IX Coordinator. If you or someone you know has been impacted by sexual harassment, sexual assault, dating or domestic violence, or stalking, please visit the Title IX website to access information about university support and resources. If you

would like to speak with someone confidentially, please contact the Counseling Services or Student Health Center.

Technical Support

If you experience any problems with your A&T account you may call Aggie Tech Support (formerly Help Desk) at 336.334.7195 or Client Technology

Services: <https://hub.ncat.edu/administration/its/client-technology-services.php>

Field Trip Policies / Off-Campus Instruction and Course Activities

If Applicable

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at:

Student Affairs: <https://www.ncat.edu/campus-life/student-affairs/index.php>

Student Handbook: <https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

Student Travel Procedures and Student Activity Travel

Waiver: <https://hub.ncat.edu/administration/business-and-finance/comptroller/forms/form-docs/stud-trvl-act-waiv.doc>

Description of any travel and/or risk-related activity associated with this course.

Other Policies (e.g., copyright guidelines, confidentiality, etc.)

Student Handbook: <https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

Sexual misconduct policy: <https://www.ncat.edu/legal/title-ix/sexual-harassment-and-misconduct-policies/index.php>

Family Educational Rights and Privacy Act: <https://www.ncat.edu/registrar/ferpa.php>

Student complaint form: <https://www.ncat.edu/current-students/student-complaint-form.php>

Student Conduct & Discipline

North Carolina A&T State University has rules and regulations that govern student conduct and discipline meant to ensure the orderly and efficient conduct of the educational enterprise. It is the responsibility of each student to be knowledgeable about these rules and regulations.

Please consult the Undergraduate bulletin: <https://www.ncat.edu/provost/academic-affairs/bulletins/index.php>, Graduate catalog: <https://www.ncat.edu/tgc/graduate-catalog/index.php>

and Student Handbook <https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php> about specific policies such as academic dishonesty, cell phones, change of grade, disability services, disruptive behavior, general class attendance, grade appeal, incomplete grades, make up work, student grievance procedures, withdrawal, etc.

Academic Dishonesty Policy

Academic dishonesty includes, but is not limited to, the following:

1. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty;
2. Plagiarism (unauthorized use of another's words or ideas, as one's own), which includes, but is not limited to, submitting exams, theses, reports, drawings, laboratory notes, or

- other materials as one's own work when such work has been prepared by or copied from another person;
3. Unauthorized possession of exams or reserved library materials; destroying or hiding source, library or laboratory materials or experiments or any other similar actions;
 4. Unauthorized changing of grades, or marking on an exam or in an instructor's grade book or such change of any grade record;
 5. Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct;
 6. Hacking into a computer and gaining access to a test or answer key prior to the test being given. A&T reserves the right to search the emails and computers of any student suspected of such computer hacking if a police report of the suspected hacking was submitted prior to the search; and
 7. Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action, but may also affect the evaluation of a student's level of performance. Any student who commits an act of academic dishonesty is subject to **disciplinary action**. In instances where a student has clearly been identified as having committed an act of academic dishonesty, *an instructor may take appropriate disciplinary action, including a loss of credit for an assignment, exam or project; or awarding a grade of "F" for the course, subject to review and endorsement by the chairperson and dean.*

These descriptions and timelines are subject to change at the discretion of the Professor.