

**Math 374- Sec 01: Scientific Computation 3 Credits; Spring 2020**  
**South Dakota State University**

**Instructor:** Matt Biesecker

**Office:** AME 242

**Office Hours:** MW 2-3; F: 12-1 T-Th: by Appointment

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**Time/Location:** MWF 11:00-11:50. Avera 380

**Prerequisite:** Stat 382 – Probability

**Textbook:** None, But I will follow the many of the topics in Numerical Analysis, 2nd Edition, by Timothy Sauer. I will type all of the course notes. i.e. If I don't type it, it won't be on the exam.;

**Description:** An introduction to the use of computers for solving mathematical problems originating in scientific application areas. Students will be expected to know how to implement algorithms, understand how rounding error and truncation error can affect accuracy, and also write efficient and robust programs implementing numerical algorithms. Students will also be expected to implement selected algorithms in parallel. Specific topics will include:

- Binary representation of numbers; IEEE standard for floating point arithmetic; Rounding and truncation errors
- Algorithms for solving linear and nonlinear equations
- Polynomial approximations; Cubic Splines
- Numerical Approximation of Derivatives and Integrals,
- Numerical solution of ordinary differential equations.
- Pseudorandom number generation; Random Walks and simulation of stochastic processes.

**Learning Outcomes:**

- Explain the consequences of finite precision and the inherent limits of the numerical methods considered.
- Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.
- Demonstrate an understanding of the mathematical concepts underlying the numerical methods considered.
- Demonstrate understanding of how to effectively implement numerical algorithms using high level (Matlab) and low level (C/C++) programming languages

**Grading:** The weighting scheme is:

Homework/Group Work	40%
Exam 1	18%
Exam 2	18%
Final Exam	24%

The grading scale is 90%-100% A, 80%-89% B, 70%-79% C, 60%-69% D, below 60% F.

**Exams Make Up Policy:** Make-up exams will be given **only in the case of a verified absence or a University approved absence and if the instructor is notified prior to the absence.**

The notification for a verified absence may be in the form of an email message. It is the

student's responsibility to have this contact information available if necessary. A verified absence may include a death in the immediate family, a sudden illness, injury, or accident. The instructor may request documentation in order to determine if it is a verified absence. For University approved absences, all makeup work must be completed prior to departure

**Final Exam:** The final exam is comprehensive and is scheduled for **Tuesday May 5, from 9:15-11:45 in Avera 380**

**Software:** All programs will be done in Matlab or C/C++. Matlab is available through the university license (see D2L News for the links). As a substitute, you can also download GNU Octave. Octave is nearly compatible with Matlab, but the user interface is not so great. I will post information on downloading. All C programs must compile without errors or warnings with the GNU C compiler gcc, version 4.x or later. See me if you do not have a C compiler available or a student CSC account. <http://www.gnu.org/software/octave/> ; <http://www.codeblocks.org/>

**ADA Statement:** Any student who feels that they may need an accommodation based on the impact of a disability should contact Nancy Hartenhoff-Crooks, Coordinator of Disability Services (605-688-4504 or Fax, 605-688- 4987) to privately discuss your specific needs. The Office of Disability Services is located in room 271, the University Student Union

**Freedom in Learning:** Students are responsible for learning the content of any course of study in which they are enrolled. Under Board of Regents and University policy, student academic performance shall be evaluated solely on an academic basis and students should be free to take reasoned exception to the data or views offered in any courses of study. Students who believe that an academic evaluation is unrelated to academic standards but is related instead to judgment of their personal opinion or conduct should first contact the instructor of the course. If the student remains unsatisfied, the student may contact the Department Head, Dean, or both, of the college which offers the class to initiate a review of the evaluation.

**Student Academic Integrity and Appeals:** The University has a clear expectation for academic integrity and does not tolerate academic dishonesty. University Policy 2:4 sets forth the definitions of academic dishonesty, which includes but is not limited to, cheating, plagiarism, fabrication, facilitating academic dishonesty, misrepresentation, and other forms of dishonesty relating to academics. The policy and its procedures also set forth how charges of academic dishonesty are handled at the University. Academic Dishonesty is strictly proscribed and if found may result in student discipline up to and including dismissal from the University.