COURSE OUTLINE: MH1101-MH111S

Course Title	**Calculus II**		
Course Code	**MH1101-MH111S**		
Offered	Study Year 1, Semester 2		
Course Coordinator	Ku Cheng Yeaw (Dr)	cyku@ntu.edu.sg	6513 8652
Pre-requisites	MH1100 or CY1601		
Mutually exclusive	MH111S, MH1800, MH1801, MH1802, MH1803, MH1805, MH1810, MH1811, CY1601		
AU	4		
Contact hours	Lectures: 39, Tutorials: 12		
Approved for delivery from	AY 2020/21 semester 2		
Last revised	25 Nov 2020, 10:50		

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 students for more advanced quantitative courses in mathematics, sciences and engineering.

Intended Learning Outcomes

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

1. Describe definite integrals in terms of Riemann sums and area, and the Fundamental Theorem of Calculus

2. Classify and evaluate improper integrals

3. Apply integration to real-world problems such as finding the area between curves, and the volume of a solid of revolution

4. Evaluate integrals using the Substitution rule, integration-by-parts, Trigonometric substitution, and partial fractions

5. Estimate definite integrals using numerical methods

6. Evaluate the limit of a sequence using formal definition.

7. Give examples of convergent and divergent sequences and series

8. Determine the convergence of a sequence and perform appropriate convergence tests for series

9. Describe how a function can be expressed as a power series, determine radius and interval of convergence of a power series

10. Represent certain functions by manipulating geometric series or by differentiating or integrating known series

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

Assessment

Component	Course ILOs tested	SPMS-MAS Graduate Attributes tested	Weighting	Team / Individual	Assessment Rubrics
Continuous Assessment					
Tutorials					
Homework 1	1, 2, 3	**1.** a, b, c **2.** a **3.** a, b **5.** a	10	individual	See Appendix for rubric
Homework 2	6, 7, 8	**1.** a, b, c **2.** a **3.** a, b **5.** a	10	individual	See Appendix for rubric
Mid-semester Quiz					
Short Answer Questions	1, 2, 3, 4, 5	**1.** a, b, c **2.** a, c **3.** a	20	individual	See Appendix for rubric
Examination (2 hours)					
Short Answer Questions	2, 5, 6, 7, 8, 9, 10, 11	**1.** a, b, c **2.** a, c **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

    a. Critically assess the applicability of mathematical tools in the workplace

    c. Develop new applications of existing techniques

3. Communication

   a. Present mathematics ideas logically and coherently at the appropriate level for the intended audience

   b. Work in teams on complicated projects that require applications of mathematics, and communicate the results verbally and in written form

5. Character

   a. Act in socially responsible and ethical ways in line with the societal expectations of a mathematics professional, particularly in relation to analysis of data, computer security, numerical computations and algorithms

Formative Feedback

Homework (CA1 & CA2): formative feedback is written in the students' homework solution, which are returned to the students.

Midterm Test (CA3): Feedback on common mistakes and students' midterm test scripts will be provided.

Students 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.

Learning and Teaching Approach

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. Students have the opportunity to work with peers and present their solution to the class.

Reading and References

James Stewart, Calculus (8th edition) ISBN: 978-1285740621

Course Policies and Student Responsibilities

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 missed component will not be counted towards the final grade.

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.

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
Ku Cheng Yeaw (Dr)	MAS-05-11	6513 8652	cyku@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course ILO	Readings/ Activities
1	Antiderivatives, definite integrals, Fundamental Theorem of Calculus	1	
2	Substitution rule & improper integrals, Area between curves	2, 3	
3	Volumes, Integration-by-parts	3, 4	CA1: Homework 1
4	Trigonometric integrals, Trigonometric substitution, partial fractions	4	
5	Numerical integration, Limit of sequences	5, 6	
6	Finding limit of sequences	7	CA3: Midterm Test
7	Monotonic sequence, Series	7, 8	
8	Integral test & the comparison test.	8	
9	Absolute & conditional convergence, the Ratio & Root test,	8	
10	Power series, radius and interval of convergence	9	CA2: Homework 2
11	Manipulate geometric series, term-by-term differentiation and integration, Taylor & Maclaurin series	10	
12	Verify convergence of series using the Error Bound, Binomial series, finding limits using power series	11	
13	Summary		

Appendix 1: Assessment Rubrics

Rubric for Tutorials: Homework 1 (10%)
Point-based marking (not rubrics based)

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)