FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Graduate Programs

Department Mathematical Sciences

College Science

*(To obtain a course number, contact **erudolph@fau.edu**)*

UGPC Approval _____
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner Posted _____
Catalog _____

Prefix MAD **Number** 6407	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab Code**	**Type of Course** Lecture	**Course Title** Numerical Analysis

Credits *(Review Provost Memorandum)*: 3

Effective Date *(TERM & YEAR)*: Fall 2018

Grading *(Select One Option)*: Regular (●) Sat/UnSat ( )

Course Description *(Syllabus must be attached; see Guidelines)*

Graduate-level treatment of scientific computing and numerical analysis: floating point number systems, nonlinear systems of equations, function approximation, numerical optimization, numerical methods for differential equations.

Prerequisites	**Corequisites**	**Registration Controls** *(Major, College, Level)*
MAA 5228, MAS 5145, and MAA 5105 with a grade of "C" or higher, or consent of the instructor.		

Prerequisites, Corequisites and Registration Controls are enforced for all sections of course

Minimum qualifications needed to teach course:	**List textbook information in syllabus or here**
Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.)	Numerical Mathematics, by Saleri, Quarteroni, and Sacco. Springer, 2006. Numerical Analysis, by L. Ridgway Scott. Princeton University Press, 2011. (http://people.cs.uchicago.edu/~ridg/newna/nalrs.pdf)
Faculty Contact/Email/Phone Jason Mireles-James/jmirelesjames@fau.edu/ 561-297-2490	**List/Attach comments from departments affected by new course**

Approved by	***Date***
Department Chair	1-22-18
College Curriculum Chair	1-22-18
College Dean	1-22-18
UGPC Chair	1-24-18
UGC Chair	1/24/18
Graduate College Dean	1-23-18
UFS President	
Provost	

Email this form and syllabus to UGPC@fau.edu one week before the UGPC meeting.

GRADUATE COLLEGE
JAN 23 2018
Received

Syllabus

1. **Course designation:**
   Course title: Numerical Analysis
   Course number: MAD 6407
   Credit hours: 3

2. **Course Prerequisites:**
   MAA 5228, MAS 5145, and MAA 5105 with a grade of "C" or higher, or consent of the instructor.

3. **Course Logistics**
   a. Fall 2018.
   b. Taught in lecture-discussion style in-person (not online).
   c. Course location is specified in the FAU course schedule.

4. **Instructor information**
   J.D. Mireles James, Office SE 262
   Phone: (561)-297-2490
   Email address: jmirelesjames@fau.edu
   Office hours: TBA

5. **TA contact information**
   N/A

6. **Course description:**

Graduate-level treatment of scientific computing and numerical analysis: floating point number systems, nonlinear systems of equations, function approximation, numerical optimization, numerical methods for differential equations.

7. **Course objectives:**
The course is a steppingstone for other course work and research in computational and applied mathematics. Upon successful completion of the course, students will have learned the basic use of the digital computer as a tool for solving problems in continuous mathematics. While numerical linear algebra will be discussed, emphasis will be placed on nonlinear problems. The course would also prepare students for entry level computational work in industry.

8. **Course evaluation methods:**
There will be weekly homework problem sets, many of which will require computer programing, and one midterm exam. There will also be a final project, the topic of which will be decided upon by the student and the instructor. The average of the homework assignments will contribute 30%, midterm exam 30%, and the final project 40% to the course grade.

9. **Course grading scale:**

The grading scale will be no worse than A: 90-100 , B: 80-89, C: 70-79, D: 60-69. I will adjust this scale slightly at the end of the semester, depending on the performance of the class.

10. Policy on makeup tests, late work, and incomplete: If you cannot complete an assignment on time due to a relevant and documents reason, you can make up the respective assignment. Extra credit work is not possible. A grade if I (incomplete) will only be given under certian conditions and in accordance with the academic policies and regulations put forward in FAU's University Catalog. The student has to show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

11. Special course requirements:
N/A

12. Classroom etiquette policy:
N/A

13. Disability policy statement:

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS)—in Boca Raton, SU 133 (561-297-3880); in Davie, LA 131 (954-236-1222); or in Jupiter, SR 110 (561-799-8585) —and follow all SAS procedures.

14. Code of Academic Integrity Policy Statement:
Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at
`http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf`

15. Required Texts/Readings
Numerical Mathematics, by Saleri, Quarteroni, and Sacco. Springer (2006)

16. Supplementary Readings:
Numerical Analysis, by L. Ridgway Scott. Princeton University Press (2011)
Available online at:
`http://people.cs.uchicago.edu/~ridg/newna/nalrs.pdf`

17. Course Topical Outline: The most of the following topics are to be covered (time permitting). The exact duration per topic will vary in dependence on prior experiences of the class participants.

- Introduction to numerical computing. Floating point numbers. Round off errors. Truncation/discretization errors. Measurement/quantification of errors (relative, a priori, and a posteriori).
- Numerical solution of finite dimensional systems of equations: simultaneous solution of N linear/nonlinear equations in N unknowns.
- Numerical solution of initial value problems
- Numerical solution of two point boundary value problems
- Function approximation: Interpolation and spectral approximation
- Numerical solution of partial differential equations (Fourier and Finite Element Methods)

18. Weekly Schedule:

Week 1: Floating point numbers and errors.
Week 2: Linear Systems Of equations
Week 3: Nonlinear systems of equations
Week 4: Analysis of errors and convergence of algorithms
Week 5: Numerical Solution of initial value problems. Euler, Taylor, and power series methods.
Week 6: Analysis of errors, and adaptive stepping. Applications of differential equations.
Week 7: Solution of two point boundary value problems by multiple shooting.
Week 8: Analysis of errors. Numerical homotopy/continuation.
Week 9: Splines and interpolation
Week 10: Interpolation errors.
Week 11: Finite element methods for linear PDE.
Week 12: Mesh generation
Week 13: Fourier series
Week 14: Spectral methods for boundary value problems
Week 15: Initial value problems for nonlinear parabolic PDEs