

PHZ3113 Introduction to Theoretical methods
Instructor – Aniket Bhattacharya
Office location PSB 452

Office Hours- M, W 1:15 PM - 2:15 PM, or by Appointment.

Please contact through UCF Webcourses or email: aniket.bhattacharya@ucf.edu for appointments

Course Information:

Term: FA 2023

Course Number & Section: PHZ3113-0001

Course Name: Introduction to Theoretical Methods of Physics

Credit 3 Hours

Class Meeting Days: M, W, F

Class Meeting Time: 11:30 AM- 12:20 AM Class Location: ENG1 0227

Course Modality: Face to Face Instruction (P)

Course Description:

Physics 3113 is a course designed to enable physics majors to learn all the mathematics that is needed in Electromagnetism, PHY 4604 and PHY 4605 (Wave Mechanics I and II), and other upper-level undergraduate courses, and to prepare them for graduate school in physics, applied mathematics, or a similar discipline.

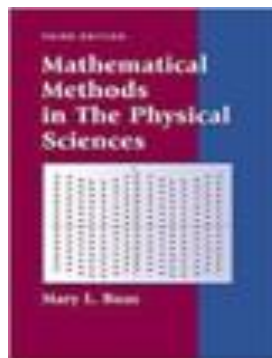
Course Materials and resources:

Required Text: Author – Mary L. Boas

Mathematical Methods in the Physical Sciences (3rd edition).

Publisher: Kaye Pace,

ISBN-13: 978-0471198260, ISBN-10:978047198260



Student Learning Outcomes:

By completing this method course, you should be able to apply the concepts and technics in solving a variety of physics problems your upper-level undergraduate courses. The most important learning outcomes are:

- You will learn importance of expressing functions in terms of series and their domain of convergence.
- You should be comfortable in connecting vectors to a physics problem, write an equation relating to vectors, and solve equations occurring in physics with your gained knowledge of vector algebra and vector calculus.
- You should be comfortable with multiple integrals appearing in physics problems.
- You should be able to calculate the coefficients of a Fourier series representing a function. You should know properties of special functions of mathematical physics, -Legendre's and Hermite's polynomials, and Bessel's functions, and the domain of applicability of these functions in physics.
- You should develop a sense of appreciation for complex variables as a powerful tool to solve various problems in physics, acquire a mastery to identify different singularities of complex series and functions and learn how to exploit contour integrals to evaluate definite integrals.
- You should learn special functions of mathematical physics, such as Legendre Polynomials, Bessel Functions, Hermite Polynomials etc. and get to know their applicability in various problems of physics.

Course Activities:

As listed, the course will be taught in the Face-to-face (P) mode although some quizzes may be available online. The lecture slides, handouts, and homework problems will be posted on a weekly basis. To remain up to date and to do well you need to visit the course Webpage at least once every day. You will benefit by reviewing the lecture materials in advance prior to attending the lectures, where we will work out end-of-the chapter problems. You can always come to my office with any concern and issues. Transparent and frequent communications are essential for the success of the course, both for the students as well as for the instructor. I am a flexible and receptive person and open to criticism.

Homework (15 %): I will assign 4-5 homework problems from each chapter. Homework will be due on a lecture day and must be submitted during lecture period unless prior arrangement is made.

Class Work (5%): Class work is a place where you can improve your learning with others, and participation will benefit your performances in tests and in the final.

Quizzes (10 %): I will give 5-8 in-class quizzes during lecture based on the topics covered during lecture and/or group activities.

Tests (45 %): There will be three tests- (each 15%), approximately one test per three chapters. The tests will be given during the lecture period and will consist of 4-5 questions easily doable in 50 minutes, if you have studied for the tests.

Comprehensive Final (25 %): The comprehensive final exam will take place per UCF final exam schedule (<https://exams.sdes.ucf.edu/2023/spring>) during the final exam week (**Wednesday, Dec 06, 2023 10:00 AM- 12:50 PM**)

Extra incentive: The appropriate weight of the final exam will replace the lowest test score, if applicable. However, please note that skipping a test (a zero to be replaced by the final) is not an option.

