

ISC 4232/5935: Computational Methods for Continuous Problems

Fall 2021

SYLLABUS

Instructor	Bryan Quaiife 444, Dirac Science Library bquaiife@fsu.edu
TA	Tara Khodaei 451C, Dirac Science Library mk16e@my.fsu.edu
Class	Lectures: TR: 9:45–11:00am
Lab	Lab: T: 3:05–5:35pm
Office Hours	Tuesdays 11:00am–12:00pm (Quaiife) TBD (Tara) Set up another time by emailing the professor or TA.
Text Book	There is no required text for this class. An unpublished textbook will be provided. Partially completed notes will be provided before each lecture.
Coding	This class uses Matlab, which is available on SC computers. Matlab may be installed on your laptop here with your FSU account. Alternatively you may use Python or Julia. Please do not submit Jupyter Notebooks.
Prerequisites	MAS 3105 (Linear Algebra) ISC 4304 (Programming for Scientific Applications)
Website	FSU's Canvas Course Management Site.

Description

This course provides numerical discretization of differential equations and implementation for case studies drawn from several science areas. Finite difference, finite element, and spectral methods are introduced and standard software packages used. The lab component illustrates the concepts learned on a variety of application problems.

Detailed Course Plan

The first class will be on August 24 (T), and the last class will be on December 2 (R). There are no classes on November 11 (Veterans' Day) and November 25 (Thanksgiving). Barring unforeseeable events, we will have 28 lectures days and 15 lab weeks.

Outline and sequence of topics is as follows:

1. *Introduction and Review* [1 week]

IVPs vs. BVPs, classifications, boundary conditions, systems, discretizations, order of accuracy

2. *Initial Value Problems (IVP)* [6 weeks]
exact solutions, Euler methods, stability, convergence, stiffness, quadrature, Runge-Kutta, multistep, predictor-corrector, systems
3. *Boundary Value Problems (BVP)* [4 weeks]
boundary conditions, classifications, discretization, solving $Ax = b$, finite differences, mean weighted residuals, finite element method, weak forms
4. *Initial Boundary Value Problems (IBVP)* [3 weeks]
prototypical parabolic and hyperbolic IBVP, discretization, finite differences for heat equation, first-order hyperbolic IBVPs, finite volumes, boundary conditions, CFL, wave equation, domain of dependence

Note that this course plan is subject to change.

Grading	Assignments	20%	(3)
	Labs	30%	(approximately 6)
	Midterm	20%	(mid October)
	Final Exam	30%	(Tuesday, December 7, 7:30am–9:30am)

Course Policies

- All lab and assignment submissions must include a **single pdf file** that serves as a report, and **well-documented computer code** that produces all results in the report. It is not the instructor's or TA's job to run your code in order to generate results and figures. These must be embedded in your report.
- Interruptions during class time are highly encouraged. If you do not understand a concept, there is a good chance that other students would benefit from further explanation.
- The incomplete notes will be posted on Canvas before class. I will annotate notes during class, and this version will be posted after class. However, listening to explanations that complement the notes is necessary to understand the course content. Therefore, it is in your best interest to attend every lecture possible. History has shown that students who “learn” the material by only reading the notes on their own time are less successful than those who also come to class and participate in the discussion.
- Unless otherwise directed, the only need for a computer, laptop, phone, or tablet during class is to follow notes or participate in a coding exercise. During class time, I ask that you do not check email, chat, text, etc. There is compelling evidence that such multitasking distracts both you and the instructor, and lowers student engagement and learning. Class discussions are less fruitful when only a handful of people participate.
- Labs will be handed out before lab time. The typical frequency will be a new lab every two weeks. Labs will focus on **computer exercises**. You are strongly encouraged to attend the lab sessions where the course TA will be able to address your questions.
- Assignments will focus on **paper-and-pencil** calculations. The assignments are meant to reinforce material learnt in class.
- Unless discussed with the instructor before the deadline, late labs and assignments will be deducted 10% per day. Assignments later than five days will not be graded.

- I encourage you to work with others on both your labs and assignments. However, the final submission, including the code, must be unambiguously yours. Plagiarism will not be tolerated, will result in a 0, and will be reported.
- The midterm and final will be in-class.

University Attendance Policy

Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found here.)

Americans With Disabilities Act

Students with disabilities needing academic accommodation should:

- register with and provide documentation to the Student Disability Resource Center; and
- bring a letter to the instructor indicating the need for accommodation and what type.

This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
sdrcadmin.fsu.edu
<http://www.disabilitycenter.fsu.edu>

Recording of Lectures

Students may record class lectures delivered by the instructor that cover academic content. No recordings of other students, class participation, or discussion will be permitted. The recordings may not be published, which includes sharing, texting, and posting of any recordings of other students, without the specific permission of the student. More information can be found in House Bill 233 Intellectual and Viewpoint Diversity Act.

Free Tutoring from FSU

For tutoring and writing help in any course at Florida State University, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of tutoring options—see <http://ace>.

`fsu.edu/tutoring` or contact `tutor@fsu.edu` for more information. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.