COURSE OUTLINE: MH3700

Course Title	**Numerical Analysis I**		
Course Code	**MH3700**		
Offered	Study Year 3, Semester 2		
Course Coordinator	Viet Ha Hoang (Assoc Prof)	vhhoang@ntu.edu.sg	6513 2021
Pre-requisites	MH1200 AND MH1201 OR MH1800 AND MH2800 OR CY1602 OR MH2802		
AU	3		
Contact hours	Lectures: 26, Laboratories: 13, Tutorials: 13		
Approved for delivery from	AY 2018/19 semester 2		
Last revised	13 Dec 2019, 17:33		

Course Aims

This course introduces you to the basis of numerical methods and their analysis for solving algebraic equations, for approximating functions and their derivatives and integrals. The course also provides you the experience in implementing the numerical methods using computer programming languages. It serves as a foundation for further studying on mathematical computation which plays essential keys in many areas of applied mathematics, mathematical modelling, engineering and computational finance.

Intended Learning Outcomes

Upon successfully completing this course, you should be able to:

1. Apply numerical methods for solving algebraic equations, for approximating mathematical functions and their derivatives and integrals
2. Decipher the mathematical analysis of the numerical methods, and the mathematical theory behind the numerical methods
3. Rigorously prove the convergence of the numerical methods, to estimate and improve their errors

Course Content

O notation

Iterative methods for solving algebraic equations: bisection method, fixed point iteration, Newton and secant methods, order convergence analysis

Lagrange and Hermite interpolation

Approximating derivatives of functions

Richardson’s extrapolation

Quadrature rules for numerical integration

Assessment

Component	Course ILOs tested	SPMS-MAS Graduate Attributes tested	Weighting	Team / Individual	Assessment Rubrics
Continuous Assessment					
Tutorials					
Quiz 1 of 15 minutes	1, 2, 3	**1.** a, b **3.** a	5	individual	See Appendix for rubric
Quiz 2 of 15 minutes	1, 2, 3	**1.** a, b **3.** a	5	individual	See Appendix for rubric
Mid-semester Quiz					
One midterm exam of 1 hour duration	1, 2, 3	**1.** a, b, c **2.** b **3.** a	30	individual	See Appendix for rubric
Examination (2 hours)					
Final exam	1, 2, 3	**1.** a, b, c **2.** b **3.** a	60	individual	See Appendix for rubric
		Total	**100%**		

These are the relevant SPMS-MAS Graduate Attributes.

1. **Competence**
   a. Independently process and interpret mathematical theories and methodologies, and apply them to solve problems
   b. Formulate mathematical statements precisely using rigorous mathematical language
   c. Discover patterns by abstraction from examples
2. **Creativity**
   b. Build on the connection between subfields of mathematics to tackle new problems
3. **Communication**
   a. Present mathematics ideas logically and coherently at the appropriate level for the intended audience

Formative Feedback

You will receive feedback on your tutorial work (you are expected to attempt the questions yourselves before the tutorials), quizzes and midterm test through provided model solutions. You will also receive general feedback during tutorial/lab sessions, and individual consultation. A report on the examination results will provide you with the feedback on the final exam.

Learning and Teaching Approach

Lectures (26 hours)	Lectures will provide you with the theoretical details on the numerical methods together with particular examples. They will help you acquire the basic ideas of the methods and the mathematical theory behind the methods. Examples will help you understand how to use the method in particular situations.
Laboratories (13 hours)	Practical lab tasks help you acquire experience applying the numerical method to solving particular problems numerically.
Tutorials (13 hours)	Tutorials will provide problems for practice. You will understand the lectures' materials better through solving particular problems with various levels of difficulty. Tutorials also touch upon further theoretical issues for which the lectures may not have time. They enhance your understanding of the mathematical concepts.

Reading and References

Text book: R. L. Burden and J. D. Faires, Numerical Analysis, 9th edition, Brooks/Cole, 2011, ISBN-10:0-538-73564-3

However, the lectures notes should be self-contained and sufficient.

Course Policies and Student Responsibilities

You are expected to attend all lectures and tutorials/lab sessions. You are expected to attempt the tutorial questions before the tutorial. Tutorials will provide solutions to help you check your own tutorial solutions and your understanding of the concepts and methods. You are expected to attend all the quizzes and midterm. You are expected to follow up all the course notes, tutorial problems and announcements on the course's website.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the Academic Integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Viet Ha Hoang (Assoc Prof)	SPMS-MAS-04-19	6513 2021	vhhoang@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course ILO	Readings/ Activities
1	Revision of basic calculus, O notation	1, 2, 3	Lecture notes will be provided
2	Iterative methods for solving algebraic equations	1, 2, 3	Lecture notes will be provided
3	Iterative methods for solving algebraic equations	1, 2, 3	Lecture notes will be provided
4	Interpolation methods for approximating functions	1, 2, 3	Lecture notes will be provided
5	Interpolation methods for approximating functions	1, 2, 3	Lecture notes will be provided
6	Interpolation methods for approximating functions	1, 2, 3	Lecture notes will be provided
7	Approximation of derivatives, Richardson extrapolation	1, 2, 3	Lecture notes will be provided
8	Approximation of derivatives, Richardson extrapolation	1, 2, 3	Lecture notes will be provided
9	Midterm exam	1, 2, 3	Lecture notes will be provided
10	Numerical integration	1, 2, 3	Lecture notes will be provided
11	Numerical integration	1, 2, 3	Lecture notes will be provided
12	Numerical integration	1, 2, 3	Lecture notes will be provided
13	Numerical integration	1, 2, 3	Lecture notes will be provided

Appendix 1: Assessment Rubrics

Rubric for Tutorials: Quiz 1 of 15 minutes (5%)

Point-based marking (not rubrics based)

Rubric for Tutorials: Quiz 2 of 15 minutes (5%)

Point-based marking (not rubrics based)

Rubric for Mid-semester Quiz: One midterm exam of 1 hour duration (30%)

Students need to understand the mathematical concepts, able to apply them to particular problems, provide accurate results and present the solutions in a clear and concise manner.

Rubric for Examination: Final exam (60%)

Students need to understand the mathematical concepts, able to apply them to particular problems, provide accurate results and present the solutions in a clear and concise manner.