

ENV 6130/4932 AEROSOL MECHANICS

CLASS NUMBER 22931/30563/30564/23172

CREDIT HOURS: 3, ENGINEERING SCIENCES

SEMESTER: SPRING 2022

CLASS LOCATION – ZOOM ([HTTPS://UFL.ZOOM.US/J/93055952729](https://ufl.zoom.us/j/93055952729))/BLK 213

CLASS MEETING TIME – TUESDAY/THURSDAY PERIODS 7-8; SYNCHRONOUS FOR ON-CAMPUS SESSION; FOR ONLINE SESSION, ASYNCHRONOUS IS THE DEFAULT BUT YOU ARE ENCOURAGED TO PARTICIPATE IN THE SYNCHRONOUS SESSION IF YOU CAN

INSTRUCTOR: CHANG-YU WU, Office: 406 AP Black Hall, cywu@ufl.edu, 352-392-0845

STUDENT HOURS: Wed period 5, and 9-9:30 pm, or by appointment, through [Zoom](#)

COURSE TEACHING SCHOLAR (TS): SRIPRIYA NANNU SHANKAR

COURSE WEBSITE: <http://e-Learning.ufl.edu>

COURSE COMMUNICATIONS: Students in the synchronous session can ask questions during class time. For students in asynchronous session, you can ask questions through CANVAS. If Dr. Wu happens not to have noticed that you have a question, use Chat to get attention. Of course, feel free to ask a question through Chat, if you feel more comfortable in that way. After class, post your question in Discussion board, since others may have the same question and answers will help them too. If you have a private question or just feel more comfortable in that way, send a message through CANVAS. Dr. Wu usually responds back within 24 hours.

REQUIRED TEXTBOOKS: Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles, 2nd Ed, by William. C. Hinds, John Wiley & Sons. ISBN 0-471-19410-7. Course notes are developed by the instructor, and they are available in CANVAS.

MATERIALS AND SUPPLIES FEES: Textbook cost: rent \$82.80, buy used \$155.25, buy new \$207.00, or buy digital \$165.99 at UF bookstore

ADDITIONAL RESOURCES: (Optional) 1. Aerosol Measurement: Principles, Techniques and Applications, 3rd Ed., Edited by P. Kulkarni, P. Baron and K. Willeke, Wiley; 2. *J. Aerosol Science, Aerosol Science & Technology, Aerosol & Air Quality Research.*

COURSE DESCRIPTION: Theory of the inertial, electrical, thermal and optical behavior of gas-borne particles. Generation, collection, measurement and dynamics of aerosols.

PREREQUISITE KNOWLEDGE AND SKILLS: Physics, Differential Equations

COURSE GOALS AND/OR OBJECTIVES: *By the end of this course, students will be able:*

1. To explain and calculate the statistics of a given **particle size distribution**.
2. To determine the movement of aerosols by a given **transport mechanics** (inertial movement, diffusion, electrical migration and thermophoresis) and analyze the important mechanisms for a given aerosol system.
3. To calculate the **optical properties** of a given aerosol system

4. To derive expressions for a given aerosol system involving multiple aerosol mechanisms (nucleation, condensation, coagulation, diffusion) and analyze the **dynamics** of the particle size distributions.
5. To design a system to **generate**, to **collect** aerosols and to **measure** particle size distribution.
6. To explain the **multi-disciplinary aspects** of aerosol science & technology.
7. To **explain** aerosol science & technology to the professional society and general public.

HOW THIS COURSE RELATES TO THE STUDENT LEARNING OUTCOMES IN THE ENVIRONMENTAL ENGINEERING PROGRAM:

Outcome	Coverage*
a. Apply knowledge	High
b1. Conduct experiments	Low
b2. Statistical design of experiments	Low
c. Design	Medium
d. Function on teams	Low
e. Solve problems	High
f. Professional and ethical responsibility	Low
g. Communicate	High
h1. Economic impact	Low
h2. Global, societal, and environmental impact	High
i. Lifelong learning	Low
j. Contemporary issues	High
k. Techniques, skills, and tools for degree program	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

INSTRUCTIONAL METHODS: This course will be conducted in flipped format. Before coming to class, you need to review recorded lectures. There is no lecture during class time, and you will participate in activities for design and discussions through Zoom, if you can attend the synchronous session. The activities will be recorded, if you cannot attend the synchronous session. A submitted solution sheet gets checked for the given credit counted toward the grade. You are allowed to submit the solution up to 6 days after the date of in-class design of that question. After class, there will be homework questions for your practice. You'll also give a tutorial of an aerosol topic of your choice and provide a final report on that topic.

