



Module Specification

Graphs, Algebra and Algorithms

Version: 2023-24, v3.0, 03 Jul 2023

Contents

Module Specification	1
Part 1: Information	2
Part 2: Description	2
Part 3: Teaching and learning methods	4
Part 4: Assessment.....	5
Part 5: Contributes towards	6

Part 1: Information

Module title: Graphs, Algebra and Algorithms

Module code: UFMFMV-30-2

Level: Level 5

For implementation from: 2023-24

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Computer Sci & Creative Tech

Partner institutions: None

Field: Computer Science and Creative Technologies

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module develops algebraic and algorithmic aspects of graph theory, the latter being an area of Mathematics that is very important, both from a theoretical viewpoint and in terms of its many applications in solving real-world problems.

The module also considers algorithms in a more general context and explore some uses of algorithms in areas other than graph theory. The module involves a continuation of the development of linear algebra that was initiated in Level Four. If

appropriate, then software or programs will be used for computations. Simple applications will be introduced at appropriate points.

Features: Not applicable

Educational aims: The aim of this module is develop a deeper understanding of structures within mathematics.

The module demonstrates the central role of linear algebra in mathematics with particular focus on graph theory and its applications.

The module also introduces algorithms in order to implement theoretical aspects and to consider applications.

Outline syllabus: Basic Graph Theory [3 weeks]

Simple graphs (basic definitions and properties)

Special families of simple graphs, bipartite graphs and regular graphs

Subgraphs

Homomorphisms, isomorphisms and graph invariants

Operations on graphs

Connectivity

Metric space aspects

Chromatic Graph Theory [3 weeks]

Vertex colourings

Colourings and homomorphisms

The chromatic number

The chromatic polynomial

The Four Colour Theorem

Spectral Graph Theory [5 weeks]

Vector spaces and linear transformations associated with a simple graph

The adjacency spectrum

The Laplacian spectrum

Spectra of special graphs

Cospectral graphs

The interaction between linear algebra properties and graph theoretic properties (possible examples include diameter, connectivity, clique number and chromatic number)

Introduction to Algorithms [2 weeks]

Purpose and design

Computational complexity

Correctness

Programming aspects

Algorithms in Action [8 weeks]

Indicative application areas

Depth-first search and breadth-first search

Walks and paths (including the Travelling Salesperson Problem)

Network flows

Coding theory

Number theory

Linear algebra

Abstract algebra

Part 3: Teaching and learning methods

Teaching and learning methods: The teaching and learning strategy will involve taught material that is interspersed with individual or group activities that develop understanding of the theory and of its applications. The activities will include calculations and investigations within a framework of problem-based learning. It is envisaged that a single multi-purpose room, e.g., a TEAL space, will be utilised for all the contact sessions.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Select and apply appropriate techniques to analyse and to solve algebraic problems related to graph theory.

MO2 Define and identify the mathematical structure of graphs and of algorithms.

MO3 Use software to implement and to adapt mathematical algorithms.

MO4 Communicate mathematical arguments clearly and effectively, by selecting and using appropriate notation, logic, concepts and techniques.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at [readinglists.uwe.ac.uk](https://rl.talis.com/3/uwe/lists/9EA54638-3264-8A68-62D8-8C1AD4FAD0E3.html?lang=en-GB&login=1) via the following link <https://rl.talis.com/3/uwe/lists/9EA54638-3264-8A68-62D8-8C1AD4FAD0E3.html?lang=en-GB&login=1>

Part 4: Assessment

Assessment strategy: At both first sit and resit, summative assessment for this module consists of a single, end of teaching block examination. The exam will be a mix of seen and unseen questions. Mid-block, formative assessment will help the students recognise their progress on their module and aid their preparation for the final assessment.

Assessment tasks:

Examination (First Sit)

Description: Exam (3 hours)

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4

Examination (Resit)

Description: Exam (3 hours)

Weighting: 100 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mathematics [Frenchay] BSc (Hons) 2022-23

Mathematics with Qualified Teacher Status [Sep][FT][Frenchay][3yrs] - Not Running
BSc (Hons) 2022-23

Mathematics with Qualified Teacher Status {Foundation} [Sep][FT][Frenchay][3yrs] -
Not Running BSc (Hons) 2021-22

Mathematics {Foundation}[Sep][FT][Frenchay][4yrs] BSc (Hons) 2021-22

Mathematics {Foundation}[Sep][SW][Frenchay][5yrs] BSc (Hons) 2021-22