

**SYLLABUS AND COURSE INFORMATION FALL 2021**  
**MATH 546 Sections 01E, 01W – Numerical Methods and Learning**  
**Location:** Bin 302; Tue, Thurs 2:00p-3:15p, **Meets** 8/28/2023 through 12/15/2023

**Instructor:** Dr. Nikolay Metodiev Sirakov  
**Office Hours:** M 2:15PM- 4:45PM  
W 2:15PM- 4:45PM  
Friday research meetings  
Others by appointment

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### COURSE DESCRIPTION

**Text:** Applied Numerical Analysis Using Matlab, L. V. Fausett, 2<sup>nd</sup> Ed., Pearson Prentice Hall, 2008.

**Helpful Text:** Linear Algebra and Optimization for Machine Learning, ISBN 978-3-030-40343-0 ISBN 978-3-030-40344-7 (eBook), ©Springer Nature Switzerland AG 2020 .

**Pre-requisite:** permission by the instructor; basic knowledge on differential equations and skills in working with Matlab may be of help

### Course Content & Calendar:

**Machine Learning (ML) fundamentals-** ML and Differential Equations; Euler's method for weight update;

**1<sup>st</sup> & 2<sup>nd</sup> weeks-**Sections: **ML-** fundaments, **3<sup>rd</sup> & 4<sup>th</sup> weeks** - Fourier Interpolation sections 10.2.1-10.2.2 ; **5<sup>th</sup> & 7<sup>th</sup> weeks-** Numerical Solutions ODE with Euler's and Runge Kutta methods-12.1.1-12.2.4; **8<sup>th</sup> to 11<sup>th</sup> weeks** - Numerical Solutions of Systems ODE with Euler's and Runge Kutta methods -Sections 13.1.1-13.1.4; **12<sup>th</sup> to 13<sup>th</sup> weeks** - Parabolic Partial DE, Heat Equation- the Method of Finite Differences - Sections 15.1.1-15.1.4; **14<sup>th</sup> week** – more ML from **Helpful Text** - 4.4.1 Checking Gradient Correctness with Finite Differences; 4.4.2 Learning Rate Decay and Bold Driver; and 4.5.2 Stochastic Gradient Descent; **15<sup>th</sup> week-** Complete previous matters if needed. How to prepare a report.

**Note:** The methods derivations and development, which are beyond the textbook will be provided by the instructor. His notes will be posted in D2L.

**Students Learning Outcomes (SLO):** The student will learn basic concepts from **ML** and will be able to interpolate data applying Fourier Transforms. They will be able to approximate the solution of ordinary differential equation (ODE), System of ODE, and partial DE. The students will develop skills to apply the above methods and to program them in MatLab environment. They will accumulate knowledge how to conduct independent study and present their work, also the students will develop skill and knowledge how to generalize theoretical problems and methods.

**Supporting materials are available at:** <http://faculty.tamuc.edu/nsirakov/> go to Teaching.

<b>COURSE EVALUATION-</b>	In-class exams	- 42%
	HW/ Num. Methods in MatLab	- 20%
	Quizzes	- 16%
	Final Exam Project	- 22%

**Grading Policy:** **A:** 100%- 90% ; **B:** 89% - 80%; **C:** 79% - 70%; **D:** 69% - 60%;

**F:** Less than 59 %

The professor reserves the rights to reward students for continuous hard work.

**Additional Performances:** Home Practice Problems, Extra Credit Problems (ECP)

**Instructional Method:** Teaching lectures with proofs, **assigning** HW, quizzes, Exams, ECP.

<b>Final Exam/Project</b>	<b>Sections:</b> 01E, 01W	<b>Day:</b> Tuesday Dec. 12	<b>Time:</b> 1:15PM-3:15PM
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## COURSE POLICIES

**HW:** *are to be solved at home and turned-in due time. No makeup is allowed.*

**Quizzes:** *are to be solved independently during the class period. No makeup is allowed.*

**Tests:** *The in-class exams will be given at regular intervals. Students will be informed of the test dates a week in advance. The exams will be given at the scheduled times. No opportunity will be given to take the exam at earlier or later times except in cases of formal institutional excuses.*

**Makeup:** *Except in the case of a formal institutional excuse, no individual makeup test will be permitted.*

**Final Exam Project:** will require development of a final differences numerical method for an elliptic, parabolic or hyperbolic partial differential equations. The method is to be coded in Matlab and used to conduct experiments.

**Cheating:** 0 credit will be given on exams, quizzes, HW and other assignments in case of cheating.

**Students with Disabilities:** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

**Office of Student Disability Resources and Services; Texas A&M University-Commerce; Halladay Student Services Building; Room 132 A/D; Phone (903) 886-5150 or (903) 886-5835; Fax (903) 468-8148**  
[StudentDisabilityServices@tamuc.edu](mailto:StudentDisabilityServices@tamuc.edu)

**All students** enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment (See Student's Guide Handbook, Policies and Procedures, Conduct).

**Texas Senate Bill - 11** (*Government Code 411.2031, et al.*) authorizes the carrying of a concealed handgun in TAMUC buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations. For a list of locations, please refer to

<http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf>

and/or consult your event organizer). Pursuant to PC 46.035, the open carrying of handguns is prohibited on all TAMUC campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

**Nondiscrimination Notice Texas A&M University-Commerce** will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. An environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

**The Counseling Center** at A&M-Commerce, located in the Halladay Building, Room 203, offers counseling services, educational programming, and connection to community resources for students. Students have 24/7 access to the Counseling Center's crisis assessment services by calling 903-886-5145. For more information regarding Counseling Center events and confidential services, please visit [www.tamuc.edu/counsel](http://www.tamuc.edu/counsel).

Texas A&M University-Commerce acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors' guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources.

*The road that will lead you to find a good job is the road of coding, learning, and developing yourself through accumulating new knowledge.*

**Commerce, Texas**

**August 24, 2023**

**Dr. Nikolay Metodiev Sirakov**