MTH 4033 – Course Information

Fall 2021

Instructor:	Prof. Youngjoon Hong	**Time:**	TBA
Email:	hongyj@skku.edu	**Place:**	TBA

Office Hours: TBA
Office:: TBA

Textbook:

- Recommended: "Finite Difference Schemes and Partial Differential Equations" by John Strikwerda.

- Recommended "Finite Difference Methods for Ordinary and Partial Differential Equations" by Randall LeVeque.

Prerequisite: Partial Differential Equations, Numerical Analysis

Homework: There will be 5–6 homework assignments during the semester.

Grading Policy: There will be homework and final project with an oral presentation. The total points for this class are distributed as follows:

- Homework: 60%

- Final project and presentation: 30%

- Attendance and participation: 10%

Missing a presentation is permitted only for the most compelling reasons. Except in extraordinary situations, permission should be obtained in advance from the instructor to miss an exam; otherwise you will be awarded zero points.

If you believe a problem on a homework or exam has been graded incorrectly, or that your score was not correctly recorded, you must bring this to the attention of the instructor within **14 calendar days** of the date of the exam or homework, and before the date of the final exam. Grading complaints not initiated within this period of time will not be considered.

Course Outline: 1-Hyperbolic Partial Differential Equations; 2-Analysis of Finite Difference Schemes; 3-Order of Accuracy of Finite Difference Schemes; 4-Stability for Multistep Schemes; 5-Dissipation and Dispersion; 6-Parabolic Partial Differential Equations; 7-Systems of Partial Differential Equations in Higher Dimensions; 8-Second-Order Equations; 9-Analysis of Well-Posed and Stable Problems; 10-Convergence Estimates for Initial Value Problems; 11-Well-Posed and Stable Initial-Boundary Value Problems; 12-Elliptic Partial Differential Equations and Difference Schemes; 13-Linear Iterative Methods; 14-The Method of Steepest Descent and the Conjugate Gradient Method.

Learning objectives
The purpose of this course is to gain a practical applications of mathematical problem seen in the ODE and PDE courses and provides you the standard formalism used in numerical analysis. Such knowledge is of importance for mathematicians who plan to have a career in the industry or in research and who need to look for practical applications. This course will give students the mathematical and computational foundations needed to take more advanced numerical analysis courses in mathematics and other interdisciplinary courses. At the end of the semester, you will be able to

- Write a Matlab program solving partial differential equations. Most of homework problems will include a program exercise to find a numerical solution of physical models, e.g., hyperbolic equations, parabolic equations, and elliptic equations.

- Build a numerical algorithm for a system of differential equations. Some of homework problems will include an algorithm exercise to find a numerical solution of system of hyperbolic equations and parabolic equations.

- Describe and manipulate the quantifier formalism. Most of homework problems will ask the quantifier formalism for a mathematical framework to prove convergence, stability, and consistency.

- Write logical proofs in numerical analysis. Many of homework problems will include an analytical exercise problem to interpret physical models such as heat equations, wave equations, and conservation laws.

- Establish a connection between mathematical problem and their applications in the PDE sense. The final project will provide a connection between numerical methods and their practical applications. Students should use a numerical and mathematical tools taught in the course to demonstrate their own problems.

Expectations and Policies
When you come to class:

- Please be on time.

    - Please pay attention.
    - Don't sleep, read the newspaper, check email, etc...
    - Please turn off mobile phones.
    - Please be courteous to other students and the instructor!
    - Abide by university statutes, and all applicable local, state, and federal laws.

- Turn in assignments on time. (**The instructor reserves the right not to accept late assignments**).

- The instructor will make special arrangements for students with documented learning disabilities and will try to make accommodations for other unforeseen circumstances, e.g. illness, personal/family crises, etc. in a way that is fair to all students enrolled in the class. Please contact the instructor **EARLY** regarding special circumstances.

Academic Integrity Policy: As an academic community, SKKU is committed to providing an environment in which research, learning, and scholarship can flourish and in which all endeavors are guided by academic and professional integrity. All members of the campus community - students, staff, faculty, and administrators - share the responsibility of insuring that these standards are upheld so that such an environment exists. Instances of academic misconduct by students will be handled pursuant to the Student Disciplinary Policy.

Religious Holidays: Students who wish to observe religious holidays shall notify the faculty member by the tenth day of the semester of the date when they will be absent unless the religious holiday is observed on or before the tenth day of the semester. In such cases, the student shall notify the faculty member at least five days in advance of the date when he/she will be absent. The faculty member shall make every reasonable effort to honor the request, not penalize the student for missing the class, and if an examination or project is due during the absence, give the student an exam or assignment equivalent to the one completed

by those students in attendance. If the student feels aggrieved, he/she may request remedy through the campus grievance procedure.

Grievance Procedures: SKKU is committed to the most fundamental principles of academic freedom, equality of opportunity, and human dignity involving students and employees. Freedom from discrimination is a foundation for all decision making at SKKU. Students are encouraged to study the University's "Nondiscrimination Statement". Students are also urged to read the document "Public Formal Grievance Procedures". Information on these policies and procedures is available on the University web pages of the Office of Access and Equity.

Note: This syllabus is subject to change based on the needs of the class