Instructor: Prof. Michael Sprague
Office: Science & Engineering 332, 209-228-4179
Mobile: (209) 217-7240
msprague@ucmerced.edu

Lecture Time & Location: MW 3:00 pm – 4:20 pm, COB 209

Discussion Section Time & Location: F 1:00 pm – 1:50 pm, COB 209

Office hours:
Monday & Wednesday: 2:00–2:50 pm (S&E 332)
Alternatively, students are welcome to e-mail, call, or just stop by my office. I am rarely on campus on Tuesdays & Thursdays, but can usually be reached via email.

Prerequisite: Math 231 or Consent of Instructor

Course Units: Four

Catalog Description: Fundamental methods presented in Math 231 are used as a base for discussing modern methods for solving partial-differential equations. Numerical methods include variational, finite element, collocation, spectral, and FFT. Error estimates and implementation issues will be discussed. A significant amount of programming will be required.

Topics covered: This is the first semester that this course is being taught. As such, it is difficult to predict the amount of material that will be covered. However, we will discuss three broad classes of numerical methods that are very common in science and engineering today: (i) finite-difference methods, (ii) spectral methods, and (iii) finite-element methods. It is my hope that students will learn the fundamental theoretical underpinnings of these methods, and be able to effectively implement them. For the latter goal, homework assignments will have a substantial programming/implementation component.

Textbooks: There are no required textbooks for this course. However, reading assignments will be taken from the list of titles below, which are held on a non-circulating basis in the library. If you were to purchase one book, I would suggest the one by Iserles.

- Pinchover & Rubinstein, *An Introduction to Partial Differential Equations*, Cambridge University Press, 2005
- Iserles, *A First Course in the Numerical Analysis of Differential Equations*, Cambridge University Press, 2000
- Canuto et al., *Spectral Methods: Fundamentals in Single Domains*, Springer, 2006

Other Useful References:

- Boyde, *Chebyshev and Fourier Spectral Methods: Second Revised Edition*, Dover, 2001
- Brenner & Scott, *The Mathematical Theory of Finite Element Methods*, Springer, 2002
- Gottlieb & Orszag, *Numerical Analysis of Spectral Methods: Theory and Applications*, SIAM, 1977
- Reddy, *Applied Functional Analysis and Variational Methods in Engineering*, Krieger, 1991
- Strikwerda, *Finite Difference Schemes and Partial Differential Equations*, SIAM, 2004

Course webpage: The Math 232 website is part of the UCMCROPS course management system (ucmcrops.ucmerced.edu). It is available automatically to all students enrolled in this class. The website contains the course calendar, announcements, and email list. We will use this site for distributing course materials.

Discussion section: In general, the discussion section will be used as a time for group work on assignments. When we fail to cover sufficient material in a week's lectures, the Friday discussion section will be used as a third lecture section. On several known dates, lecture will be held in discussion section in place of a missed lecture from that week (see schedule).

Homework, Class Participation & Grade determination: The course grade is based on homework (90%) and class participation (10%). Homework will be assigned approximately every two weeks. Late homework will not be accepted without prior permission.

You are encouraged to work in groups. However, **all work turned in must be your own.** You must **list explicitly any outside sources employed** (*e.g.* websites, *Mathematica*, book other than the three textbook listed aboe, etc.) for each problem you solve. This does not mean that you are allowed to copy a solution should you find it posted elsewhere (see Academic integrity below). All programs must be written by you.

Exams: There will be no exams in this course.

Computers & Software: You may use a calculator (graphing or otherwise) or other computational tool (*e.g.*, Mathematica, Maple, Matlab, etc) to aid in your completion of homework assignments.

Your homeworks will require a significant amount of programming and data presentation. Any language will do, but I recommend Matlab or free alternative (Octave or python). Please present data graphically whenever possible.

Dropping the course: Please see the UC Merced *General Catalog* for more details.

Special accommodations: If you qualify for accommodations because of a disability, please submit a letter from Disability Services to the instructor in a timely manner so that your needs may be addressed. Student Affairs determines accommodations based on documented disabilities.

I will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please speak with me during the first week of classes regarding any potential academic adjustments or accommodations that may arise due to religious beliefs during this term.

Academic integrity: Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty. The current policies for UC Merced are described in the Academic Honesty Policy (see under Student Judicial Affairs at http://studentlife.ucmerced.edu) The following general guidelines are adapted from the UC Davis Code of Academic Conduct (http://sja.ucdavis.edu/cac.html).

Examples of academic dishonesty include:

- receiving or providing unauthorized assistance on examinations
- using unauthorized materials during an examination
- plagiarism - using materials from sources without citations
- altering an exam and submitting it for re-grading
- fabricating data or references
- using false excuses to obtain extensions of time or to skip coursework

The ultimate success of a code of academic conduct depends largely on the degree to which the students fulfill their responsibilities towards academic integrity. These responsibilities include:

- Be honest at all times.
- Act fairly toward others. For example, do not disrupt or seek an unfair advantage over others by cheating, or by talking or allowing eyes to wander during exams.
- Take group as well as individual responsibility for honorable behavior. Collectively, as well as individually, make every effort to prevent and avoid academic misconduct, and report acts of misconduct which you witness.
- Do not submit the same work in more than one class. Unless otherwise specified by the instructor, all work submitted to fulfill course requirements must be work done by the student specifically for that course. This means that work submitted for one course cannot be used to satisfy requirements of another course unless the student obtains permission from the instructor.
- Unless permitted by the instructor, do not work with others on graded coursework, including in class and take-home tests, papers, or homework assignments. When an instructor specifically informs students that they may collaborate on work required for a course, the extent of the collaboration must not exceed the limits set by the instructor.
- Know what plagiarism is and take steps to avoid it. When using the words or ideas of another, even if paraphrased in your own words, you must cite your source. Students who are confused about whether a particular act constitutes plagiarism should consult the instructor who gave the assignment.
- Know the rules – ignorance is no defense. Those who violate campus rules regarding academic misconduct are subject to disciplinary sanctions, including suspension and dismissal.