Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Viet Ha Hoang
Course Author Email	vhhoang@ntu.edu.sg
Course Title	Numerical Analysis I
Course Code	MH3700
Academic Units	3
Contact Hours	52
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	MH1200 AND MH1201 OR CY1602 OR MH2802
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

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.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Apply numerical methods for solving algebraic equations, for approximating mathematical functions and their derivatives and integrals
ILO 2	Decipher the mathematical analysis of the numerical methods, and the mathematical theory behind the numerical methods
ILO 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

Reading and References (if applicable)

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

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they are available.

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

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Revision of basic calculus, O notation	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
2	Iterative methods for solving algebraic equations	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
3	Iterative methods for solving algebraic equations	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
4	Interpolation methods for approximating functions	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
5	Interpolation methods for approximating functions	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
6	Interpolation methods for approximating functions	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
7	Approximation of derivatives, Richardson extrapolation	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
8	Approximation of derivatives, Richardson extrapolation	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
9	Midterm exam	1,2,3	Lecture notes will be provided	In-person	
10	Numerical integration	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
11	Numerical integration	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
12	Numerical integration	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap
13	Numerical integration	1,2,3	Lecture notes will be provided	In-person	Lecture and Wooclap

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	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 themathematical theory behind the methods. Examples will help you understand how to use the method in particular situations.
Laboratories	Practical lab tasks help you acquire experience applying the numerical method to solving particular problems numerically.
Tutorials	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.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Quiz 1 of 15 minutes)	1, 2, 3		5		Individual	Analytic	Relational
2	Continuous Assessment (CA): Class Participation(In-class activities during lectures)	1, 2, 3		5	Class participation is tracked via Wooclap during lectures. Completing at least 7 sessions earns full participation marks (5%), while 5–6 sessions earns partial participation (3%).	Individual	Analytic	Relational
3	Continuous Assessment (CA): Test/Quiz(One midterm exam of 1 hour duration)	1, 2, 3		30		Individual	Analytic	Relational
4	Summative Assessment (EXAM): Final exam()	1, 2, 3		60		Individual	Analytic	Relational

Description of Assessment Components (if applicable)

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.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Communication	Intermediate
Creative Thinking	Advanced
Curiosity	Advanced
Problem Solving	Advanced

Course Policy

Policy (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. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to attend all classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements. You are expected to participate in all discussions and activities.

Policy (Absenteeism)

Absence from quizzes, tests and examination without a valid reason will affect your overall course grade. If you have a valid reason for absence from quizzes, tests and examination, you must submit your reason to the school within the specified timeframe.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

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 yourown 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.

Appendix 1: Assessment Rubrics

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

Point-based marking (not rubrics based)

Rubric for Class Participation (5%)

Point-based marking (not rubrics based)

Class participation is tracked via Wooclap during lectures. Completing at least 7 sessions earns full participation marks (5%), while completing 5–6 sessions earns partial participation (3%).

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

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