

## COURSE SPECIFICATION

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	<b>Course Title</b>	Numerical Analysis				
2.	<b>Originating Department</b>	Department of Mathematics				
3.	<b>Course Code</b>	MA305				
4.	<b>Credit Value</b>	3				
5.	<b>Course Type</b>	Major Elective Courses				
6.	<b>Semester</b>	Fall				
7.	<b>Teaching Language</b>	English & Chinese				
8.	<b>Instructor(s), Affiliation &amp; Contact</b> For team teaching, please list all instructors	<div style="text-align: center;">3    423</div> <a href="mailto:yangj7@sustc.edu.cn">yangj7@sustc.edu.cn</a> Yang Jiang, Mathematics, Associate Professor Room 423, Block 3, Wisdom Valley <a href="mailto:yangj7@sustc.edu.cn">yangj7@sustc.edu.cn</a>				
9.	<b>Tutor/TA(s), Contact</b>	NA				
10.	<b>Maximum Enrolment</b> (      ) Optional					
11.	<b>Delivery Method</b>	Lectures	/   / Tutorials	/   / Lab/Practical	(      ) Other   Please specify	Total
	<b>Credit Hours</b>	48			2 Revision & Exam (2 weeks)	48

12. <b>Pre-requisites or Other Academic Requirements</b>	III(MA203a) ( MA213 ) Mathematical Analysis III (MA203a) (or Real Analysis (MA213))
13. <b>Courses for which this course is a pre-requisite</b>	Linear Algebra is a prerequisite for Computational Finance, Computational Physics, Numerical Methods for Ordinary Differential Equations, Numerical Methods for Ordinary Differential Equations, and etc.
14. <b>Cross-listing Dept.</b>	None

## SYLLABUS

### 15. **Course Objectives**

To introduce the basic concepts in Numerical Analysis including interpolations, approximation theory, direct and indirect methods for solving systems of linear equations, numerical integrations and numerical methods for computing the eigenvalues.

### 16. **Learning Outcomes**

QR

MATLAB

After completing this course, students should understand a few basic methods and techniques in Numerical Analysis. They should be able to manipulate the theory and algorithm of interpolations for functions, manipulate the approximation theory and curve fitting methods, solve systems of linear equations with direct and indirect methods, manipulate the numerical integration algorithms, compute eigenvalues with the power method, the inverse power method and the QR method. After learning this course, students should be able to do the basic numerical computation using some mathematical softwares, such as Matlab, Maple.

### 17.

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

3	Chapter 1. Mathematical Preliminaries and Error Analysis: Round-off Errors and Computer Arithmetic
3	Chapter 2. Solutions of Equations in One Variable: The Bisection Method, Fixed-Point Iteration, Newton's Method and Its Extensions, Error Analysis for Iterative Methods.
6	Chapter 3. Interpolation and Polynomial Approximation: Interpolation and the Lagrange Polynomial, Divided Differences, Hermite Interpolation, Cubic Spline Interpolation.
6	Chapter 4. Numerical Differentiation and Integration: Numerical Differentiation, Elements of Numerical Integration, Composite Numerical Integration, Gaussian Quadrature.
6	Chapter 5 Initial-value Problems for Ordinary Differential Equations: The Elementary Theory of Initial-Value Problems, Euler's Method, Runge-Kutta Methods, Higher-Order Equations and Systems of Differential Equations, Stability.
6	Chapter 6 Direct Methods for Solving Linear Systems: Pivoting Strategies, Linear Algebra and Matrix Inversion, The Determinant of a Matrix, Matrix Factorization, Special Types of Matrices.
6	Chapter 7 Iterative Techniques in Matrix Algebra: Norms of Vectors and Matrices, Eigenvalues and Eigenvectors, The Jacobi and Gauss-Seidel Iterative Techniques.
3	Chapter 8 Approximation Theory: Discrete Least Squares Approximation, Orthogonal Polynomials and Least Squares Approximation.
6	Chapter 9 Approximating Eigenvalues: Orthogonal Matrices and Similarity Transformations, The Power Method, Inverse iteration and Rayleigh Quotient Iteration, Householder's Method, The QR Algorithm
3	Chapter 10 Numerical Solutions of Nonlinear System of Equations: Fixed Points for Functions of Several Variable, Newton's Method.

# 18. Textbook and Supplementary Readings

Textbook : Numerical Analysis, 9 <sup>th</sup> Edition, by Richard L. Burden, J. Douglas Faires, Brooks/Cole, 2011.	
Supplementary Readings :	
1.	2012
2.	2007
3.	2010
4.	2008

## ASSESSMENT

19.

Type of Assessment	Time	% of final score	Penalty	Notes
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<b>Attendance</b>				
<b>Class Performance</b>				
<b>Quiz</b>		20%		
<b>Projects</b>				
<b>Assignments</b>		25%		
<b>Mid-Term Test</b>		20%		
<b>Final Exam</b>		35%		
<b>Final Presentation</b>				
<b>Others (The above may be modified as necessary)</b>				

20.

#### GRADING SYSTEM

A.	Letter Grading
B.	/ Pass/Fail Grading

#### REVIEW AND APPROVAL

21.

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This Course has been approved by the following person or committee of authority

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