LIPSCOMB UNIVERSITY | COLLEGE OF COMPUTING & TECHNOLOGY

Syllabus

CS 3433-01 Numerical Methods

The mission of the College of Computing and Technology is to advance scholarship in key domains of computing and technology to our students by ***serving*** the computing and technology community as well as society at large, ***connecting*** to key industries, influencers, and thought leaders in the computing and technology arena, and ***innovating*** through up-to-date curricula and impactful research that will enhance the computing and technology community in Nashville and beyond.

Class Times: 1:00 – 1:50pm MWF
Class Location: Swang 118
Instructor: Dr. Qingguo Wang
Office: Swang 120
Phone: 615-966-5814
Office Hours: M-F 8:30-10:30am

Text:

Numerical mathematics and computing, 7th Edition, Ward Cheney and David Kincaid
ISBN-10: 1-133-10371-5; ISBN-13: 978-1-133-10371-4

Pre-requisites:

Math 2314 and CS 2233 with grades of "C" or higher

Course Description:

This class will study scientific computing which consist of writing program to find roots of equations, error analysis, simultaneous linear equations, numerical integration, least squares approximations, numerical solutions for ordinary differential equations, and real number and floating point representation. This class will focus more on the implementation of the methods listed previously.

Course Objectives:

Upon successful completion of this course, you should be able to:

i. Implement and apply numerical methods to obtain approximate solutions to mathematical problems
ii. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations
iii. To learn more about error analysis.

iv. To be able to find solutions of one variable using the following: the Bisection Method, Fixed-Point Theorem, or Newton's Method and use error analysis on these methods.

v. To be able to do numerical differentiation and in particular use Richardson's extrapolation.

vi. To be able to do numerical integration and in particular use Romberg integration. Adaptive quadrature methods, or Gaussian quadrature.

vii. To be able to do numerical integration for multiple and improper integrals.

viii. To be able to find eigenvalues and eigenvectors numerically.

ix. To be able to understand Monte Carlo Methods and Simulation

x. To be able to understand Linear Programming

	Learning Objectives Students will be able to:	Delivery Methods[1]	Assessment Methods[2]	Achievement Goal[3]
1.	Implement and apply numerical methods to obtain approximate solutions to mathematical problems	1,2,3,4	1,3	*
2.	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations	1,2,3,4	1,3	*
3.	To learn more about error analysis	1,2,3,4	1,3	*
4.	To be able to find solutions of one variable using the following: Bisection Method, Fixed-Point Theorem, or Newton's Method and use error analysis on these methods.	1,2,3,4	1,3	*
5.	To be able to do numerical integration for multiple and improper integrals.	1,2,3,4	1,3	*
6.	To be able to do numerical integration for multiple and improper integrals.	1,2,3,4	1,3	*
7.	To be able to find eigenvalues and eigenvectors numerically.	1,2,3,4	1,3	*
8.	To be able to do numerical differentiation and in particular use Richardson's extrapolation.	1,2,3,4	1,3	*
9	To be able to understand Monte Carlo Methods and Simulation	1,2,3,4	1,3	*
10	To be able to understand Linear Programming	1,2,3,4	1,3	*

[1]Delivery methods: (1) Lecture; (2) Demonstrations; (3) In-class Exercises; (4) Example programs
[2]Assessment methods: (1) Exams; (2) In class Quizzes; (3) Homework
[3]Achivement goals: (*) See grading scale below

Course Expectancies:

Students are responsible for all of the material covered in the class sessions, textbook chapters and external reading material. The tests will cover all material covered and/or assigned. Students are expected to be prepared for class by having read the reading material to be covered in the next class.

Classroom Procedure:

Students are encouraged to ask questions. Class participation is an essential part of the learning experience.

Students will be expected to follow the rules in the Student Handbook. The **dress code** should be followed according to the guidelines in the student handbook. All electronic devices such as; cell phones, pagers, PDAs, etc. should be set to OFF during class.

Testing:

There will be a midterm exam and one final exam. Make-up exams will be considered for only two reasons, sickness and unforeseen tragedy. In the case of sickness, an excuse written by a doctor or the school nurse on office letterhead is required. In the case of unforeseen tragedy, I expect you to contact me personally or through the Dean of Students or Provost's Office. It is your responsibility to initiate the scheduling of a make-up exam, failure to do so within two class days after the initial exam will result in a zero for that exam.

