

Syllabus

MAE 578 Geophysical and Environmental Fluid Dynamics, Spring 2019

Time: M/W 4:35-5:50 PM, Classroom: LL247

Instructor: Huei-Ping Huang (hp.huang@asu.edu), ERC 359

Office hours: Monday 3-4 PM, Tuesday 3-5 PM, or by appointment

Course website <http://www.public.asu.edu/~hhuang38/MAE578.html>

Note: Items 4-9 in this syllabus are modified from a template provided by FSE to aid compliance with the syllabus requirements of ACD 304-10.

1. Course Objectives and Expected Learning Outcomes

Development and solution of partial differential equations in engineering. Applications in solid and fluid mechanics, vibrations, and heat transfer.

2. Readings, Assignments, Examinations, Special Materials, Required Activities

Textbook: "Atmosphere, ocean, and climate dynamics, an introductory text", J. Marshall and R. A. Plumb, Academic Press, Required

The first 8 chapters of the book will be used extensively in the class. Additional lecture notes will be provided by instructor to supplement the textbook.

Other recommended textbooks:

For GFD of large-scale flows:

- (1) "Atmospheric and oceanic fluid dynamics", G. K. Vallis, Cambridge University Press
- (2) "Atmosphere-ocean dynamics", A. E. Gill, Academic Press
- (3) "Geophysical fluid dynamics", J. Pedlosky, Springer-Verlag
- (4) "An introduction to dynamic meteorology", J. R. Holton, Elsevier-Academic Press

For environmental flows at smaller scales:

- (1) "An introduction to boundary layer meteorology", R. B. Stull, Springer
- (2) "Turbulence and diffusion in the atmosphere", A. K. Blackadar, Springer

Course outline

(The number of lectures indicated in the parenthesis is approximate)

1. Overview (1 lecture)
2. Energy balance of large-scale atmospheric circulation (3 lectures)
3. Stratified flow: vertical structure, static stability, and convection (4 lectures)
4. Water vapor, moist convection, and precipitation (2 lectures)
5. Survey of 3-D momentum and energy equations of fluid flows (2 lectures)
6. The effect of earth rotation (5 lectures)

7. Atmospheric boundary layer & near-surface processes (3 lectures)
8. Effect of topography and gravity waves (1 lecture)
9. Global-scale circulation of the atmosphere (3 lectures)
10. Issues related to numerical weather prediction (2 lectures)
11. Issues related to observation/measurement (2 lectures)

Requirement of programming using Matlab or equivalent: The term project and some homework assignments will require programming using Matlab (or other programming languages/tools such as Fortran, C++, Python, Java, R). A beginner's guide for Matlab will be posted to the class website.

3. Grading Policies

Grade will be based on homework assignments (60%), a term paper (30%), and an oral exam (10%). Attendance is required. Excessive absence will result in a failing grade.

Specific rules for collaboration on homework will be released along with the first assignment. A violation of the rule(s) may lead to lowering of the score for the assignment, in addition to consequences of a violation of ASU's Academic Integrity Policy.

The typical thresholds for letter grades are: A = 90%, B = 80%, C = 70%, and D = 60%. These thresholds are subject to adjustments depending on the distribution of the total scores for the class.

4. Absence & Make-Up Policies

Instructor will arrange make-up exams, extension of deadline for projects, and/or assignment of alternative projects for students who are excused from class with proper reasons. This policy will accommodate students who have (a) Excused absences due to an emergency, illness, or other unforeseeable events that prevent students from attending class or completing a project within the regularly allocated time ; (b) Excused absences related to religious observance/practices that are in accord with ACD 304-04, "Accommodation for Religious Practices"; (c) Excused absences related to university sanctioned events/activities that are in accord with ACD 304-02, "Missed Classes Due to University-Sanctioned Activities"

Students who expect to miss class due to officially university-sanctioned activities should inform the instructor early in the semester. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences. The preceding policies are based on ACD 304-04, "Accommodation for Religious Practices" and ACD 304-02, "Missed Classes Due to University-Sanctioned Activities."

5. Classroom Behavior

Note-taking using electronic devices such as laptops is permitted as long as the activity does not cause disruption to the lecture or disturbance to other participants in the class. Cellphone and similar communication devices should be turned off or set to silent mode when class is in session. Any violent

or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students.

6. Academic Integrity

All students in this class are subject to ASU's Academic Integrity Policy (available at <http://provost.asu.edu/academicintegrity>) and should acquaint themselves with its content and requirements, including a strict prohibition against plagiarism. All violations will be reported to the Dean's office, who maintain records of all offenses. Students are expected to abide by the FSE Honor Code (<http://engineering.asu.edu/integrity/>). Specific to this class, limited collaboration is allowed for homework assignments. Specific rules for collaboration on homework will be released separately in the beginning of the semester.

7. Disability Accommodations

Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will require same. Such students must be registered with the Disability Resource Center and provide documentation to that effect.

8. Offensive Materials

Participants of this course who find any course material objectionable may consult with the instructor or MAE Program Chair to identify appropriate accommodations.

9. Sexual Discrimination

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>. As a mandated reporter, the instructor is obligated to report any information upon becoming aware of alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available for students who wish to discuss any concerns confidentially and privately.

Notice: Any information in this syllabus may be subject to change with reasonable advance notice.