North Carolina Agricultural and Technical State University

Spring 24 Course Syllabus

College of Science & Technology Physics

NOTE: Students are responsible for reading, understanding, and following the syllabus.

Undergraduate Course Information

Course Name: Atmospheric Thermodynamics
Course Number/Section: ASME 231 Credit Hours: 3
Days and Times: 12:30 – 1:45 TR Class Location: Gibbs 302

Instructor Contact Information

Instructor: Dr. Yuh-Lang Lin
Office Location: 302H Gibbs Email Address: ylin@ncat.edu Office Phone: 336-285-2127

Communication

Students will receive an answer to all communications by email within 48 hours excluding holidays. The secondary point of contact will be the TA, Jackson Wiles, whose email address is shown below.

Teaching Assistant: Md Shamimul Hasan <mhasan6@aggies.ncat.edu>; Davion Huggins <dphuggins@aggies.ncat.edu>

Student Hours

11:00-12:00 TR. For a longer discussion, email to make an appointment.

Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☒ Friday ☐

Course Prerequisites

PHYS 241 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, a mixture of gases, the first law of thermodynamics, internal energy, specific heats and enthalpy, adiabatic processes, potential temperature, Carnot's cycle, the second law of thermodynamics, entropy, moisture variables, phase transitions, Clausius-Clapeyron equation, moist 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.

Student Learning Objectives/Outcomes (SLO)

Objective: Use analytical thinking skills to evaluate information critically
Outcome: Students will demonstrate the ability to answer conceptual questions on examination questions.
Objective: Effectively relate basic ideas and concepts to more sophisticated atmospheric systems.
Outcome: Students will demonstrate the ability to employ critical thinking in answering

short questions as well as solving problems on examinations.

Objective: Use a wide range of disparate information and knowledge to draw references and summarize various concepts, theories, and observational evidence in the literature.

Outcome: Students will demonstrate the ability to absorb various concepts, theories and observations in assigned references and summarize and present them to the class.

Required Textbooks and Materials

Required Texts: "Lecture Notes" by Yuh-Lang Lin, NCAT, will be posted on the MesoLab website.

Required Materials: N/A

Suggested Course Materials

Suggested Readings/Texts:

(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.

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Suggested Materials: N/A

Grading Policy

Course Grade Scale *[Undergraduate level courses]*

94% and above	A	83% - 80%	B-	69% - 67%	D+
93% - 90%	A-	79% - 77%	C+	66% - 60%	D
89% - 87%	B+	76% - 74%	C	59% - 0%	F
86% - 84%	B	73% - 70%	C-		

Grading Allocation

Course grades are based on a weighted grading scale of 100%. The breakdown for the course is as follows:

30% Labs
30% Midterm
40% Final Exam

Course Policies

Use Of Blackboard as The Learning Management System

Blackboard is the primary online instructional and course communications platform. Students can access the course syllabus, assignments, grades, and learner support resources. Lecture notes will be posted on the MesoLab website. Students are encouraged to protect their login credentials, complete a Blackboard orientation and log in daily to the course.

Make-Up Exams Any request for make-up should follow the University's policies and procedures. A penalty may be applied.

Extra Credit N/A

Late Work Penalty will be applied for late submission of assignments. For an assignment, a penalty of 15% per day will be applied.

Special Assignments N/A

Class Schedule [See here for a complete calendar]

Presentation Schedule

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

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

- Please refer to the Common Policies file for all other University policies, which should also be provided to all students or available in the course Blackboard shell.