MODULE SPECIFICATION

Part 1: Information			
Module Title	Algebra, Combinatorics and Graphs		
Module Code	UFMFC7-30-2	Level	Level 5
For implementation from	2018-19		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Contributes towards			
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

Educational Aims: See Learning Outcomes

Outline Syllabus: This module provides an introduction to three mutually interacting areas of Mathematics, namely abstract algebra, graph theory and combinatorics. Loosely, abstract algebra is the study of sets equipped with binary operations. A very important part of abstract algebra is group theory, this being one of the main ways of describing notions of 'symmetry', and the module provides a rigorous introduction to this area. The second area, namely graph theory, is the study of 'networks', these being objects that appear throughout Mathematics and its applications. Finally, combinatorics is the study of finite sets, in particular the generation of such sets, and the computation of their cardinality. In addition to studying each area individually, the module examines the rich interaction between them, thereby shedding light both on theory and on applications. Important themes that arise across Mathematics, for example the notion of a morphism and the idea of a relation, thread through this module. The module utilises, in particular, the student's knowledge - acquired at level one - of set theory, of number systems, of linear algebra, and of basic graph theory, and it also exploits mathematical experience and maturity. This module provides a vehicle for exploring the power of the axiomatic methodology

that is at the very heart of Mathematics. The areas covered in this module all display the important mathematical skills of working with abstract ideas and applying these to model the situations that are encountered in applications.

Basic Ideas:
Brief revision of number systems, sets, functions and cardinality.
Binary relations, equivalence relations and set partitions.
Modular arithmetic.
General themes in mathematical theories.

Algebra:
Binary operations, monoids and groups.
The group of units of a monoid.
Basic properties of groups.
Direct product groups.
Subgroups.
Cyclic groups.
Group actions.
Group homomorphisms and group isomorphisms.
Cosets, Lagrange's Theorem and the Orbit-Stabiliser Theorem.

Combinatorics:
Basic counting techniques.
Combinations, permutations and partitions.
Cardinality of sets of functions.
Combinatorial proof.
Recurrence relations.
Generating functions.
The Orbit-Counting Theorem and its applications.

Graphs:
Revision of basic graph theory and of graph models.
Important families of graphs.
Representing graphs.
Graph homomorphisms and graph isomorphisms.
Colouring of graphs.
Connectivity of graphs.
Planarity of graphs.

Teaching and Learning Methods: The module is delivered by means of lecture and tutorials. Attendance at all classes is strongly encouraged, both in terms of learning, and also as part of the preparations for assessment.

Throughout the module, connections are made between the three mathematical areas that constitute the syllabus.

In order to prepare for assessment, students are expected to undertake self-directed learning in addition to the directed learning that supports taught classes.

Typically, the scheduled teaching hours take the form of:

(i) whole group lectures, used to deliver new material and to consolidate previous material;
(ii) small-group workshops/tutorials with activities designed to reinforce and to enhance students' understanding of the lecture material.

Contact time 72 hours
Assimilation and development of knowledge 150 hours
Coursework preparation 22 hours
Examination preparation 56 hours
TOTAL 300 HOURS

Part 3: Assessment

Assessment A1 is a written examination that is based on a portfolio of materials - e.g., suggested reading, a coursework style brief - supplied to the students beforehand.

Prior to the examination, the student has ample time to engage with the portfolio, which relates to the topics delivered in the first teaching block and to extensions or applications of these areas. The examination itself, which takes place in January, is designed to test the individual student's knowledge and understanding of the materials in the portfolio. Assessment A1 is summative and formative in that it tests both the student's comprehension of some of the topics covered during the first teaching block and also the student's ability to extend their knowledge of this material in the context of more challenging problems. This January examination also tests the student's ability to exhibit independent learning by means of assessment based on directed reading.

The student may be allowed to take into examination A1 certain specified notes or other documents, these instructions' being notified to the students well in advance of the examination.

Assessment A2 is a traditional, closed-book, unseen written examination that assesses the student's understanding of concepts and techniques from across the entire module, and also their ability to apply these. This examination takes place in May and is purely summative.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Examination - Component A		25 %	A1 Examination (3 hours) January
Examination - Component A	✓	75 %	A2 Examination (3 hours) May
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Examination - Component A	✓	100 %	Exam - 3 hours

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will be able to:

	Module Learning Outcomes
MO1	To exhibit a basic, but thorough, knowledge and understanding of the theory of groups and of group actions.
MO2	To select and to apply appropriate techniques to solve problems involving the counting and generation of discrete mathematical objects
MO3	To show detailed knowledge and understanding of basic techniques of graph theory, including both theoretical and algorithmical aspects
MO4	To make clear definitions, to state theorems precisely, and to construct proofs utilising correct mathematical language and notation from the theories of groups, combinatorics and graphs.

Contact Hours	**Contact Hours**	
	Independent Study Hours:	
	Independent study/self-guided study	228
	Total Independent Study Hours:	228
	Scheduled Learning and Teaching Hours:	
	Face-to-face learning	72
	Total Scheduled Learning and Teaching Hours:	72
	Hours to be allocated	300
	Allocated Hours	300
Reading List	*The reading list for this module can be accessed via the following link:* https://uwe.rl.talis.com/modules/ufmfc7-30-2.html	