Course Change Request

New Course Proposal

Date Submitted: 11/19/18 5:56 pm

Viewing: **PHYS 325 : Intermediate Physics Laboratory Methods**

Last edit: 11/24/18 7:57 pm

Changes proposed by: prubin

Are you completing this form on someone else's behalf? No

Effective Term: Fall 2019

Subject Code: PHYS - Physics **Course Number:** 325

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Intermediate Physics Laboratory Methods

Banner Title: Interm Phys Lab Methods

Will section titles vary by semester? No

Credits: 3

Schedule Type: Laboratory

Hours of Lab or Studio per week: 3

Repeatable: May be only taken once for credit, limited to 3 attempts (N3) **Max Allowable Credits:** 3

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only): Prerequisites: PHYS 251 and PHYS 261.

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description: Methods of experimental physics, including data analysis and simulation.

Justification: Because course number changes require a course replacement, this is a course replacement, of PHYS 265. The title of that course (Intermediate University Physics Laboratory) has been modified slightly to

In Workflow

1. **PHYS UG Committee**
2. **PHYS Chair**
3. **SC Curriculum Committee**
4. SC Associate Dean
5. Assoc Provost-Undergraduate
6. Registrar-Courses
7. Banner

Approval Path

1. 12/09/18 4:23 pm Philip Rubin (prubin): Approved for PHYS UG Committee
2. 12/09/18 4:35 pm Paul So (paso): Approved for PHYS Chair

differentiate the course more clearly from the introductory physics laboratory sequence (PHYS 161 and 261, University Physics), and the catalog description has been shortened and generalized to reflect its complementary relationship with the recently commissioned intermediate laboratories [PHYS 311 (Instrumentation) and PHYS 312 (Waves and Optics)], as well as with the introductory laboratory sequence.

Does this course cover material which crosses into another department?	No
Learning Outcomes:	
Attach Syllabus	phys325syllabus.pdf
Additional Attachments	
Staffing:	Can be taught by almost any experimental or computational physicist in the Department.
Relationship to Existing Programs:	Will become a requirement for Computational Physics and Applied and Engineering Physics concentrations, and an elective for all other majors in Physics and Astronomy.
Relationship to Existing Courses:	Replaces PHYS 265, integrates and expands PHYS 161, 251, and 261, and complements PHYS 311 and 312.

Additional Comments:	
Reviewer Comments	

Key: 16175

PHYS 325
Intermediate Physics Laboratory Methods

Spring 20XX
Lecture: Fridays 10:30 – 1:10 pm
Classroom: Exploratory Hall 1004

Instructor:

- Name: TBD
- Phone: TBD
- E-mail: TBD
- Office: TBD
- Office Hours: TBD

Course Description:

Methods of experimental physics, including data analysis and simulation.

Prerequisite(s): C or higher in PHYS 251 and PHYS 261. Prerequisites enforced by registration system.

About this Class:

This is an activity-driven course. Each class meeting will be split into two parts. In the first part, brief overviews of topics will be presented. In the second part, you will begin working on homework problems due at the start of the following class. Before leaving class, your work will be checked to make sure you are on the right track. You are expected to review relevant material, available on Blackboard, before each class. The lecture notes also contain example problems and activities.

You are encouraged to work with other students on the in-class activities.

If you miss a class, you will likely find the homework assignments to be quite difficult.

Objectives:

- To develop proficiency integrating laboratory work and computational techniques.
- To analyze data: uncertainties, plots and statistics.
- To model physical processes through experiments and correlate them with a numerical model.
- To be proficient in developing ideas for ways to determine if a numerical solution is physically reasonable or correct and compare it to an experiment.
- To develop and analyze the results of numerical experiments of physical systems.

Topics Outline:

- Data analysis: Free fall
    - converting file formats – excel to csv to plain ascii
    - curve fitting – linear and non-linear
    - error analysis and plots
- Solving passive electric circuits – Direct Current and Alternate Current
    - Solve system of n equations with n unknowns: direct and iterative methods to solve linear system of equations
- Logic: TRUE and FALSE tables
    - Conditionals
- Computational geometry: basics of CAD

- Model laser beam profiles
    - Hermite Gaussian modes
- Model rainbows
    - Law of refraction and law of reflection
- Introduction to image processing
    - Zernike polynomials
    - Aberration
- Data: noise and signal averaging
- Using Arduino/Raspberry PI board to collect data

Textbooks:

There is not a required textbook for this course. The following list is a sample of the books available in the University Library. Some of these books are available online through the University. The course will not follow any specific book.

