MATH 693B ADV COMPUTATIONAL PDE

SPRING 2020
Schedule Number: 22325

COURSE INFORMATION

Class Days: T Th
Class Times: 1100-1215
Class Location: EBA-247
Mode of Delivery: Lecture

Instructor: Prof. Uduak George
Office Hours: W. Th. 12:30-13:30 or by appointment
Office Hours Location: GMCS 584
Email: ugeorge@sdsu.edu
Phone: 619-594-7247

ADDITIONAL COURSE INFORMATION

I'll try to respond within 24-48 hours to emails, my email is ugeorge@sdsu.edu. For quick questions, the turnaround time may be much shorter. For questions that involve, say, the clarification of course concept, you may want to call me in my office at (619) 594-7247, but email is to be preferred. I will available during my office hours.

Grades and lectures will be posted on Blackboard

COURSE MATERIAL

REQUIRED TEXTS:

- Finite Differences and Partial Differential Equations, 2nd edition. John C. Strikwerda, Society for Industrial and Applied Mathematics, November 2004. ISBN 0-8987-1567-9. (SIAM Student Members can get the member price! (30% off) at https://my.siam.org/Store/Product/viewproduct/?ProductId=988)

COURSE DESCRIPTION

Methods for hyperbolic, parabolic, and elliptic partial differential equations: consistency, stability, convergence

ENROLLMENT INFORMATION

Prerequisites: M531 and M541 with grades of C (2.0) or better

STUDENT LEARNING OUTCOMES

- Students will be able to derive numerical methods for hyperbolic, parabolic, and elliptic partial differential equations.
- Student will be able to compute numerical approximate solutions for hyperbolic, parabolic, and elliptic partial differential equations.
- Students will understand the concept of convergence and consistency of numerical schemes.
- Students will be able to investigate the stability of numerical schemes.
- Students will learn how to visualize numerical solutions.

COMPUTATIONAL RESOURCES

MATLAB will be the primary programming language. However, students are free to use any computational environment that they are comfortable with, but the instructor may not be able to help.

COURSE ASSESSMENT AND GRADING

Your final score will consist of homework (60%), Project (40%).

- You will hand in your codes via Blackboard. A printed/hand written copy of your home work will be collected during lecture.
- You are encouraged to work with one another to solve homework problems, but you should write solutions individually. Do not allow someone else to copy your work. If you suspect a student of cheating please inform me. The Mathematics and Statistics Department expects academic honesty from our students, as laid out in the University Policies below. Violations will be reported to the Center for Student Rights and Responsibilities.
- The following grading scale will be used:

A 93% - 100%	A- 90% - 93%			
B+ 87% - 90%	B 83% - 87%	B- 80% - 83%		
C+ 76% - 80%	C 72% - 76%	C- 68% - 72%		
D+ 64% - 68%	D 60% -64%	D- 55% - 60%	F Below 55%	

COURSE SCHEDULE

WK	Dates	HW	
1	Jan 20-24		Course Overview
2	Jan 27-31	HW1 assigned	Introduction to Hyperbolic PDEs Convergence, Consistency and Stability: the CFL Condition
3	Feb 3-7		Analysis of Finite Difference Schemes Order of Accuracy of Finite Difference Schemes
4	Feb 10-14	HW2 assigned HW1 Due	Stability of Lax-Wendroff and Crank-Nicolson: Boundary Conditions Stability for Multistep Schemes, Leapfrog Scheme, General Multistep Schemes
5	Feb 17-21		Stability for Multistep Schemes; Schur and von Neumann Polynomials Dissipation and Dispersion
6	Feb 24-28	HW3 assigned HW2 Due	Parabolic PDEs Overview - Exact Solutions and Boundary Conditions Stability, Boundary Conditions, Convection-Diffusion, Variable Coefficients
7	Mar 2-6		Systems of PDEs in Higher Dimensions The Alternating Direction Implicit Method Projects and Homework
8	Mar 9-13	HW4 assigned HW3 Due	Second Order Equations Boundary Conditions; 2D and 3D
9	Mar 16-20		Analysis of Well-Posed and Stable Problems Convergence Estimates for Initial Value Problems
10	Mar 23- 27	HW5 assigned HW4 Due	Well-Posed and Stable Initial Boundary Value Problems Finite Difference Schemes for Elliptic Problems Project Plan Due
11	Mar 30-Apr 3	Spring Recess	
12	Apr 6-10		Elliptic Problems: Iterative Schemes Steepest Decent and Conjugate Gradient Real-World Application: Simulations of Pattern Formation

13	Apr 13-17	HW6 assigned HW5 Due	Spectral Methods
14	Apr 20-24	HW7 assigned HW6 Due	Spectral Methods Mimetic Methods / MTK Toolkit
15	Apr 27-May 1	HW7 Due	Project Presentations (10-15 min) Link to choose a presentation time is on Google Drive
16	May 4-8	Last day of classes May 7	Please make sure to hand in your project code and presentation in Blackboard. Project Presentations (10-15min)
17	May 22		Last day of spring semester. Grades due from instructors.

Students with Disabilities

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Ability Success Center at (619) 594-6473. You can also learn more about the services provided by visiting the Student Ability Success Center website. To avoid any delay in the receipt of your accommodations, you should contact Student Ability Success Center as soon as possible. Please note that accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

Academic Honesty

The University adheres to a strict policy prohibiting cheating and plagiarism. Examples of academic dishonesty include but are not limited to:

- copying, in part or in whole, from another's test or other examination;
- obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- collaborating with another or others in work to be presented without the permission of the instructor;
- falsifying records, laboratory work, or other course data;
- submitting work previously presented in another course, if contrary to the rules of the course;
- altering or interfering with grading procedures;
- assisting another student in any of the above;
- using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- copying and pasting work from an online or offline source directly and calling it your own;
- using information you find from an online or offline source without giving the author credit;
- replacing words or phrases from another source and inserting your own words or phrases.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

Student Privacy and Intellectual Property

The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Religious Observances

According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

Medical-related absences

Medical-related absences: Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact of an absence, as well as any arrangements for making up work, rest with the instructors. Student Health Services (SHS) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student's consent, communicate with the student's instructors via the Vice President for Student Affairs and may communicate with the student's Assistant Dean and/or the Student Ability Success Center.

Technical Support for Blackboard

Student support for Blackboard is provided by the Library Computing Hub, located on the 2nd floor of Love Library. They can be reached at 619-594-3189 or hub@mail.sdsu.edu

Turnitin

Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. You may submit your papers in such a way that no identifying information about you is included. Another option is that you may request, in writing, that your papers not be submitted to www.turnitin.com. However, if you choose this option you will be required to provide documentation to substantiate that the papers are your original work and do not include any plagiarized material.

SDSU Economic Crisis Response Team

SDSU Economic Crisis Response Team: If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit sdsu.edu/ecrt, email ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.

Resources for students

A complete list of all academic support services--including the Writing Center and Math Learning Center--is available on the Student Affairs' Academic Success website. Counseling and Psychological Services (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

Classroom Conduct Standards

SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
    1. physical abuse, threats, intimidation, or harassment.
    2. sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.