Computational Physics (PHY175)

COURSE MEETING TIME AND PLACE:

Course Section	Meeting Time	Location
175-01	Tu, Th 11:00 AM – 12:15 PM	Anderson 315

INSTRUCTOR INFORMATION:

Dr. Tianran Chen
e-mail: tchen@wcupa.edu
phone: (610) 436-3563
office: Merion Science Center 128
office hours: M 2:00 PM – 5:00 PM, T 3:30 – 5:00 PM, W 5:00 – 6:00 PM

REQUIRED COURSE MATERIALS:

- Required Text: *Matlab: a practical introduction to programming and problem solving, 5th Edition,* by Stormy Attaway, Elsevier 2018. Hard copy, paperback or electronic versions are all adequate.
- *References (optional):*
  Essential Matlab for Engineers and Scientists, 6th Ed, by Brian Hahn and Daniel T. Valentine, 2016;
  Matlab Primer (FREE tutorial book with your Mathworks account), Mathworks;
  Computational Physics by M. Newman, ISBN 1480145513.

COURSE DESCRIPTION:

PHY175 is an introductory course on the basic ideas and programming skills of computational physics, with a nine-week introduction to programming and five-week introduction to programming applications to physics. Students will develop Matlab software to solve problems in mechanics, electrostatics, magnetism, and other areas.

The course can be roughly divided into four conceptual and technical parts:

- Introduction to programming basics, such as variables, arithmetic, arrays and matrices, file operation, selection and loop statements, user-defined functions, string/text manipulations, and debugging technique.
- Graphics and visualization: commands generated scatter plots, density plots and simple 3D graphics.
- Numerical solutions to mathematical physics equations, including numerical integration, differentiation and interpolation, and simultaneous solutions to linear equations.
- Finally, we will discuss simulation of various physics phenomena, random processes and Monte Carlo methods.

Prerequisites: MAT 161 (Calc. I), MAT 162 (Calc. II), and PHY170 (Physics I)

Co-requisites: MAT 261 (Calc. III), MAT 311 (Linear Algebra), and PHY180 (Physics II)

Software and hardware requirements:

The course requires a ***significant*** amount of programming work on your own time. In this course, including homework and exams, we will be using Matlab as the software/language. For installing Matlab, go to West Chester University of Pennsylvania MATLAB Portal for download and instructions. Training and Help resources can also be found on the West Chester University of Pennsylvania MATLAB Portal .

LEARNING OUTCOMES:

Programmatic (B.S. Physics) student learning outcomes:

- **Goal A**: Knowledge and understanding of the concepts and principles of physics
- **Goal B**: Research Skills
- **Goal C**: Effective communicator

Course-specific learning outcomes:

- **Outcome 1**: Students will be able to perform basic programming tasks.
- **Outcome 2**: Students will be able to generate 2D and 3D graphs using computer commands.
- **Outcome 3**: Students will be able to numerically solve mathematical physics equations discussed in PHY170 & PHY180.
- **Outcome 4**: Students will be able to model physics problems.

Assessment of learning outcomes:

Learning goals will be assessed via a combination of in-class examinations and homework assignments. See course schedule for details.

CLASS ACTIVITIES:

Every lecture has programming practice integrated, where students have opportunities to gain some hands-on experience and to strengthen the programming knowledge learned in classroom.

ASSESSMENT:

I will be using the D2L grade-book feature to post course grades. Please check it periodically.

- **Homework** (25%):
  There will be weekly graded problem sets consisting mainly of programming challenges. Classroom time will be spent primarily on programming basics and principles and techniques behind computational physics methods; the homework assignments are your chance to put those principles into action. A typical assignment will describe problems that can be solved using a method studied in class and ask you to write a program to solve them and present your results.

  Collaboration is allowed when solving exercises, but you must write your own programs and turn in your own work. **Copying from other students is plagiarism and NOT allowed.** You may use example programs from the textbook as a starting point for your work, but **copying from any other source, including books or the Internet, is NOT allowed.** Late homework is not accepted.

