Advanced topics: Computer Programming in Environmental Sciences  
(ESCI5490)  
Department of Physical and Environmental Sciences  
Fall 2015

A. COURSE INFORMATION
Course number/section: ESCI 5490/002
Class meeting time: TR 7:15PM-8:30PM
Class location: OCNR255
Course Website: http://bb9.tamucc.edu/

B. INSTRUCTOR INFORMATION
Instructor: Chuntao Liu
Office location: NRC 3510
Office hours: MW 8:00AM-1:00PM
Telephone: 361-825-3845
e-mail: chuntao.liu@tamucc.edu
Appointments: available by email or phone

C. COURSE DESCRIPTION

This course is to enhance the programming skills of graduate students under various scientific programming environments. The focus is on the data analysis and problem solving using Python, MATLAB and IDL. The contents of the course include the basic concepts of the operating systems and high level programming languages, basics of programming in Python, general data analysis methods and tools, common scientific data formats, publication quality scientific graphics, the critical steps of building a large programming project, and the webpage programming with simple HTML language. The final project will be closely tied to each graduate student’s dissertation research. Though Python is encouraged to finish assignments and the final project, IDL and MATLAB are also permitted to use in the class.

The course topics include: introduction of different file systems of operating systems (Linux, MAC and Windows) and the compilers of high level programming languages (e.g. Python, IDL and MATLAB); Basic syntax of variables, arrays, conditions and loops in Python; elements of a publication quality scientific graphics; and steps to develop a big programming project; simple ways to share the scientific results online. Some general tools of statistics, scientific graphics, and the how to construct large programming projects, as well as basic web programming will be exercised. The final project will be closely tied to each graduate student’s research.

The course is open to a broad audience of graduate students in the College of Science and Engineering, who are interested in improving the computer programming skills in various research computing environments. Primary audience will be the graduate students in the
Coastal and Marine System Science, Environmental Science and Geospatial Engineering programs. Secondary audience includes graduate students in Mathematics, Geology, and Biology.

D. **PREREQUISITES AND COREQUISITES**

None

E. **REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES**

**Required Textbook(s)**
None

**Optional Textbook(s) or Other References**
- A Primer on Scientific Programming with Python (Texts in Computational Science and Engineering), by Hans Petter Langtangen.
- Tutorial at website: http://docs.python.org/2/tutorial/
- A Primer on Scientific Programming with Python (Texts in Computational Science and Engineering), by Hans Petter Langtangen.
- Barnes, N., 2010: Publish your computer code: it is good enough, *Nature*, 467, 753-753.
- Petersen A. C., 2012: Simulation nature: a philosophical study of computer-simulation uncertainties and their role in climate science and policy advice.,
- Miller, H, P. Haller, L. Rytz, and M. Odersky, 2014: Functional programming for all! Scaling a MOOC for students and professional alike, ICSE, Hyderabad, India.
- 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**
A laptop (either Mac, LINUX or MS windows) with wireless connection

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 format.
- 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 parts of the courses are practices of programming in class and at home. Classes in general include light lectures and realtime computer demonstrations of coding and methods to fix syntax errors. Homework will consist of assigned small programming tasks. A final project is required that will involve a relatively big programming project relevant to the research topic of each graduate student. Students are expected to complete the major frame of the programming and have some graphical results to share in the class. The grade will depend on the difficulty of the coding and 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>
</tr>
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<tbody>
<tr>
<td>Class Participation</td>
<td>5%</td>
</tr>
<tr>
<td>Homeworks:</td>
<td>50%</td>
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<tr>
<td>Final Project:</td>
<td>45%</td>
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<tr>
<td>Total:</td>
<td>100%</td>
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</tbody>
</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>
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<tr>
<td>89.9% ≤ X &lt;</td>
<td>B - Good</td>
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I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<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>
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<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 Matlab</td>
</tr>
<tr>
<td>15</td>
<td>Webpages and web programming</td>
</tr>
<tr>
<td></td>
<td>Final Exam</td>
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</tbody>
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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

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.

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.

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 graduate catalog for the ongoing academic year.

**Cell Phone Use**
Prohibited during the class

**Laptop Use**
A personal laptop is required to be used in the class

### 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)**
The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must be submitted. No student is eligible to receive a W without completing the official drop process by this deadline. 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.C2.01, 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 encouraged 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.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). 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/](http://disabilityservices.tamucc.edu/)

- **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.