COURSE OUTLINE: MH1812

Course Title	**Discrete Mathematics**		
Course Code	**MH1812**		
Offered	Study Year 1, Semester 1		
Course Coordinator	Gary Greaves (Dr)	gary@ntu.edu.sg	6513 8652
Pre-requisites	None		
Mutually exclusive	CE1001, CZ1001, MH1301		
AU	3		
Contact hours	Flipped Classroom: 13, Lectures: 13, Tutorials: 12		
Approved for delivery from	AY 2020/21 semester 1		
Last revised	13 Jun 2020, 16:46		

Course Aims

This course serves as an introduction to various topics in discrete mathematics. Familiarity with formal analysis through simple problems in some basic discrete structures is a key objective rather than knowing these structures in depth. Specifically, the main aim is to learn topics from the following broad areas of discrete mathematics: number theory, logic, combinatorics, and graph theory.

This course aims to provide students with a solid mathematical foundation and is intended for first year computer science and computer engineering students.

Intended Learning Outcomes

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

1. Identify which integers are congruent modulo a positive integer
2. Formulate, interpret, and manipulate logical statements
3. Identify valid and invalid arguments
4. Prove elementary mathematical results using various proof techniques
5. Apply basic tools for counting
6. Solve linear recurrence relations
7. Identify two equal sets and provide justification that these sets are equal
8. Manipulate relations and functions between sets
9. Apply basic techniques in graph theory

Course Content

Elementary Number Theory: Types of numbers, Euclidean division, modular arithmetic, operator closure. Propositional Logic: Propositions, logical operators, compound propositions, truth tables, equivalent statements, De Morgan's laws

Propositional Logic: Logical equivalence laws, order of operations, arguments, inference rules.

Predicate Logic: Predicates, quantification, negating quantifiers, determining truth values.

Predicate Logic: Conditional quantification, inference rules. Proof Techniques: Direct proof, proof by induction

Proof Techniques: Proof by contradiction, proof by contrapositive. Combinatorics: Principle of counting, combinations, permutations.

Linear Recurrence Relations: Solving by backtracking, solving by characteristic equation. Set Theory: Sets, union, intersection, set difference, set equivalence, cardinality, power sets

Set Theory: Cartesian products, double inclusion.

Relations: Relations, relations on a set, reflexivity, symmetry, antisymmetry, transitivity.

Relations: Equivalence relations, partial orders, matrix representation, composition, ternary relations.

Functions: Functions, injectivity, surjectivity, bijectivity, inverse, composition

Functions: Floor and ceiling, pigeonhole principle, countable sets, Cantor's diagonal argument.

Graph Theory: Graphs, vertices, edges, subgraphs, multigraphs, directed graphs, Euler paths/cycles, Euler's theorem.

Graph Theory: complete graphs, bipartite graphs, handshaking lemma, adjacency matrix, Hamilton cycles, graph isomorphism.

Assessment

Component	Course ILOs tested	EAB Graduate Attributes tested	Weighting	Team / Individual	Assessment Rubrics
Continuous Assessment					
Mid-semester Quiz					
Short Answer Questions 1	1, 2, 3	a, c, e, j, l	25	individual	See Appendix for rubric
Short Answer Questions 2	4, 5, 6, 7	a, c, e, j, l	25	individual	See Appendix for rubric
Examination (2 hours)					
Short Answer Questions	1, 2, 3, 4, 5, 6, 7, 8, 9	a, c, e, j, l	50	individual	See Appendix for rubric
		Total	**100%**		