

<b>Academic Year</b>	2017/18	<b>Semester</b>	1
<b>Course Coordinator</b>	Ng Keng Meng		
<b>Course Code</b>	MH1300		
<b>Course Title</b>	Foundations of Mathematics		
<b>Pre-requisites</b>	A-level Mathematics or equivalent		
<b>No of AUs</b>	4		
<b>Contact Hours</b>	Lecture Hours = 39, Tutorial Hours = 12		
<b>Proposal Date</b>	17 October 2017		

### Course Aims

This course aims to develop and equip you with the necessary skills for a mathematically related job. You should demonstrate a basic understanding of fundamental mathematical concepts and processes such as such as formal mathematical proofs. You should also learn the rigorous way to approach mathematical problems and to be familiar with the process of abstracting from examples, as these skills are essential for all future mathematics courses. You should develop critical analytical skills for a career in a mathematical related job. You will acquire the communication skills necessary to communicate technical ideas, both written and verbal, to a broad audience.

### Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) should be able to:

#### Elementary logic:

1. Distinguish between the different kinds of mathematical statements.
2. Apply the rules of elementary logic to correctly formulate mathematical arguments.
3. Apply truth tables to decide logical equivalence and the validity of arguments.
4. Differentiate between the different kinds of quantified statements.
5. Decide the truth of quantified statements.
6. Derive the different ways to prove a quantified statement.

#### Mathematical proofs:

7. Apply different proof techniques in various situations, including direct proofs, indirect proofs, proof by cases, proof by contraposition and proof by contradiction.
8. Distinguish between the different proof techniques above and judge when each method is more suitable than another.
9. Explain how to disprove a given mathematical statement.
10. Recall proof by mathematical induction.
11. Give examples of when strong mathematical induction is preferred over the regular form of induction.
12. Employ the use of the Well-ordering principle in problems.

#### Sets, relations and functions:

13. Describe the concept of a sequence and distinguish it from a series.

14. Describe the notion of a set and apply the different set operations to reason about them.
15. Apply the algebraic method and the element method to prove statements about sets.
16. Solve problems using the concept of relations and equivalence relations.
17. Describe the equivalence classes of a given equivalence relation.
18. Rediscover functions as relations.
19. Judge when a given function is injective, surjective or bijective.
20. Explain the concept of function composition and inverse.

**Systems of numbers:**

21. Differentiate natural numbers and other systems of numbers.
22. Perform basic arithmetical operations on complex numbers.
23. Produce the complex roots of a given complex value.
24. Administer the Division and Euclidean algorithms to solve for various quantities such as the greatest common divisor and apply them to linear combinations.
25. Solve simple equations involving modulo arithmetic.

**General skills:**

26. Independently describe underlying mathematical concepts and solve related, but not previously encountered problems.

**Course Content**

1. Elementary logic, mathematical statements, quantified statements
2. Sets, operations on sets, Cartesian products, properties of sets
3. Natural numbers, integers, rational numbers, real numbers, complex numbers
4. Relations, equivalence relations, equivalence classes
5. Functions, injective and surjective functions, inverse functions, composition of functions
6. Division algorithm, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, modulo arithmetic

## Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Final Examination	All	A1-A3, B1, B3-B4	60%	Individual	Point-based marking
2. Continuous Assessment 1 (CA1): Midterm Test	1-10	A1-A3, B1	25%	Individual	Point-based marking
3. CA2: Assignments	All	A1-A2, B1, B4, C1-C2, E	15%	Individual	Point-based marking
Total			100%		

### Formative feedback

For the midterm and final exams, feedback on the common mistakes are given on NTULearn after the grades are announced.

For the HW, tutors will discuss and answer any questions about mistakes.

### Reading and References

- *Main Textbook* – Discrete Mathematics with Applications, Susanna S. Epp, Thomson Brooks, 4<sup>th</sup> Edition.
- *Reference* – Discrete Mathematics, Richard Johnsonbaugh, Pearson New International Holding, 7<sup>th</sup> Edition.
- *Reference* – Discrete Mathematics with its Applications, Kenneth Rosen, McGraw Hill, 6<sup>th</sup> Edition.

## **Course Policies and Student Responsibilities**

### **(1) General**

Students are expected to complete all assigned pre-class readings and activities, attend all tutorial classes punctually and take all scheduled assignments and tests by due dates. Students are expected to participate in all tutorial discussions and activities.

### **(2) Absenteeism**

Absence from the midterm without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for CA components.

All homework assignments must be submitted to your tutor by the end of the tutorial session. Failure to do so will affect your score.

## **Academic Integrity & Collaboration Policy**

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.

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. 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.

### Course Instructors

Instructor	Phone	Email	Office Location
Ng Keng Meng		kmng@ntu.edu.sg	MAS-05-09

### Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1-3	Elementary Logic	1-6, 26	
4-9	Mathematical Proof	7-12, 26	
10-11	Sets, relations and functions	13-20, 26	
12-13	Systems of numbers	21-25, 26	