University of Central Florida

Department of Electrical Engineering & Computer Science

**COT 4500 Numerical Calculus**

**Spring 2013**

**Syllabus**

**Credits:** 3

**Class Hours:** Mondays – Wednesdays – Fridays

From 9:30 a.m. to 10:20 a.m. in HEC 110

**Instructor:**

Euripides Montagne

Email: [**eurip@eecs.ucf.edu**](mailto:eurip@eecs.ucf.edu)

Office: HEC - 217

Phone: 407-823-2684

Office Hours: M-W-F 11:00 a.m. to 12:00 p.m.

T-TH 3:00 p.m. to 4:00 p.m.

**GTA:**  Brendan Patrick Lynch

Email: [brendan.lynch@knights.ucf.edu](mailto:brendan.lynch@knights.ucf.edu)

Office hours: Thursday 1:30 to 3:30 pm (HEC-313)

**Grader:** Frank Plochan

Email: [fplochan@gmail.com](mailto:fplochan@gmail.com)

Office hours: T –Th 3:00 p.m. to 4:00 p.m. (HEC 308)

**Course Objective:**

This course is designed to provide a basic understanding of the construction of numerical algorithms. Students will learn how to develop numerical methods and estimate numerical errors. Students will be exposed different numerical methods during the course, including: Root finding, solving systems of linear equations, interpolation and approximation of functions, numerical integration and differentiation.

**Course outcomes:**

1) **Outcome 1[Error, precision, and number representation]**: A passing student shall have an understanding of floating point representation, error handling, accuracy, and precision in arithmetic computation and approximating functions by Taylor polynomials .

2) **Outcome 2 [Finding Roots]**: A passing student shall have to understand the implementation of different methods for finding roots such as Bisection method, Newton’s method, Secant method, and the analysis of convergence for each technique.

3) **Outcome 3 [Linear Systems]**: A passing student will have knowledge and shall have to understand the implementation issues for the solution of system of linear equations using direct and iterative methods: Gauss elimination, partial pivoting, Tridiagonal and Banded systems, LU Factorization, LDLT Factorization, Cholesky Factorization, Eigenvalues and Eigenvectors, QR Factorization, Gauss-Seidel method, Jacobi Method, and QR factorization

4) **Outcome 4 [Interpolation and Numerical Integration]**: A passing student will have an understanding of interpolation and polynomial approximation, numerical differentiation and integration.

**Course Topics:**

Mathematical preliminaries and error analysis. Solutions of equations in one variable. Direct methods for solving linear systems. Iterative techniques in matrix algebra. Interpolation and polynomial approximation. Numerical differentiation and integration.

**Prerequisite:**

MAC 2312 and COP 3502.

**Required Textbook:**

Numerical Analysis, (8th or 9th Ed.), R. L. Burden and J. D. Faires, Thomson Brooks/Cole, 2011.

ISBN-13: 978-0-538-73351-9

**Other recommended sources:**

Numerical Mathematics and Computing (7th Ed), W. Cheney and D. Kincaid, Brooks/Cole, 2013.

Elementary Numerical Analysis (3rd Ed.), K. Atkinson and W. Han, John Wiley & Sons, 2004.

Introduction to Numerical computation, L. Eldén, L. Wittmeyer-Koch, and H. B. Nielsen, Studentlitteratur, 2004.

The text will be supplemented with additional notes that will be provided for you via the course web site: <http://www.cs.ucf.edu/courses/cot4500/spr2013>

**Style of Class Meetings:**

Class meetings will not consist of traditional lectures, with the instructor doing most of the talking and the student doing most of the listening. Rather, meetings will consist of discussions on each topic and the instructor will help guide the discussion by asking questions.

**Grading Policy:**

(10%) **Individual Homework assignment** (at least four assignments)

(20%) **Programming assignments (team projects –Max. two students per team)**

(40%) **In Class Quizzes** – closed book, closed notes exam given in class.

(30%) **Final Exam** – closed book, closed notes comprehensive exam given during final exam week.

**Letter Grades:**

* A = 90 – 100% (88 – 89) = A- (86 - 87) = B+
* B = 80 – 85% (78 – 79) = B- (76 – 77) = C+
* C = 70 – 75% (68 – 69) = C- (66 – 67) = D+
* D = 60 – 65% (58 – 59) = D-
* F = Otherwise

**Course Policies**

• The Assignment Due Dates will be announced in class and on the course webpage – the Course Calendar is below.

• **Webcourses and Course webpage:** the instructor will be using the course webpage and Webcourses to post Lectures, assignments, grades, and other information related to this course. Please make sure to **check The course Webpage and Webcourses regularly (at least once per day)** for any important information about the course.

• **Email:** email is the best way to contact me.