Grading:

You are required to do all assignments to receive a grade for the course. **Late homework assignments will carry a "one letter grade per day" penalty.** No assignment is accepted during or after the week of final exam, i.e. after the study day on April 23rd.

Grades will be based on the following scale:

Homework	30 %
Quizzes	20 %
Midterm Exam	20 %
Final Exam	30 %

A	=	90 + %
B	=	80 – 89
C	=	70 – 79
D	=	60 – 69
F	=	below 60 %

This is a minimum grade guarantee. For example, if you score 75 %this semester you are guaranteed to get at least a grade of C.

Attendance:

Attendance is mandatory. Your final grade will be lowered for every absence past the sixth one. This policy does not authorize skipping class but explains the consequences of poor attendance. See page 36 of the catalog for more information on the university attendance policy. You would not be upperclassmen if you were not attending class, so be sure to continue this trend of excellent attendance.

Academic Integrity:

Because Lipscomb's primary mission is to integrate Christian faith and practice with academic excellence, integrity is important in this course. As your instructor, I will deal with each student fairly and honestly. As students, you are expected to do your own work on all tests, labs, and assignments unless I indicate that collaboration is allowed on a specific assignment. Penalties for integrity violations will range from failure on the assignment involved to failure in the course. I also reserve the right to report violations to members of the administration. For clarification, refer to the university's Code of Conduct and the Academic Integrity Policy.

In addition, **you are not allowed to use external entities** (friends, relatives, previous student's assignments, and especially internet sources) **to obtain solutions to the homework and/or programming projects.** I will choose at random one student to explain his or her solution for each of the homework assignments during class. If you cannot explain what you have turned in, the grade will be re-evaluated. Please do not compromise your academic integrity for the sake of turning in homework on time. If you are having trouble with an assignment, please make an appointment to see me.

Students Requiring Accommodations:

It is the policy of Lipscomb University to accommodate students with disabilities, pursuant to federal and state law. Therefore, any student with a documented disability who needs to arrange reasonable accommodations must contact the ACCESS Ability Program at the beginning of each semester. The ACCESS Ability office is located in the Academic Success Center and they can be reached by phone at 615.966.6301 or by email at accessability@lipscomb.edu.

If you require classroom accommodations for a documented disability, please discuss your circumstances with me immediately. If you are entitled to accommodations but have not yet registered with the Counseling Center, contact that office at 279-1781 immediately.

Dropping the Course:

A decision to stop attending class does NOT constitute dropping the course. A drop/add form (available in the Registrar's Office) must be signed by the teacher and processed in the Registrar's Office before the drop is official. If your name appears on the roster at

grading time and you have not officially dropped the course, a grade will be assigned based upon the policies outlined in this syllabus.

Snow Schedule:

Lipscomb University's Class Schedule Disruption Policy can be reviewed at http://www.lipscomb.edu/academics/class-schedule-disruption-policy. Except in the rarest of instances, Lipscomb does not cancel classes or close offices. In the event of a class schedule disruption that prevents a class from meeting at its normal location and/or time, students will be notified by the instructor via email using their Lipscomb email account (or via email in Canvas). The instructor may use the following options to achieve the learning goals of the class during a class schedule disruption:

Student's Responsibility for Notification of Extended Absence

Students who find themselves in extenuating circumstances and who will miss classes for an extended period of time (e.g., missing a week of classes due to illness) should contact me and the Academic Support Office who will communicate the student's situation to the appropriate faculty members and administrators. Students are expected to provide timely notification regarding any extended absence and may be required to provide supporting documentation for their absences.

This schedule is tentative and subject to changes. Changes will be advised in class.

Index	Lectures & Tests	Reading Assignment
1	Introduction & Math Preliminaries	Chapter 1
2	Floating Point, Rational Number, Real Number Representation	Chapter 1
3	Linear System: Gaussian Elimination	Chapter 2
4	Non Linear Equation: Bisection, Newton's method, Secant's method	Chapter 3
5	Estimating Derivative and Richardson Extrapolation	Chapter 4
6	**Midterm Exam**	
7	Numerical Integration: trapezoid, Romberg and Simpson's Rule	Chapter 5
8	Numerical Integration: Gaussian Quadrature	Chapter 5
9	Spline Functions	Chapter 6
10	Monte Carlo methods and simulation	Chapter 10
11	Minimization of Functions	Chapter 13
12	**Final**	