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South East Technological University

# Module Descriptor

# Discrete Mathematics (Computing and Mathematics)

# Discrete Mathematics (A10841)

**Short Title:** Discrete Mathematics
**Department:** Computing and Mathematics
**Credits:** 5 **Level:** Introductory

## Description of Module / Aims

This module provides a solid foundation of selected topics in discrete mathematics related to computing and information sciences. The topics are covered in an elementary manner in order to reinforce understanding of concepts and improving algebraic problem-solving skills so that the student can effectively proceed with their study of a degree programme in computing.

## Programmes

| | | stage/semester/status |
|---|---|---|
| MATH-0001 | BSc (Hons) in Applied Computing (International) (WD_KACCM_BI) | 2 / 3 / M |
| MATH-0001 | BSc (Hons) in Applied Computing (WD_KACCM_B) | 1 / 1 / M |
| MATH-0001 | BSc (Hons) in Applied Computing (WD_KCOMP_B) | 1 / 1 / M |
| MATH-0001 | BSc (Hons) in Computer Forensics and Security (WD_KCOFO_B) | 1 / 1 / M |
| MATH-0001 | BSc (Hons) in Computer Science (WD_KCMSC_B) | 1 / 1 / M |
| MATH-0001 | BSc (Hons) in the Internet of Things (International) (WD_KINTT_BI) | 2 / 3 / M |

## Indicative Content

- Sets, relations and functions: Venn diagrams; set operations and their laws; properties of relations; function domain, range and target set; function composition; function definition using lookup table, direct formula, and recursion
- Proofs and predicate logic: Propositions; logical connectives and truth tables; informal arguments and formalising arguments; introduction to predicates and quantifiers
- Proof techniques: direct proof; induction; proof by contradiction and counterexamples
- Enumeration: combinatorial enumeration problems; permutations and combinations; binomial expansions
- Graph Theory: Basic definitions; graph traversal techniques and applications
- Recurrence Relations: sigma and product notation; finite sequences and recurrence relations; iteration techniques

## Learning Outcomes

*On successful completion of this module, a student will be able to:*

1. Demonstrate competency in algebraic manipulation of expressions involving sets, combinatorials, predicate logic elements and finite sequences.
2. Use mathematical reasoning to comprehend and construct mathematical arguments (direct proof, proof by contradiction, mathematical induction).
3. Employ elementary combinatorial techniques to resolve simple problems.
4. Use basic concepts in graph theory to represent and solve problems arising in computer science.
5. Compute basic recurrence relations and construct a recurrence relation when given a descriptive problem.
6. Apply concepts and methods in discrete mathematics to problems using a computer.

## Learning and Teaching Methods

- Delivery of the subject will be through a mixture of lecture, tutorials and computer based practical sessions.
- The lectures will be used to introduce the context for the material, develop theory and lead students through worked examples.
- The tutorials will provide a forum through which the student will rehearse/refine the demonstrated skills. Students will be encouraged, through the problem sheets, to construct valid and precise mathematical arguments and will be expected to produce solutions using appropriate mathematical notation.
- The practical programme is designed to re-enforce the strong interconnections between discrete mathematics and Computer Science concepts through the use of CAS and guided development of students own code. A typical activity consists of investigating the effect on computation time of different recursive and iterative implementation of a recurrence relation solver and their role in computer science.
- Active engagement with frequent practise on examples is strongly encouraged through regular course work and formative class tests.

## Learning Modes

| Learning Type | F/T Hours | P/T Hours |
|---|---|---|
| Lecture | 36 | |
| Tutorial | 12 | |
| Practical | 12 | |
| Independent Learning | 75 | |

## Assessment Methods

| | Weighting | Outcomes Assessed |
|---|---|---|
| Continuous Assessment | 25% | |
| Practical | 25% | 6 |
| Final Written Examination | 75% | 1,2,3,4,5 |

## Assessment Criteria

*<40%:* Inability to demonstrate knowledge or understanding of the main concepts in discrete mathematics as outlined in the syllabus content, inability to apply concepts to selected problems.

*40%–49%:* Able to demonstrate a basic understanding of the fundamental concepts and techniques in vector calculus and matrix systems as concepts outlined in syllabus content.

*50%–59%:* In addition to above, using appropriate mathematical notation.

*60%–69%:* All the above, in addition be able to determine appropriate mathematical techniques to analyse applied problems and to express their work with rigour and precision.

*70%–100%:* All the above to an excellent level. Demonstrates an ability to put a solution into a context and assess whether such solutions are meaningful.

## Supplementary Material(s)

- Johnsonbaugh, R. *Discrete Mathematics*. 7th. NY: Macmillan, 2008.

## Requested Resources

- Room Type: Computer Lab