MAT 425 Numerical Analysis (14038)

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MAT 425 Course Overview Numerical analysis is responsible for designing and analyzing the algorithms used for solving mathematical problems that arise in many areas, especially science and engineering. Most real world problems in mathematics cannot be solved exactly, so it is crucial to design and implement computational algorithms that can accurately and effectively obtain approximations to the true solution. MAT 425 is the second course in a two course series that focuses on the design and implementation of such computational algorithms. It is not required that students have taken the first course, MAT 423, in order to take MAT 425. The topics covered in MAT 425 include: floating point arithmetic and stability, interpolation, approximation, numerical differentiation and integration, and numerical solution of ordinary and partial differential equations. Some computer programming will be expected in this class.

Who should take this class? If you have already taken, or are currently taking, any math modeling or differential equations class (junior/senior level) this course should broaden your knowledge of computational tools to solve interesting problems.

Time and Place : 10:30-11:45am Tues, Thurs, Wexler Hall, 109

Office Hours: Tues, Thurs 1-2pm (tentative). Office GWC 650. Appointments by email.

Prerequisites: MAT 274 / 275 and fluency in a computer programming language, or instructor approval. Do not take this course if you have never had a course in differential equations.

Course Description: Introduces differential equations, theoretical and practical solution techniques. Applications. Problem solving using Matlab.

Textbook: Recommended but not required. Scientific Computing: An Introductory Survey (2002), Heath, McGraw-Hill, Inc., ISBN: 9780072399103 `https://epubs.siam.org/doi/book/10.1137/1.9781611975581`

Lecture Notes will be posted for all covered sections of the course.

Online Resources and other texts

- An Introduction to Numerical Analysis, Endre Sli and David F. Mayers `https://ebookcentral-proquest-com.ezproxy1.lib.asu.edu/lib/asulib-ebooks/detail.action?pq-origsite=primo&docID=221072`
- Elementary Numerical Analysis: An Algorithmic Approach, D. Conte and Carl de Boor `https://doi.org/10.1137/1.9781611975208`
- Numerical Computing with Matlab: Cleve Moler, `https://doi-org.ezproxy1.lib.asu.edu/10.1137/1.9780898717952`

Software: Matlab, (`https://myapps.asu.edu/?check_logged_in=1`).

Homework: All HW consists of theory and computing.

Table 1: **Tentative Schedule (Subject to change)**

Date	Note	Topic	DUE
Jan. 9		Floating Point Arithmetic	
Jan. 11		Machine Epsilon / Rounding	
Jan. 14	**Last day to register or drop/add without college approval**		
Jan. 16		Backward Error and Condition	
Jan. 18		Interpolation	
Jan. 21	**Drop Deadline**		
Jan. 23		Interpolation	
Jan. 25		Interpolation	
Jan. 26	HW 1 Due		
Jan. 30		Interpolation	
Feb. 1		Approximation	
Feb. 6		Approximation	
Feb. 8		Numerical Integration	
Feb. 9	HW 2 Due		
Feb. 13		Numerical Integration	
Feb. 15		Numerical Integration	
Feb. 20		Numerical Integration	
Feb. 22		Numerical Integration	
Feb. 23	HW 3 Due		
Feb. 27	**Test: (Take Home likely due March 2)**		
Feb. 29		Numerical Differentiation	
Mar. 4-8	**Spring Break No class**		
Mar. 12		Numerical Ordinary Differential Equations	
Mar. 14		Numerical Ordinary Differential Equations	
Mar. 15	HW 4 Due		
Mar. 19		Numerical Ordinary Differential Equations	
Mar. 21		Numerical Ordinary Differential Equations	
Mar. 26		Numerical Ordinary Differential Equations	
Mar. 28		Partial Differential Equations	
Mar. 29	HW 5 Due		
Mar. 31	**Course withdrawal deadline**		
Apr. 2		Partial Differential Equations	
Apr. 4		Partial Differential Equations	
Apr. 9		Partial Differential Equations	
Apr. 11		Partial Differential Equations	
Apr. 12	HW 6 Due		
Apr. 16		Partial Differential Equations	
Apr. 18		Partial Differential Equations	
Apr. 23		Partial Differential Equations	
Apr. 25		Partial Differential Equations	
Apr. 26	HW 7 Due		
Apr. 30	Final Exam 9:50am-11:40am		