PHYS 220 Introduction to Computational Physics
Spring 2023

Instructor: Dr. Adriana Rocha-Lima
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Dates and Location:
Tuesday & Thursday 10:00AM - 11:15AM
Building: Physics – Room 201

Office Hours: By appointment
Office: Physics Building – Room 425

Recommended textbooks:
1. Computational Physics, Mark Newman, Revised and expanded.
   Sample chapters are available at the author's webpage:
   http://www-personal.umich.edu/~mejn/cp/

2. Numerical Python: Scientific Computing and Data Science Applications with Numpy, SciPy and Matplotlib, Robert Johansson, Second Edition.

3. Computational Physics: Problem Solving with Python, Rubin H. Landau, Manuel J. Páez and Cristian C. Bordeianu, Third Edition.

4. An Introduction to Error Analysis, The Study of Uncertainties in Physical Measurements, Second Edition, by John R. Taylor.

Equipment:
Computer access (and the possibility of installing software) is required. Students should have a computer with access to the internet every class.

Grading:
Homework: 30%, Midterm: 25%, Class Activities: 20%, Final Project: 25%.

Final Project will consist of three parts: Proposal 5%, Oral Presentation 10%, and Final Report 10%.

A: 100 - 90+; B: 90 - 75+; C: 75 - 60+; D: 60 - 50+; F: Below 50.

Late homework policy:
I do NOT accept late homework.

Class Attendance and Missed Work
Absences from class and missed work are accommodated (excused) in five circumstances: 1) significant illness, 2) personal instances of distress or emergency, 3) religious observance, and 4) varsity athletic participation and 5) required court or legal

appearances. For each circumstance, you will need to present to the instructor supporting evidence (e.g., doctor note).

Coarse Description:
An introduction to the computational packages in Python, with particular emphasis on their use in solving physics problems and analyzing experimental data taken in physics laboratory experiments. Applications to problems in mechanics, electromagnetics and wave propagation will be stressed.

Learning Goals:
By the end of the course, you should be able to:

- Use a high-level programming language (e.g., Python) to write modularized programs and plot simple figures, such as scatter plot, time series, histogram, and 2D contour.
- Write programs to solve physics problems involving ordinary differential-equations (ODE), such as projectile motion with drag and nonlinear oscillation.
- Write programs to solve physics problems involving partial differential equations (PDE), such as finding electrostatic potential and simulating heat diffusion.
- Use Monte Carlo method to simulate and understand random walk problem, such as photon transport in isotropic-scattering medium.
- Have a good mastery of basic data analysis methods, such as linear regression, uncertainty analysis, null hypothesis testing, and Fourier analysis.

At a Glance: UMBC Policies and Resources for Students

For Spring 2023 Safety Protocols and Compliance guidelines, please click the following link:

https://covid19.umbc.edu/masks/

Accessibility and Disability Accommodations, Guidance and Resources

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu

SDS phone: 410-455-2459

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination

UMBC Policy and Federal law (Title IX) prohibit discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Morgan Thomas, Acting Director and Title IX Coordinator

410-455-1354 (direct line), morganthomas@umbc.edu

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in or thinking about making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited.

Notice that Faculty are Responsible Employees with Mandatory Reporting Obligations:

All faculty members are considered *Responsible Employees*, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty are therefore required to report any/ all available information regarding conduct falling under the Policy and violations of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report *past and present* sexual assault, domestic and interpersonal

violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their rights, resources and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

- The Counseling Center (Main Campus): 410-455-2472 /
  After-Hours 410-455-3230 [Monday – Friday; 8:30 a.m. – 5 p.m.]
- Center for Counseling and Consultation (Shady Grove Campus):
  301-738-6273 (Messages checked hourly) Online Appointment Request Form
- University Health Services: 410-455-2542 [Monday – Friday 8:30 a.m. – 5 p.m.]
- Pastoral Counseling via Interfaith Center: 410-455-3657; interfaith@umbc.edu
  [7 days a week; Fall and Spring 7 a.m. – 11 p.m.; Summer and Winter 8 a.m. – 8 p.m.]

Other Resources:

- Women's Center (for students of all genders):
  410-455-2714; womenscenter@umbc.edu.
  [Monday – Thursday 10:00am-5:30pm and Friday 10:00am-4pm]
- Shady Grove Student Resources, Maryland Resources, National Resources.

Child Abuse and Neglect:

Please note that Maryland law and UMBC policy require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

Pregnant and Parenting Students

UMBC's Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination expressly prohibits all forms of Discrimination and Harassment on the basis of sex, including pregnancy. Resources for pregnant, parenting and breastfeeding students are available through the University's Office of Equity and Inclusion. Pregnant and parenting students are encouraged to contact the Title IX Coordinator to discuss plans and ensure ongoing access to their academic program with respect to a leave of absence or return following leave related to pregnancy, delivery, adoption, breastfeeding and/or the early months of parenting.

Pregnant students and students in the early months of parenting may be entitled to accommodations under Title IX through the Office of Equity and Inclusion.

In addition, students who are pregnant and have an impairment related to their pregnancy that qualifies as disability under the ADA may be entitled to accommodations through the Student Disability Service Office.

Religious Observances & Accommodations

UMBC Policy provides that students should not be penalized because of observances of their religious beliefs, and that students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences or requested modifications for religious observances in advance, and as early as possible. For questions or guidance regarding religious observance accommodations please contact the Office of Equity and Inclusion at oei@umbc.edu.

Hate, Bias, Discrimination and Harassment

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement.

Consistent with these principles, UMBC Policy prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information.

Students (and faculty and staff) who experience discrimination, harassment, hate or bias or who have such matters reported to them should use the online reporting/referral form to report discrimination, hate or bias incidents. You may report incidents that happen to you anonymously. Please note that, if you report anonymously, the University's ability to respond will be limited.

Source: https://oei.umbc.edu/sample-title-ix-responsible-employee-syllabus-language/