COURSE POLICIES:

ATTENDANCE POLICY: Attendance is and monitored through in-class assignment submission, which should be submitted within 6 days of class time. Absence in in-class activities may jeopardize your active learning opportunities. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

QUIZ/EXAM DATES/POLICIES: Take a **10-min pre-class quiz** before the designated class time of the specific module. This is to ensure you have watched the lecture before class so that you can meaningfully participate in in-class activities. Take a **20-minute post-class quiz** (8 multiple-choice/answer questions) after the specific module is covered. This is to test your conceptual understanding of the topic. The post-quiz is available on CANVAS after each class for that module. You decide when you are ready to take it, but you need to finish it before 11:59 pm within 6 days. You have **two trials** for each quiz.

You can expect to be able to answer the quiz questions without complicated calculations. Contents covered in **video lectures, in-class discussion as well as textbook**, will be included. Post-quiz is proctored by Honorlock. You need to download the Honorlock Extension before taking the exam/quiz. Check out the [Honorlock Student page](#) for additional support. If you have questions about the grading of quiz, check with Dr. Wu.

There is no exam.

MAKE-UP POLICY: There is **NO make-up** quiz since two quizzes with the lowest grades (for any reason including sickness, family reunion, technology failure or just feeling lazy) will be dropped when calculating the final grade.

ASSIGNMENT POLICY: Assignments (homework and project report) should be submitted **by the beginning of class time on specified dates**. **20%** will be deducted for any late submission on the same day after class, **40%** for that submitted on the 2nd day. Any assignment submitted late for more than 2 days will **NOT** be accepted unless with a certified medical reason or if it is agreed by Dr. Wu prior to the due time with reasonable explanation.

Homework: For each homework assignment, **there will be 2 versions submitted**. Questions are posted on CANVAS 1 week before the first deadline unless otherwise specified. The first version of the homework is to be completed to the best of your ability and scanned/submitted to CANVAS. After the first deadline, the solutions will be posted. You are then **responsible for grading your own assignment** and making all necessary corrections. Then the self-graded and corrected version of the homework will be scanned/submitted by the **second deadline 6 days later**. Both versions have the same weighting of the grade.

Discussion among students is allowed, but copying from other student's work (e.g., same mistakes) is a waste of everyone's time, and both students will be reported to the University.

If your procedure is correct but there are errors in calculation, you get partial credit. It is important to **SHOW YOUR PROCEDURE CLEARLY**. You won't get any credit if your procedure is wrong or unclear, even if the numbers are mysteriously correct. If you use any number from any table or graph, you need to CITE the source (e.g., Table 1.1). There will be no credit for magic numbers that appear in the solution.

For questions that involve calculation, the following steps should be followed:

- i. List all given conditions and parameters, e.g., $T = 298 \text{ K}$, $P = 1 \text{ atm}$, $R = 8.314 \text{ J/mole}\cdot\text{K}$ and their sources, e.g., Textbook Appendix B; Fig. 14-1 in textbook.
- ii. For each step, the equation used for calculation should be listed, followed by the specific numbers replacing the parameters. Units should also be included in the calculation.
- iii. The most important thing is to show the flow of your thought in solving the problem. Both handwriting and typing are acceptable, but they need to be clear, neat and organized.

An example of homework preparation is given below. Be sure to follow the format before you submit your homework. It also helps you to get more scores in your exams.

Q1 The secondary NAAQS for SO₂ is 0.5 ppm (for a 3-hr avg). Calculate the equivalent conc. in $\mu\text{g}/\text{m}^3$ at standard temperature and pressure (STP: T = 25 °C, P = 1 atm)

Given:

$$C_{\text{ppm}} = 0.5 \text{ ppm}$$

Solution:

Since it is at STP, use Equation 1.9

$$MW_p = 64 \text{ g/gmol}$$

$$C_{\text{mass}} = 1000 \times C_{\text{ppm}} \times MW_p / 24.45 \text{ L/gmol} = 1000 \times 0.5 \text{ ppm} \times 64 \text{ g/gmol} / 24.45 \text{ L/gmol} \\ = \mathbf{1309 \mu\text{g}/\text{m}^3}$$

Tutorial: Each student should form a team with a fellow student to give a tutorial of an aerosol application topic. The duration of the tutorial is 110 minutes, including time for Q&A. You are encouraged to use PowerPoint or equivalent for your instructional material. There will be a quiz based on the material you cover, with questions coming from both you and Dr. Wu. Submit your presentation material and 5 quiz questions to Dr. Wu for approval at least 1 week before your tutorial. The final version of your presentation materials should be posted on CANVAS by 11:59 pm the day before your presentation. An evaluation by your audience will be conducted at the end of your tutorial.