Additional Information:

- You should have regular access to the internet and plan on logging into the webcourse every day each week to check uploads of lecture slides, lecture notes, additional worked out problems, and to check the deadline for homework/quizzes.
- You should plan on a couple of hours every day to watch the lecture videos and the slides, and work through the worked-out problems independently before trying the assigned homework problems.
- The course textbook by Mary L. Boas is a well-established textbook across the nation including top-rated institutions and contains many ends of the chapter problems after each section.
- I strongly encourage that you invest time to work out some problems of your own and discuss them with others students enrolled in this course

Attendance/Participation:

Attending lectures will help you to do well in the course. Thus, if you do not attend the lectures on a regular basis, I expect you to tell me the reason. The course will be taught in a partially flipped mode. Lecture slides will be posted on a weekly basis prior to the lectures. You will get benefitted by reviewing these materials prior to attending the lectures. During the lecture period, we will work out problems similar to those assigned in homework and quizzes. These extra problems will prepare you better for the tests and final. There will be ongoing group activities during lecture which will benefit you to learn from someone else, as well as help others to learn. Prior courses show a strong positive correlation between attending lectures and the test grade.

Make-up Exams and Assignments:

Per university policy, you are allowed to submit make-up work (or an equivalent, alternate assignment) for authorized university-sponsored activities, religious observances, or legal obligations (such as jury duty). If this participation conflicts with your course assignments, I will offer a reasonable opportunity for you to

complete missed assignments and/or exams. The make-up assignment and grading scale will be equivalent to the missed assignment and its grading scale. In the case of authorized university activity, it is your responsibility to show me a signed copy of the Program Verification Form for which you will be absent, prior to the class in which the absence occurs. In any of these cases, please contact me ahead of time to notify me of upcoming needs. At the discretion of the instructor, the make-up may take any reasonable and appropriate form including, but not limited to the following: allowing a replacement exam, replacing the missed work with the same score as a later exam. All assignment and exam grades are final 72 hours after they have been returned. Please contact me before this 72-hour period is over if you have a grading dispute.

Assessment and Grading Procedures:

The following table shows the percentage weight distribution of each category contribution to your final grade.

Homework	Quizzes	Groupwork	Tests (*)	Final	Total
15%	10%	5%	45%	25%	100%

(*) If applicable, your final score will replace the lowest test score.

The following table shows the range of percentage score for a letter grade.

Letter Grade	A	A-	B+	B	B-	C+	C	D	F
Percentage score	> 90%	87%-90%	85%-87%	80%-85%	75%-80%	70%-75%	60%-70%	50%-60%	<50%

In case if you have issues with the grade, please contact me as soon as possible. I will consult the latest Undergraduate or Graduate catalog (<http://catalog.ucf.edu/>) for regulations and procedures regarding grading, such as, Incomplete grades, grade changes, and grade forgiveness.

Course Schedule:

Examination schedules and coverage:

Please mark your calendar for the following test days:

Test1	September 18- lecture period (50 minutes)	Chapters 1, 2, 3
Test2	October 16- lecture period (50 minutes)	Chapters 4,5,6.1-6.7,
Test3	November 17- lecture period (50 minutes)	Chapters 6.8-6.12, 11, 12
Final	December 6, 2023, 10:00 PM – 3:50 PM	Chapters 1-6,7,10-12

Please visit the course schedule page for approximate week-by-week course progression and activities

Important Dates:

