Introduction to Data Analysis in Atmospheric Sciences (ATSC 4590)
Department of Physical and Environmental Sciences
Fall 2020

A. COURSE INFORMATION

Course number/section: ATSC4590/001
Class meeting time: TR 9:30 AM - 10:45 AM
Class location: Online / RFEB400
Course Website: https://bb9.tamucc.edu/

B. INSTRUCTOR INFORMATION

Instructor: Chuntao Liu
Office location: Science Lab #1 101
Office hours: MWF 08:00AM-12:00AM
Telephone: 361-825-3845
e-mail: chuntao.liu@tamucc.edu
Appointments: by email

C. COURSE DESCRIPTION

Catalog Course Description
This course will enhance student skills for analyzing atmospheric science-related datasets under various scientific programming environments. The focus is on developing a data analysis and problem-solving skillsets using mostly Python. The course includes: basic concepts of operating systems and high-level programming languages; basics of programming in Python; general data analysis methods and tools; scientific data formats used in remote sensing data and numerical model output; publication-quality scientific graphics; and critical steps of building a large programming project. Examples with IDL and FORTRAN are also included.

Extended Course Description
Course topics include: introduction to different file structures for the Linux, MAC, and Windows operating systems; compilers of high-level programming languages; basic syntax of variables, arrays, conditions and loops in Python; elements of publication-quality scientific graphics; and steps to developing a large programming project; and guidelines to sharing scientific results online. General tools of diagnostics and scientific graphing are include throughout the semester.

The course is open to a broad audience of undergraduate students in the College of Science and Engineering interested in improving their data analysis skills in various research computing environments. The primary audience will be undergraduate students in the Atmospheric Science, Environmental Science and Geospatial Engineering programs. A secondary audience includes mathematics, geology, and biology majors.
D. PREREQUISITES AND COREQUISITES

Prerequisites
None.
Corequisites
None.

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)
No requirement

Optional Textbook(s) or Other References
- Tutorial at website: http://docs.python.org/2/tutorial/.
- Barnes, N., 2010: Publish your computer code: It is good enough, Nature, 467, 753-753.
- Carter, L., 2006: Why students with an apparent aptitude for computer science don’t choose to major in computer science, ACM SIGCSR, 38, 27-31.
- Python Tutorial online: http://docs.python.org/2/tutorial/
- IDL Basics: https://www.cfa.harvard.edu/~scranmer/Ay201a/Data/idl_basics.pdf
- HTML online tutorial: http://www.w3schools.com/html/DEFAULT.asp

Supplies
For online class, a desktop computer with internet connect is needed. For on campus class, a laptop (either Mac, LINUX or MS windows) with wireless connection is required.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes
for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

At the conclusion of this course the student should be able to:

- Compile and execute a set of high-level programs under Linux, MAC or MS Windows environments.
- Code with high-level programming languages to read and write scientific data in common formats, including ASCII, Binary, and NETCDF formats.
- Complete simple data analysis using one of the high-level programming languages.
- Design publication-quality scientific graphics.
- Build large programming projects.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

The major part of this course is online programming supplemented with assignments. Classes will include lectures and real-time computer demonstrations of coding, as well as methodology to identify and fix syntax errors. Homework assignments will consist of small programming tasks. A final project is required that will involve a relatively in-depth programming project relevant to the student’s interest. Students are expected to complete the major frame of the programming project and produce graphical results shared in the class. The grade will depend on the difficulty of the coding, the quality of the analysis, and the resulting graphics.

H. MAJOR COURSE REQUIREMENTS AND GRADING

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Overall Grade Percentage</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>5%</td>
</tr>
<tr>
<td>Homework:</td>
<td>70%</td>
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<tr>
<td>Final Project:</td>
<td>25%</td>
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<tr>
<td>Total:</td>
<td>100%</td>
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</table>

