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	Cyrus Mostajeran
Course Author Email	cyrussam.mostajeran@ntu.edu.sg
Course Title	Calculus II
Course Code	MH1101
Academic Units	4
Contact Hours	51
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	MH1100 or CY1601
Co-requisites	
Pre-requisite to	
Mutually exclusive to	MH111S, MH1800, MH1801, MH1802, MH1803, MH1805, MH1810, MH1811, CY1601
Replacement course to	
Remarks (if any)	

Course Aims

This course aims to develop fundamental mathematical concepts such as definite integrals and their applications to find areas and volumes, Fundamental Theorem of Calculus, integration techniques, tests for convergence and divergence of sequences and series, interval and radius of convergence of power series, differentiation and integration of power series, and Taylor series. Techniques learned in this course will prepare you for more advanced quantitative courses in mathematics, science and engineering.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	Describe definite integrals in terms of Riemann sums and area, and the Fundamental Theorem of Calculus
ILO 2	Classify and evaluate improper integrals
ILO 3	Apply integration to real-world problems such as finding the area between curves, and the volume of a solid of revolution
ILO 4	Evaluate integrals using the Substitution rule, integration-by-parts, Trigonometric substitution, and partial fractions
ILO 5	Estimate definite integrals using numerical methods
ILO 6	Evaluate the limit of a sequence using formal definition.
ILO 7	Give examples of convergent and divergent sequences and series
ILO 8	Determine the convergence of a sequence and perform appropriate convergence tests for series
ILO 9	Describe how a function can be expressed as a power series, determine radius and interval of convergence of a power series
ILO 10	Represent certain functions by manipulating geometric series or by differentiating or integrating known series
ILO 11	Find Taylor series of a given function using definition or by manipulating known series, and verify convergence of series using the Error Bound

Course Content

Antiderivatives, definite integrals, Fundamental Theorem of Calculus
Substitution rule & improper integrals, Area between curves
Volumes, Integration-by-parts
Trigonometric integrals, Trigonometric substitution, partial fractions
Numerical integration, Limit of sequences
Finding limit of sequences
Monotonic sequence, Series
Integral test & the comparison test.
Absolute & conditional convergence, the Ratio & Root test,
Power series, radius and interval of convergence
Manipulate geometric series, term-by-term differentiation and integration, Taylor & Maclaurin series
Verify convergence of series using the Error Bound, Binomial series, finding limits using power series
Summary

Reading and References (if applicable)

Stewart, James, Daniel K. Clegg, and Saleem Watson. *Calculus: Metric Version*. 9th ed. Boston, MA: Cengage, 2021 (ISBN-13: 9780357113462)

Hass, Joel R., Christopher E. Heil, Przemyslaw Bogacki, and Maurice D. Weir. *Thomas' Calculus*. 15th ed. Upper Saddle River, NJ: Pearson, 2022 (ISBN-13: 9780137559824)

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Antiderivatives, definite integrals, Fundamental Theorem of Calculus	1		In-person	
2	Substitution rule & improper integrals, Area between curves	2, 3		In-person	
3	Volumes, Integration-by-parts	3, 4		In-person	
4	Trigonometric integrals, Trigonometric substitution, partial fractions	4		In-person	
5	Numerical integration, Limit of sequences	5, 6		In-person	
6	Finding limit of sequences	7		In-person	
7	Monotonic sequence, Series	7, 8		In-person	
8	Integral test & the comparison test. (+ Midterm)	8		In-person	
9	Absolute & conditional convergence, the Ratio & Root test,	8		In-person	
10	Power series, radius and interval of convergence	9		In-person	
11	Manipulate geometric series, term-by-term differentiation and integration, Taylor & Maclaurin series	10		In-person	

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
12	Verify convergence of series using the Error Bound, Binomial series, finding limits using power series	11		In-person	
13	Summary			In-person	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures (39 hours)	Derivation and demonstration: Explain the motivation behind mathematical notions and ideas. Presents systematic ways to solve problems related to the concepts developed. Derive important formulas that are fundamental in the study of Calculus. Problem solving: Develops competence in solving a variety of problems related to integral calculus, sequences and series.
Tutorials (12 hours)	Derivation and demonstration: Explain the motivation behind mathematical notions and ideas. Presents systematic ways to solve problems related to the concepts developed. Derive important formulas that are fundamental in the study of Calculus. Problem solving: Develops competence in solving a variety of problems related to integral calculus, sequences and series. Peer Instruction: Develops communication and presentation skills and deepen understanding. You have the opportunity to work with peers and present your solution to the class.

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	Summative Assessment (EXAM): Final exam(Examination (2 hours))	2,5,6,7,8,9,10,11		60		Individual	Analytic	Multistructural
2	Continuous Assessment (CA): Assignment(Homework 1)	1,2,3		5	Online assignment through WebAssign (by Cengage)	Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Assignment(Homework 2)	6,7,8		10	Online assignment through WebAssign (by Cengage)	Individual	Analytic	Multistructural
4	Continuous Assessment (CA): Test/Quiz(Mid-semester Quiz)	1,2,3,4,5		20		Individual	Analytic	Multistructural
5	Continuous Assessment (CA): Class Participation(In-lecture Wooclap assessment)			5	You will need to complete 8 out of 12 Wooclap in-class activities to receive full marks. The best 8 scores will be used to assess each candidate.	Individual and Team	Analytic	Multistructural

Description of Assessment Components (if applicable)

Formative Feedback

Homework: Formative feedback provided upon completion.
Midterm Test: Feedback on common mistakes and students' midterm test scripts will be provided.
You will also receive formative feedback for all learning outcomes (including LO 9-11 tested in the final exam) during weekly tutorial classes from Week 2-Week 13.

NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level
Creative Thinking	Intermediate
Curiosity	Intermediate
Decision Making	Intermediate
Problem Solving	Advanced
Sense Making	Basic

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 lectures and tutorials. The course includes an in-class participation component.

Policy (Absenteeism)

Absence due to medical or other reasons

If you are sick and unable to attend a midterm test or missed the deadlines for your assignments, you must:

1. Send an email to the instructor regarding the absence.
2. Submit the original Medical Certificate* to an administrator.

*The Medical Certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

In this case, a makeup assessment will be arranged. If a make-up test cannot be arranged due to unavailability of venue or other circumstances, the weightage of the total course marks would subsequently be rescaled to a base of 100%.

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.

Collaboration Policy

Collaboration is encouraged for your homework because peer-to-peer learning helps you understand the subject better and working in a team trains you to better communicate with others in your profession. As part of academic integrity, crediting others for their contribution to your work promotes ethical practice.
You must write up your solutions by yourself and understand anything that you hand in.
If you do collaborate, you must write on your solution sheet the names of the students you worked with. If you did not collaborate with anyone, please explicitly write, “No collaborators." Failure to do so constitutes plagiarism.

Use of materials outside the course is strongly discouraged. If you use outside source, you must reference it in your solution.

Appendix 1: Assessment Rubrics

Rubric for Tutorials: Homework 1 (5%)
Point-based marking (not rubrics based)

Rubric for Class Participation: Wooclap (5%)
Point-based marking (not rubrics based)
Complete 8 out of 12 Wooclap in-class activities to receive full marks

Rubric for Tutorials: Homework 2 (10%)
Point-based marking (not rubrics based)

Rubric for Mid-semester Quiz: Short Answer Questions (20%)
Point-based marking (not rubrics based)

Rubric for Examination: Short Answer Questions (60%)
Point-based marking (not rubrics based)