Classes begin: Monday, August 21, 2023

Late Registration on myUCF: Monday, August 21- Friday, August 25, 2023

Drop/swap deadline on myUCF: Friday, August 25, 2023, 11:59 PM

Last day of full refund: Friday, August 25, 2023, 11:59 PM

Add deadline on myUCF: Friday, August 25, 2023, 11:59 PM

Payment deadline: Friday, September 01, 2023

Withdrawal deadline: Friday, October 27, 2023, 11:59 PM

Grade forgiveness deadline: Saturday, December 02, 2023, 11:59 PM

Last lecture Friday Dec 01, 2023

Final exam: [Wednesday, December 6, 2023, 10:00 AM – 12:50 PM](#)

Holidays:

Veteran's Day: Friday November 10 – **No Classes**

Thanksgiving Wednesday: November 22 – **No Classes**

Thanksgiving: Thursday Nov 23 – Saturday November 25 – **No Classes**

Academic Integrity:

Students should familiarize themselves with [UCF's Rules of Conduct](#).

According to Section 1, "Academic Misconduct," students are prohibited from engaging in:

- Unauthorized assistance: Using or attempting to use unauthorized materials, information or study aids in any academic exercise unless specifically authorized by the instructor of record. The
- unauthorized possession of examination or course-related material also constitutes cheating.
- Communication to another through written, visual, electronic, or oral means: The presentation of material which has not been studied or learned, but rather was obtained through someone else's efforts and used as part of an examination, course assignment, or project.
- Commercial Use of Academic Material: Selling of course material to an extent person, student, and/or uploading course material to a third-party vendor without authorization or without the express written permission of the university and the instructor. Course materials include but are not limited to class notes, Instructor's PowerPoints, course syllabi, tests, quizzes, labs, instruction sheets, homework, study guides, handouts, etc.
- Falsifying or misrepresenting the student's own academic work.
- Plagiarism: Using or appropriating another's work without any indication of the source, thereby attempting to convey the impression that such work is the student's own.
- Multiple Submissions: Submitting the same academic work for credit more than once without the express written permission of the instructor.

Responses to Academic Dishonesty, Plagiarism, or Cheating

Students should also familiarize themselves with the procedures for academic misconduct in UCF's student handbook, [The Golden Rule](#). UCF faculty members have a responsibility for students' education and the value of a UCF degree, and so seek to prevent unethical behavior and when necessary respond to academic misconduct. Penalties can include a failing grade in an assignment or in the course, suspension or expulsion from the university, and/or a "Z Designation" on a student's official transcript indicating academic dishonesty, where the final grade for this course will be preceded by the letter Z. For more information about the Z Designation, see <http://goldenrule.sdes.ucf.edu/zgrade> (<http://goldenrule.sdes.ucf.edu/zgrade>).

Course Accessibility Statement:

The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. This syllabus is available in alternate formats upon request. Students with disabilities who need specific access in this course, such as accommodations, should contact the professor as soon as possible to discuss various access options. Students should also connect with [Student Accessibility Services](#) (Ferrell Commons, 7F, Room 185, sas@ucf.edu (<mailto:sas@ucf.edu>), phone (407) 823-2371). Through Student Accessibility Services, a Course Accessibility Letter may be created and sent to professors, which informs faculty of potential access and accommodations that might be reasonable.

Campus Safety Statement:

UCF dedicated to keeping campus a safe place to learn, live, work, and play. It's important to remember that safety is a team effort. If you see something, say something. Please refer to the [campus safety page](#) for further

information.

Copyright:

This course may contain copyright protected materials such as audio or video clips, images, text materials, etc. These items are being used with regard to the Fair Use doctrine in order to enhance the learning environment. Please do not copy, duplicate, download or distribute these items. The use of these materials is strictly reserved for this online classroom environment and your use only. All copyright materials are credited to the copyright holder.

Third-Party Software and FERPA:

During this course you might have the opportunity to use public online services and/or software applications sometimes called third-party software such as a blog or wiki. While some of these could be required assignments, you need not make any personally identifying information on a public site. Do not post or provide any private information about yourself or your classmates. Where appropriate you may use a pseudonym or nickname. Some written assignments posted publicly may require personal reflection/comments, but the assignments will not require you to disclose any personally identity-sensitive information. If you have any concerns about this, please contact your instructor.

