PHYS-3490.306, Selected Topics: Computational Physics
Department of Physical and Environmental Sciences
Spring 2018

A. COURSE INFORMATION

Course number/section: PHYS-3490.306, 3.0 credits
Class meeting time: TR 12:30-1:45pm
Class location: CCH-249, offered to TPC through TTVN
Course Website: http://wtclass.wtamu.edu/

B. INSTRUCTOR INFORMATION

Instructor: Dr. Jeffery Spirko
Office location: NRC-1111
Office hours: MW 1-3pm, Thu 11am-Noon
Live Calendar: http://tinyurl.com/spirkocal
Telephone: 361-825-6020
e-mail: jeffery.spirko@tamucc.edu
Appointments: Email for appointments. Check calendar and suggest an open time.

C. COURSE DESCRIPTION

Catalog Course Description (generic)
Subject materials will be chosen from Electromagnetic Field Theory, Thermodynamics, Mathematical Methods of Physics, Waves and Optics, Advanced Modern Physics, Quantum Theory, Computational Physics, Geophysics, Environmental Physics and Medical Physics. May be repeated for credit if topics selected are different. (See next item for specific topic.)

Extended Course Description (Computational Physics)
Computational Physics will cover the use of Python computer programs to solve physics problems in various areas of physics. Techniques to be covered will include basic calculus and equation solving, plotting results, vector operations, matrix methods, solving ordinary differential equations, Fourier transforms, and eigenvalue problems.

This course is offered to other universities in the Texas Physics Consortium (http://www.tarleton.edu/tpc/), and it counts as an upper-level Physics Elective for students majoring in physics in the TPC.
D. **PREREQUISITES AND COREQUISITES**

**Prerequisites**
- PHYS-2426, University Physics II
- One of the following or equivalent programming experience.
  - COSC-1435 Introduction to Problem Solving with Computers I
  - Computer Science course which satisfies the Joint BS in Physics computer science requirement on the local campus. (This is to allow TPC Member institutions to select the appropriate prerequisite on their campus.)

**Pre/Corequisite**
- MATH-3315 – Differential Equations

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

**Required Textbook(s)**
No textbook is required, as there are many free online resources.

**Optional Textbook(s) or Other References**
  [http://www-personal.umich.edu/~mejn/cp/index.html](http://www-personal.umich.edu/~mejn/cp/index.html)
A Primer on Scientific Programming in Python, H.P. Langtangen, ISBN: 3662498863
Python and Matplotlib Essentials for Scientists and Engineers, Matt A. Wood,
Numerical Recipes, the Art of Scientific Computing, 978-0521880688
  [http://numerical.recipes/](http://numerical.recipes/)
CodeAcademy.com, [https://www.codecademy.com/learn/learn-python](https://www.codecademy.com/learn/learn-python)

**Supplies**
A desktop or notebook computer with internet access is required. Relying on University computer labs, a tablet, or a smart phone may be possible but it is not recommended. Having Visual Python locally installed is recommended, though the Glowscript and Trinket.io websites provide online access to Visual Python.

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.

By the end of this course, students should be able to:

1. Write computer programs to solve a variety of introductory physics problems for an array
of given information.
2. Plot, graph or visualize the results of numerical calculations to facilitate interpretation.
3. Write computer programs to calculate basic mathematical operations among vectors and/or matrices.
4. Choose an appropriate method for solving an ordinary differential equation, write a program that applies that method, and interpret the results.
5. Calculate the Fourier transform of a set of data and interpret the results.
6. Numerically determine and visualize the solution to a vector integral or partial differential equation such as the heat equation, the Laplace equation for electrostatic or static magnetic fields, the Navier-Stokes equations, the Biot-Savart Law, Newtononian gravitation for a non-symmetric system, or another equation of similar difficulty.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

TTVN: Lectures will be held in a video classroom, with the instructor present at TAMUCC. Other TPC Universities will participate via live two-way video from their respective TTVN classrooms.

WTClass: All Class notes, homework assignments and videos will be posted using TPC’s WTClass management system. It is student’s responsibility to check the system prior to each class meeting, complete reading and homework assignment and submit the latter through WTClass prior to the deadline. All graded homework will be returned via WTClass.

Trinket.io: A free account on this website will facilitate writing, running, debugging, and sharing computer programs in this course.

Assignments: There will be programming assignments throughout the semester. Though study groups and helping each other is encouraged, each assignment must represent your own work. Copying (or even paraphrasing) others’ work and claiming it as your own is plagiarism, regardless of free or open source copyright licenses.

Exams: Written exams will test both numerical method abilities (using a calculator and paper) and programming abilities (with sample code to be amended by the student). Available materials (equation sheet?, book?) will be determined at the start of the course.

H. MAJOR COURSE REQUIREMENTS AND GRADING

There will likely be one Homework assignment covering each of the Student Learning Outcomes listed above. A midterm exam and a final exam

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<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Exams</td>
<td>20%</td>
</tr>
<tr>
<td>Homework</td>
<td>50%</td>
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<tr>
<td>Final Exam</td>
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I. COURSE CONTENT/SCHEDULE
WEEK | TOPIC
--- | ---
1-3 | Intro to Python Programming
4 | Matplotlib
5-6 | Derivatives and Integrals
7-8 | Matrices and Linear Equations
9-11 | Ordinary Differential Equations
12 | Fourier Analysis
13 | Eigenvalue Problems
14 | Partial Differential Equations
15 | Final Exam

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
Students are expected to be present for all scheduled classes. In case of missing the scheduled class, students are responsible for all material covered and/or assigned during that class period.

Late Work and Make-up Exams
Students need to contact the instructor in advance about missing assignment or exam AND need to provide a valid reason in writing and documentation for the absence to be considered an excused absence. Valid reasons for missing homework or exam are (1) health related, backed by a doctor's note, (2) family emergency which can be documented, (3) job interview with the letter of invitation for the interview, and (4) participation in a previously scheduled athletic, or university event or travel to a conference. In case of excused absence, missed homework and tests may be made up and will be handled on a case by case basis with prior notification required unless absolutely impossible.

Cell Phone Use
Do not distract your classmates.

TTVN Etiquette
Generally, keep your microphone muted to keep background noise from being sent to the entire class. Only unmute your microphone to talk to the instructor or to the class.

Plagiarism
You may not copy-and-paste anything without permission from the author. (A message about material being public domain, creative commons, or similar license constitutes
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.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, and the College of Science and Engineering Grade Appeals webpage at 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/

• 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.

**Changelog**
- Ver1, 2017-10-08, without schedule, for TPC course planning.
- Ver2, 2017-10-18, Added all textbook ISBN’s.
- Ver3, 2017-11-25, Polish to meet TAMUCC College of Sci & Engr Requirements.