The topics for the tutorial include, but not limited to:

- Aerosols in the Health Care Field
- Ambient Aerosol Sampling
- Atmospheric Aerosols
- Bioaerosols
- Global Aerosols
- High Temperature Aerosol Sampling
- Indoor Aerosols
- Aerosol and Climate Change
- Material Synthesis by Aerosol Processes
- Mine Aerosols
- Measurement of Asbestos and Fibers
- Polar Stratospheric Clouds
- Radioactive Aerosols
- Respiratory Deposition of Aerosols
- Chem-Bio-Radioactive Aerosol Agents

You should discuss with Dr. Wu for the topic of your tutorial and the topic should be finalized no later than the specified date in the schedule. Submit a **mid-term progress report** to update the status of your preparation. Also submit a final report on your tutorial topic, and you should include at minimum 20 patents or journal articles in your review. Submit your **final report** on CANVAS.

The final report should be reviewed by one other team before submitted to Dr. Wu. It's your responsibility to arrange the review done before its submission, and the reviewer should e-sign on the draft. 3% of your tutorial final grade is based on the inclusion of the review, and 2% is based on your review of other's report. The purpose of this review is to get comments/suggestions from your classmate (regarding content, format, flow, etc.), and it is to your own benefits that you incorporate the comments/suggestions in the final version.

The weight of the grade: lecture **30%**, your quiz grades of all tutorials **30%**, your class' quiz grade on your tutorial **10%**, mid-term progress report **5%**, final report **20%**, report reviewed by classmate **3%**, and your review of your classmate's report **2%**.

COURSE TECHNOLOGY: Zoom, Word, Excel, PowerPoint, PDF Reader, and internet browser. Information about course technology can also be inquired at *the UF Help Desk*.

- <http://helpdesk.ufl.edu>
- (352) 392-HELP - select option 2

ONLINE COURSE EVALUATION: "Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semesters, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

GRADING SCALE:

Percent	Grade	Grade Points
≥ 90	A	4.00
85.0 – 89.9	A-	3.67
80.0 - 84.9	B+	3.33
75.0 - 79.9	B	3.00
70.0 - 74.9	B-	2.67
65.0 - 69.9	C+	2.33
60.0 - 64.9	C	2.00
55.0 - 59.9	C-	1.67
50.0 - 54.9	D+	1.33
45.0 – 49.9	D	1.00
40.0 – 44.9	D-	0.67
≤ 39.9	E	0.00

Grade is not curved in this course. It is theoretically possible for everyone in the class to get an **A** (or an **F**). Your performance depends only on how you do, not on how everyone else in the class does. It is therefore in your best interest to work with your classmates in every legal way possible, but definitely do not copy other's solution.

GRADING POLICIES:

METHODS BY WHICH STUDENTS WILL BE EVALUATED AND THEIR GRADE DETERMINED:

Assignment	Total Points	Percentage of Final Grade
In-Class Activities	1 each	10%
Homework Sets	80-120 each	28%
Pre-Class Quizzes	2 each	8%
Post-Class Quizzes	8 each	24%
Tutorial	100	30%
		100%

INFORMATION ON CURRENT UF GRADING POLICIES FOR ASSIGNING GRADE POINTS:

Grade point is assigned per UF policy at

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

COURSE SCHEDULE:

CRITICAL DATES: Midterm Report: 03/03; Final report: 04/21; Homework: 02/01, 02/24, 03/22.

A WEEKLY SCHEDULE OF TOPICS AND ASSIGNMENTS: See Schedule-ENV6130.docx for details as well as Assignments in CANVAS.

UF POLICIES:

UNIVERSITY POLICY ON ACCOMMODATING STUDENTS WITH DISABILITIES: Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

UNIVERSITY POLICY ON ACADEMIC CONDUCT: UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with Dr. Wu or TS in this class.

CLASS DEMEANOR OR NETIQUETTE: All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats.

SOFTWARE USE: All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

STUDENT PRIVACY: There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera

off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

IN-CLASS RECORDING

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

COVID-19

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.

If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.

UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

CAMPUS RESOURCES:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

e-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.

COMMITMENT TO A SAFE AND INCLUSIVE LEARNING ENVIRONMENT: The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination and systemic racism. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@ufl.edu

SEXUAL DISCRIMINATION, HARASSMENT, ASSAULT, OR VIOLENCE: If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

GETTING HELP:

For issues with technical difficulties for Canvas, please contact the UF Help Desk at:

- <http://helpdesk.ufl.edu>
- (352) 392-HELP (4357)
- Walk-in: HUB 132

Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from the Help Desk when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

Other resources are available at <http://www.distance.ufl.edu/getting-help> for:

- Counseling and Wellness resources
- Disability resources
- Resources for handling student concerns and complaints
- Library Help Desk support

Should you have any complaints with your experience in this course, please visit <http://www.distance.ufl.edu/student-complaints> to submit a complaint.

Disclaimer: This syllabus represents current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.