• **Missed Lectures:** Students are responsible for obtaining information about assignments and material covered or provided during missed lectures from other students in the course.

• **Makeup Exams:** No makeup exams will be given except for medical reasons with written documentation.

• **Makeup Assignments**:No makeup assignments will be given.

• **Academic Integrity:** Plagiarism and Cheating of any kind on an examination, quiz or assignment will not be tolerated. It may result in an “F’ for that assignment (and may, depending on the severity of the case, lead to an “F” for the entire course) and may be subject to appropriate referral to the Office of Student Conduct for further action. Please refer to The Golden Rule (http://www.goldenrule.sdes.ucf.edu/) of the University of Central Florida's Student Handbook for further information.

**Important Dates:**

**- Classes begin: January 7.**

* **Withdrawal deadline: Monday March 11th.**
* **Classes end: Monday April 22nd.**
* **Final exam: Tuesday April 26th (7:00 p.m. – 9:50 p.m.).**
* **Final Exam period:** [**http://registrar.sdes.ucf.edu/calendar/exam/2013/spring/**](http://registrar.sdes.ucf.edu/calendar/exam/2013/spring/)

- **Spring 2013 Holidays are:**

**Martin Luther King Jr. Day: Monday, January 21, 2013**

**Spring Break: March 4 – 9, 2013**

**Students with Disabilities**  
Students with disabilities who have special testing needs are required to contact the Student Disability Services at the beginning of the semester in order to make special testing arrangements. They are located in SRC 132 and can be reached at (407) 823-2371.

**\*\*\*The Syllabus is subject to change at any time and in any manner – the instructor will announce changes in class and by Posting to Webcourses or the Webpage for the class**.

**CAP 4500 Spring 2013 - Tentative Schedule**

|  |  |  |
| --- | --- | --- |
| **Week** | **CLASS** | **SUBJECT** |
| 1 | 1/7 | Adminstrivia; Introduction, course Objectives, grading policies, assignments and programming projects. |
| 1 | 1/9 | **Errors in Computation**.  Relative and Absolute errors. Examples. Rounding and chopping. |
| 1 | 1/11 | Error propagation. Loss of significance. Examples |
| 2 | 1/14 | Rolle’s theorem. Mean Value Theorem. Examples |
| 2 | 1/16 | Taylor series representation of functions |
| 2 | 1/18 | Taylor series representation of functions |
| 3 | 1/21 | **Martin Luther King Jr. Day** |
| 3 | 1/23 | Representation of numbers. Conversion of integers. |
| 3 | 1/25 | Quiz #1 |
| 4 | 1/28 | Floating point representation. Conversion of floating point numbers. |
| 4 | 1/30 | IEEE standard floating point representation |
| 4 | 2/1 | IEEE standard floating point representation |
| 5 | 2/4 | **Finding Roots:**  Techniques for finding roots of equations |
| 5 | 2/6 | Bisection method |
| 5 | 2/8 | Newton’s method |
| 6 | 2/11 | Secant method |
| 6 | 2/13 | Analysis of convergence for each technique |
| 6 | 2/15 | Quiz #2 |
| 7 | 2/18 | **Linear System**:  Linear System of equations and Gaussian elimination |
| 7 | 2/20 | Pivoting strategies |
| 7 | 2/22 | Tridiagonal and Banded Systems |
| 8 | 2/25 | LU Factorization |
| 8 | 2/27 | LDLT Factorization |
| 8 | 3/1 | Quiz #3 |
|  | 3/4  to  3/9 | **Spring Break: March 4 – 9** |
| 9 | 3/11 | Cholesky Factorization |
| 9 | 3/13 | Gauss-Seidel method |
| 9 | 3/15 | Jacobi Method |
| 10 | 3/18 | Eigenvalues and Eigenvectors |
| 10 | 3/20 | Power method. |
| 10 | 3/22 | QR factorization |
| 11 | 3/25 | **Interpolation:**  Interpolating polynomial: Lagrange form |
| 11 | 3/27 | Interpolating polynomial: Newton form |
| 11 | 3/29 | Divided differences |
| 12 | 4/1 | Hermite interpolation |
| 12 | 4/3 | Cubic spline interpolation |
| 12 | 4/5 | Quiz #4 |
| 13 | 4/8 | **Numerical Integration:**  Trapezoidal rule |
| 13 | 4/10 | Trapezoidal rule |
| 13 | 4/12 | Romberg Algorithm |
| 14 | 4/15 | Simpson’s rule |
| 14 | 4/17 | Gaussian Quadrature |
| 14 | 4/19 | **Review** |
| 15 | 4/22 | **Classes end** |
| **16** | **4/26** | **Final Exam Scheduled – 7:00 a.m. to 9:50 a.m.** |