Tentative course schedule

(*)Due dates: All due dates are posted on Webcourses

Day/Week	Topics	Assignments(*)
Week1 Aug 21 – Aug25	Introduction about the course Chapter 1: infinite series, power series 1.1 - 1.3 The geometric series, applications 1.4 - convergence and divergent series 1.5 - 1.6 Testing series for convergence the Preliminary test, The integral test and the ratio test. 1.7 - 1.10; Alternating series, the interval of convergence	
Week2 Aug 28 – Sep 01	Continuation of Chapter 1 1.11- 1.14- Expanding functions in power series, Taylor's and McLaurin's expansion, some useful tricks for series expansions. 1.15- Some special series. Chapter 2: Complex numbers 2.1 - 2.4 - Real and imaginary parts of a complex number, the complex plane, terminology and notation 2.5 Complex algebra, the absolute value of a complex number, representation, complex algebra, absolute values, physical application, 2.6 Complex power series disk of convergence 2.7 Elementary functions of complex numbers	Homework 1
Week3 Sep 04 – Sep 08	Chapter 2 continued: 2.9- Euler's formula, 2.10- Powers and roots of complex numbers, 2.11- 2.12: The trigonometric and hyperbolic functions of complex arguments	
Week4 Sep 11 – Sep 15	Chapter 3: Linear Algebra Linear algebraic equations and matrices, transpose and inverse, determinant, the rank of a matrix, vectors, matrix operations, linear operators, special matrices. Eigenvalues and eigenvectors, matrix diagonalization, application to physics problems	Homework 2

Week5 Sep 18 – Sep 22	Chapter 4: Partial differential equation; examples of partial differentiation, solution of the wave equation	Homework 3 Test-I Monday Sept 18 (Chapters 1, 2 & 3)
Week6 Sep 25 – Sep 29	Chapter 4: Laplacian in rectangular and spherical polar coordinate. Method of Lagrange multiplier	
Week7 Oct 02 – Oct 06	Chapter 5: Multiple integrals, double and triple integrals, applications, change of variables in integrals: Jacobian, spherical and cylindrical coordinates, surface integrals	
Week8 Oct 09 – Oct 13	Chapter 6: Vector addition, dot and cross products, triple products, vector differentiation directional derivatives, divergence and curl of a vector, applications work done by a force, line integrals.	Homework 4
Week 9 Oct 16 – Oct 20	Chapter 6: Green's theorem, Gauss's and Stoke's theorem, some applications in physics.	Test 2 - Monday, Oct 16 (Chapters 4, 5, & 6.1-6.7)
Week 10 Oct 23 – Oct 27	Chapter 7: Fourier series and transform; simple harmonic motion, applications of Fourier series, Fourier coefficients,	
Week 11 Oct 30 – Nov 03	Chapter 7: Parseval's theorem, Fourier transform	Homework 6
Week12 Nov 06-Nov 10	Chapter 11: Special functions, Gamma and Beta functions, elliptic integrals; Chapter 12 special functions - Legendre polynomial	Homework 7
Week13 Nov 13 - Nov 17	Chapter 11: Special functions, Gamma and Beta functions, Elliptic integrals; Chapter 12 special functions - Legendre polynomial	Homework 8 Test 3, Nov 17 Chapters 6.8-6.12, 11, 12
Week14 Nov 20 – Nov 24	Complex analysis – Function of a complex variable, analytic function, Cauchy's theorem, Cauchy's integral formula,	
Week15 Nov 27 – Dec 01	Cauchy Residue theorem, evaluation of integrals using residue theorem; Final exam Review	Homework 9
Week 16 Dec 04 – Dec 09	<u>December 6 – Comprehensive Final Exam – 10:00 AM – 12:50 PM</u>	Wednesday December 06 2023 10AM- 12:50 PM