

## COURSE OUTLINE: MH5101

Course Title	<b>Advanced Investigations in Calculus II</b>		
Course Code	<b>MH5101</b>		
Offered	Study Year X, Semester 2		
Course Coordinator	Ku Cheng Yeaw (Dr)	cyku@ntu.edu.sg	6513 8652
Pre-requisites	MH1101 OR Approval by the Division of Mathematical Sciences		
Co-requisites	MH1101		
AU	1		
Contact hours	Tutorials: 24		
Approved for delivery from	AY 2022/23 semester 2		
Last revised	10 Jan 2023, 11:43		

### Course Aims

This course is a supplement to MH1101 students who want to be challenged. You will develop problem solving skills for complex and challenging problems in Calculus related to integrals, sequences and series.

### Intended Learning Outcomes

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

1. Develop deeper understanding of mathematical concepts by solving complex problems.
2. Explain the processes used to arrive at solutions rather than remembering or applying a set of procedures.
3. Investigate complex problems by trying a variety of approaches and strategies.
4. Appreciate the relevance and usefulness of the concepts and tools in Calculus beyond standard text.
5. Present (in writing and speaking) mathematical ideas logically and coherently at the appropriate level for the intended audience.

### Course Content

Fundamental Theorem of Calculus, Applications of Integrations

Techniques of integrations

Numerical Integrations

Sequences and Series, Convergence Tests

Power Series, Taylor Series, Maclaurin Series

Fourier Series

Fourier Transforms

## Assessment

Component	Course ILOs tested	SPMS-MAS Graduate Attributes tested	Weighting	Team / Individual	Assessment Rubrics
<b>Continuous Assessment</b>					
<b>Tutorials</b>					
In-class presentations	1, 2, 3, 4, 5	1. a, b, c, d 2. a, b, c, d 3. a, b 4. a 5. a	40	individual	See Appendix for rubric
Assignments (2 sets)	1, 2, 3, 4, 5	1. a, b, c, d 2. a, b, c, d 3. a, b 4. a 5. a	25	individual	See Appendix for rubric
Test	1, 2, 3, 4, 5	1. a, b, c, d 2. a, b, c, d 3. a, b 4. a 5. a	35	individual	See Appendix for rubric
<b>Total</b>			<b>100%</b>		

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
- d. Use computer technology to solve problems, and to communicate mathematical ideas

### 2. Creativity

- a. Critically assess the applicability of mathematical tools in the workplace
- b. Build on the connection between subfields of mathematics to tackle new problems
- c. Develop new applications of existing techniques
- d. Critically analyse data from a multitude of sources

### 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

### 4. Civic-mindedness

- a. Develop and communicate mathematical ideas and concepts relevant in everyday life for the benefits of society

### 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

Assignments: formative feedback is written in the students' homework solution, which are returned to the students.

In-class presentations: Feedback on presentation and common mistakes will be provided during the weekly tutorials.

Test: Students will also receive a report on the test.

## Learning and Teaching Approach

<b>Tutorials</b> (24 hours)	Every week you will be assigned different problems to work on in advance before the class. During the lesson, you will take turn to present your work on the assigned problems. The course instructor will facilitate the discussions, and comments on common mistakes, important ideas and tools involved, and connection with related concepts and level of difficulty.
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## Reading and References

James Stewart, Calculus (8th edition)

ISBN-13: 978-1285740621

ISBN-10: 1285740629

## 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 weightage of the test will be transferred to the final exam.

Collaboration is encouraged for your assignment 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.

### 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.

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## 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	Fundamental Theorem of Calculus, Applications of Integrations	1, 2, 3, 4, 5	
2	Fundamental Theorem of Calculus, Applications of Integrations	1, 2, 3, 4, 5	In-class presentations
3	Techniques of integrations	1, 2, 3, 4, 5	In-class presentations
4	Techniques of integrations	1, 2, 3, 4, 5	In-class presentations & Assignment 1
5	Numerical Integrations	1, 2, 3, 4, 5	In-class presentations
6	Numerical Integrations	1, 2, 3, 4, 5	In-class presentations
7	Sequences and Series, Convergence Tests	1, 2, 3, 4, 5	In-class presentations
8	Sequences and Series, Convergence Tests	1, 2, 3, 4, 5	In-class presentations & Assignment 2
9	Power Series, Taylor Series, Maclaurin Series	1, 2, 3, 4, 5	In-class presentations
10	Power Series, Taylor Series, Maclaurin Series	1, 2, 3, 4, 5	In-class presentations
11	Fourier Series	1, 2, 3, 4, 5	In-class presentations
12	Fourier Transforms	1, 2, 3, 4, 5	In-class presentations
13	REVIEW	1, 2, 3, 4, 5	Test

## Appendix 1: Assessment Rubrics

### Rubric for Tutorials: In-class presentations (40%)

Category	Scoring Criteria
<b>Organization (25%)</b>	Did the student describe the background behind the topic?
	Was information organized in a logical and systematic manner?
	Did the student lay out the objectives well, and establish a framework for the rest of the presentation?
	Are technical terms well-defined in language appropriate for the target audience?
	Did the student concluded appropriately?
	Good time management?
<b>Visual and Oral Presentation (25%)</b>	Are the slides/presentation on the board informative?
	Are the slides/presentation too cluttered or too sparse, well prepared and not distracting?
	Clear and audible voice?
	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).
<b>Q &amp; A (50%)</b>	Did the student understand the questions, and answer to the point?
	Was the student confident in his/her answer?

### Rubric for Tutorials: Assignments (2 sets) (25%)

Point-based

### Rubric for Tutorials: Test (35%)

Point-based