- "University Physics", Young and Freedman,
- "Numerical Analysis", Richard L. Burden and J. Douglas Faires, 1993.
- "Python and Matplotlib Essentials for Scientists and Engineers", Matt A. Wood, 2015.
- "Mastering Matplotlib", Duncan M. McGreggor, 2015.
- "Introduction to Programming in Python: An Interdisciplinary Approach", Robert Sedgewick, Kevin Wayne and Robert Dondero, 2015.
- "Numerical Python: A Practical Techniques Approach for Industry", Robert Johansson, 2015.
- "NumPy: Beginner's Guide", Ivan Idris, 3rd Edition, 2015.
- "NumPy Essentials", Leo Chin and Tanmay Dutta, 2016.
- "SciPy and NumPy", Eli Bressert, 2012.
- "Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language", Fabio Nelli, 2015,

References:

The following are additional references covering Computational Physics at the Junior/Senior undergraduate level.

- "Computational Physics", Nicholas Giordano and Hisao Nakanishi, 2nd Edition, 2006.
- "Computational Physics", Mark Newman, 2012.
- "Basic Concepts in Computational Physics", Benjamin A. Stickler and Ewald Schachinger, 2014.
- "A Course on Mathematical Methods for Physicists", Russel L. Herman, 2013.
- "Introduction to Computational Science: Modeling and Simulation for the Sciences", Angela B. Shiflet George W. Shiflet, 2006.

Other links:

- Finding E-Books at Mason: [1]
- A list of computational physics books: [2]
- Instructor resources for undergraduate computational physics: [3]

Grading:

- Exams: 60% - One midterm and one final, equally weighted. You will be given sample exams to practice from. The exam will contain a hand-written part and a part that requires the use of a computer.
- Homework: 40% - Usually one assignment per week. The lowest homework grade is dropped. I do not accept late homework assignments.

Letter Grades:

- > 97: A+
- 93 to 96.9: A
- 90 to 92.9: A-
- 87 to 89.9: B+
- 83 to 86.9: B
- 80 to 82.9: B-
- 77 to 79.9: C+
- 73 to 76.9: C
- 70 to 72.9: C-
- 60 to 69.9: D
- < 60: F

Email Communication:

Please send all your question to me via email. Here are a few thinks to remember to make email communication better.

- Please use your name in the salutation so that I don't have to look up your name given only your Mason email address. There is a way of setting up your email so your full name appears in the header - see below.
- If you have a question about a program, copy it inline in the email body, attach it (worst option), or (best option), send me a direct link to it on Bitbucket so I can place my comments directly in your program.
- Always tell me what you tried and read and be very specific about your point of confusion. Otherwise, I may guess incorrectly why you are confused. For example, if you say "I don't know where to start" I may guess that you don't know how to use a keyboard or that you need to be told "at the beginning". You will oftentimes find that if you write out a question, in the process of trying to make yourself clear about your point of confusion, you'll realize the answer to your question.

If you want to make any instructor happy, do all the above in all your email communications.

How to show your full name in MasonLive emails:

1. Log in to your MasonLive account.
2. Click on the 'Settings Gear' at the top right of your window, then select 'Options' from the drop-down list.
3. On the left-hand menu click 'General', then click on 'My Account'.
4. On the 'My Account' screen, type in your full name in the 'Display Name' area, then click 'Save'.

Collaboration Policy:

You may collaborate with other students on your homework. *However, the write-up and code that you turn in must be independent.* I suggest starting the homework prior to having any discussion with other students. Turning in a write-up or code that is similar to another student's will be treated as an honor code violation. The best way to avoid an honor code violation is to have someone look at your work when you are stuck and have them suggest modifications (rather than looking at someone else's work). ***Plagiarism will not be tolerated.*** If you collaborate with another student, you must indicate the name of the student on your write-up and/or code.

Referencing Policy:

It is quite unlikely that any homework problem will have a solution available on an external website, and you are encouraged to use other resources to help you with parts of a problem. If you used a website or a book while doing your homework, please reference it. This is a good habit to have when you do any programming or writing.

Software:

All software needed for this course is available to GMU students free of charge. Students will build on example code in Python; no prior experience with other languages is expected. We will also experiment with Python during the class.

Academic Calendar: GMU Academic Calendar

University Policy:

The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/ . All members of the university community are responsible for knowing and following established policies.

Disability Accommodations:

If you have a learning disability or other condition that may affect academic performance, please: a) make sure documentation is on file with Office of Disability Services (SUB I, Rm. 4205; 993-2474; http://ods.gmu.edu) to determine the accommodations you need; and b) talk with me to discuss your accommodation needs.

Counseling and Student Support:

- Counseling and Psychological Services provides confidential psychological services, including 24/7 crisis intervention and consultation to faculty and staff: http://caps.gmu.edu/
- Student Support helps students negotiate life situations by connecting them with appropriate on- and off-campus resources http://studentsupport.gmu.edu/referral-form/