- **Regular Exams** (10%*2 + 20%=40%):

Three exams will be given over the course of the semester, one in the form of in-class programming practice (20%), where students create and test short codes during class time, and the other two as paper tests (each worth 10%), which comprehensively examines students' programming knowledge. All three exams are closed-book, closed-notes. See the attached course schedule for (tentative) exam dates.

- **If you miss a regular exam:** If you miss an exam for a **University Sanctioned Event** you must notify me in advance so that we can arrange for you to take the exam in a manner consistent with its integrity. You must also provide some form of documentation (performing arts program, competition schedule etc.) If you are seriously ill, you must produce a doctor's note no later than 24 hours after the exam has been administrated. In all other cases you will receive a zero for a missed exam.
- **If you have an OSSD letter pertaining to exams:** You are responsible for making the appropriate arrangements at least one week prior to the exam date and time.

- **Final** (10%+25%=35%)
  The final exam consists two parts: a paper test (10%) and an in-class programming test (25%). The formats are similar to the regular exams, both are closed-book, closed-notes.

  The dates and times of the final exams for this course (as set by the registrar) are listed below. **You should plan to be available for the entire finals week.** We have in past semesters had to reschedule finals due to weather related events.

Course Number	Date and Location of Final	Time of Final
PHY 175-01	Thursday 5/7, Anderson 315	10:30 AM – 12:30 PM

I will be using the official WCU scale for grades, see p.48 in the undergraduate catalog. However, I reserve the right to adjust the weights of individual components, or the scale to account for unforeseen circumstances.

In terms of the WCU standard and the courses point system grades are as follows.

Letter	Grade Points	Percentage	
A	4.000	93 - 100	Excellent
A-	3.670	90 - 92	
B+	3.330	87 - 89	Superior
B	3.000	83 - 86	
B-	2.670	80 - 82	
C+	2.330	77 - 79	Average
C	2.000	73 - 76	
C-	1.670	70 - 72	
D+	1.330	67 - 69	Below Average
D	1.000	63 - 66	
D-	0.670	60 - 62	
F	0.000	59 or lower	Failure

TENTATIVE COURSE SCHEDULE: I reserve the right to modify it as needed over the course of the semester. Calendar year of spring 2019:

Date		Lecture	Reading	Assignments
T	Jan. 21	Getting started; Variables, Assignments, Expressions	1.1 – 1.4	Homework#1
R	Jan. 23	Strings, Relational Expressions, Built-In Functions	1.5 – 1.8	
T	Jan. 28	Vectors and Matrices I	2.1 – 2.3	Homework#2
R	Jan. 30	Vectors and Matrices II	2.4 – 2.5	
T	Feb 4	Matlab Scripts, Input and Output	3.1 – 3.4	
R	Feb 6	Plots, File Input/Output, User-defined Functions	3.5 – 3.8	Homework#3
T	Feb 11	Selection Statements I: "If", "If-else"	4.1 – 4.3	
R	Feb 13	Selection Statements: "Switch", "Is"	4.4 – 4.5	Homework#4
T	Feb 18	Loop Statements I: "For"; **Exam I (paper): Ch 1 – 4**	5.1 – 5.2	
R	Feb 20	Loop Statements II: "While", Vectorizing	5.3 – 5.4	Homework#5
T	Feb 25	More types of User-defined Functions	6.1 – 6.3	
R	Feb 27	Debugging Techniques	6.5	Homework#6
T	Mar 3	Catch Up/Snow Day		
R	Mar 5	**Exam II (programming): Ch 1 – 6**		
		SPRING BREAK		
T	Mar 17	String Manipulation	7.1 – 7.2, 7.4	Homework#7
R	Mar 19	Data Structures: Cell Arrays and Structures	8.1 – 8.2	
T	Mar 24	Data Transfer: Handling Spreadsheets and Lower-level File Functions	9.1 – 9.3	
R	Mar 26	Practice/Catch Up; **Exam III (paper): Ch 1 – 9**		Homework#8
T	Mar 31	Numerical Methods I: Integrals		
R	Apr 2	Numerical Methods II: Derivatives		Homework#9
T	Apr 7	Numerical Methods III: Interpolation, Linear Equations		
R	Apr 9	Random Processes: Random Number Generation, Statistics and Probability		Homework#10
T	Apr 14	Dynamical Systems I: Electric Current		
R	Apr 16	Dynamical Systems II: Free Fall, Projectile with Friction		Homework#11
T	Apr 21	Simulation I: Rolling Dice, Bacteria Division		
R	Apr 23	Simulation II: A Random Walk, Traffic Flow		Homework#12
T	Apr 28	Monte Carlo methods I: importance sampling		Homework#13
R	Apr 30	Monte Carlo methods II: Markov chain		
Th	May 7	**Final Exam 10:30 AM – 12:30 PM**	ALL	