<table>
<thead>
<tr>
<th>Class Average (X)</th>
<th>Grade</th>
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<tbody>
<tr>
<td>X ≥ 90.0%</td>
<td>A – Excellent</td>
</tr>
<tr>
<td>89.9% ≤ X &lt; 80.0%</td>
<td>B – Good</td>
</tr>
<tr>
<td>79.9% ≤ X &lt; 70.0%</td>
<td>C – Satisfactory</td>
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<tr>
<td>69.9% ≤ X &lt; 60.0%</td>
<td>D – Passing</td>
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<tr>
<td>X &lt; 60.0%</td>
<td>F – Failing</td>
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I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Compilers and environments of operating systems</td>
</tr>
<tr>
<td>2</td>
<td>Variables, arrays, and statements</td>
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<tr>
<td>3</td>
<td>Conditions and Loops</td>
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<tr>
<td>4</td>
<td>Data structure and functions</td>
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<tr>
<td>5</td>
<td>Strings and lists</td>
</tr>
<tr>
<td>6</td>
<td>Dictionaries and sets</td>
</tr>
<tr>
<td>7</td>
<td>Files and IO</td>
</tr>
<tr>
<td>8</td>
<td>Common scientific data format and access</td>
</tr>
<tr>
<td>9</td>
<td>Data analysis tools (I)</td>
</tr>
<tr>
<td>10</td>
<td>Scientific graphics (I)</td>
</tr>
<tr>
<td>11</td>
<td>Scientific graphics (II)</td>
</tr>
<tr>
<td>12</td>
<td>Project development (I)</td>
</tr>
<tr>
<td>13</td>
<td>Project development (II)</td>
</tr>
<tr>
<td>14</td>
<td>Other scientific computing languages: IDL and FORTRAN in numerical modeling</td>
</tr>
<tr>
<td>15</td>
<td>Online sharing tools</td>
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<tr>
<td></td>
<td>Final project</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

COVID-19
Face Coverings—Face coverings (cloth face covering, surgical mask, etc.) must be properly worn in all non-private spaces including classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource and support offices, and outdoor spaces where 6 feet of physical distancing is difficult to reliably maintain. Extra masks will be made available if needed.

Attendance/Tardiness
It is the best of student’s interest to attend each class, because of the weight placed on the lectures in the homework and exams. Participation is essential to do well in the class, which includes in-class discussion and direct communication with the instructor and peers.

Discussions and student input are considered an important part of the class. Class exams cannot be retaken other than for an excused absence. Excused absences are limited to medical emergencies that can be certified in writing by a physician, participation in a TAMUCC sanctioned event or other similar circumstances justified in writing and specified in the TAMUCC catalog for the ongoing academic year.

**Late Work and Make-up Exams**
Assignments are expected on time unless prior arrangements are made. Such prior arrangements will be granted only in exceptional circumstances as well. Without prior arrangement, the late homework has a 10% deduction if turned in prior to grading of other assignments and 20% if turned in after graded assignments are returned.

**Extra Credit**
N/A.

**Cell Phone Use**
Not allowed.

**Laptop Use**
A personal laptop is needed. For online class, a desktop with internet connection is needed.

**Food in Class**
Not allowed.

**K. COLLEGE AND UNIVERSITY POLICIES**

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. **Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.** Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C0.03, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is required to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C0.03, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://academicaffairs.tamu.edu/rules_procedures/assets/13.02.99.c0.03_student_grade_appeals.pdf. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.
Disability Services
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

http://disabilityservices.tamucc.edu/

Civil Rights Complaints
Texas A&M University–Corpus Christi is committed to fostering a culture of caring and respect that is free from discrimination, relationship violence and sexual misconduct, and ensuring that all affected students have access to services. For information on reporting Civil Rights complaints, options and support resources (including pregnancy support accommodations) or university policies and procedures, please contact the University Title IX Coordinator, Sam Ramirez (Samuel.ramirez@tamucc.edu) or Deputy Title IX Coordinator, Rosie Ruiz (Rosie.Ruiz@tamucc.edu) x5826, or visit website at Title IX/Sexual Assault/Pregnancy.

Limits to Confidentiality. Essays, journals, and other materials submitted for this class are generally considered confidential pursuant to the University's student record policies. However, students should be aware that University employees, including instructors, are not able to maintain confidentiality when it conflicts with their responsibility to report alleged or suspected civil rights discrimination that is observed by or made known to an employee in the course and scope of their employment. As the instructor, I must report allegations of civil rights discrimination, including sexual assault, relationship violence, stalking, or sexual harassment to the Title IX Coordinator if you share it with me.

These reports will trigger contact with you from the Civil Rights/Title IX Compliance office who will inform you of your options and resources regarding the incident that you have shared. If you would like to talk about these incidents in a confidential setting, you are encouraged to make an appointment with counselors in the University Counseling Center.

Statement of Academic Continuity
In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi;
this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. OTHER INFORMATION

- Academic Advising
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.