ELECTRONIC DEVICE POLICY

The pace of the course is such that your undivided attention will be required for the entire lecture period. Please set all electronics to silent or "vibrate mode" and put them away (except during programming sessions when a laptop is required), so that both you and your neighbors will be able to concentrate on the material at hand. No texting or making phone calls is allowed in the classroom.

D2L

We will be using the online platform D2L for this course. Course materials and homework assignments will be posted on D2L. Homework and projects submission is also via D2L. To allow for *structured note taking* I will post my lecture slides

prior to class. These slides intentionally leave some information, such as example solutions out, and provide space to fill that material in during lecture. **It is your responsibility to check these resources periodically for any updates and announcements.**

ATTENDANCE POLICY

Attendance is not taken for this course. Attending lecture, however, is highly correlated with success in this course, and I strongly recommend it. This is your chance to ask questions, see examples and get hands-on programming experience, which will significantly improve your grade.

DISABILITY STATEMENT

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities(OSSD), please contact the OSSD which is located at 223 Lawrence Center. The OSSD hours of Operation are Monday – Friday 8:30 a.m.–4:30 p.m. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at www.wcupa.edu/ussss/ossd.

ELECTRONIC COMMUNICATIONS STATEMENT

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course**.**

ATTENDANCE POLICY

Attendance is not taken regularly for this course; however per the Title IV of the Higher Education Act, your attendance needs to be verified at three points during the semester for the administration of federal student aid. Additionally, attending lecture is highly correlated with success in this course, and I strongly recommend it. This is your chance to ask questions, see examples and get hands-on programming experience, which will significantly improve your grade.

EXCUSED ABSENCES POLICY

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

INTELLECTUAL PROPERTY STATEMENT

I, the instructor, utilize copyrighted materials under the "Freedom and Innovation Revitalizing the United States Entrepreneurship Act of 2007" (Fair Use Act). Apart from such copyrighted materials, all other intellectual property associated with this course is owned and copyrighted by the instructor, including, but not limited to, lectures, course discussions, course notes, slides, assessment instruments such as exams, and supplementary materials posted or provided to students authored by the instructor. No recording, copying, storage in a retrieval system, or dissemination in any form by any means of the intellectual property of the instructor, in whole or in part, is permitted without prior written permission of the instructor. When such permission is granted, it must specify the utilization of the intellectual property and all such permissions and waivers shall terminate on the last day of finals of the semester in which this course is held.

TITLE IX/REPORTING INCIDENTS OF SEXUAL VIOLENCE

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at the webpage for the Office of Social Equity at http://www.wcupa.edu/_admin/social.equity/.

ACADEMIC INTEGRITY & CONDUCT

I have a zero tolerance policy for breaches of academic integrity. Breaches of academic integrity will be investigated and sanctions imposed to the full extent available under University policy. For questions regarding the university Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department's handbook, the Undergraduate Course Catalogue, the Rams Eye View, or the University Web Site. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class.

ALL OTHER ACADEMIC POLICIES

For any university wide academic policy not explicitly covered in this document, such as No Grade policies. Please consult your major advising handbook, the Undergraduate Catalog, the Ram's Eye View, or the University Website.

PUBLIC SAFETY

The Emergency Communications Committee recommends that the number of WCU's Department of public safety be available on every course syllabi. WCU Department of Public Safety: (610) 436-3311.