# MODULE SPECIFICATION

| Part 1: Information | | | |
|---|---|---|---|
| Module Title | Decision Modelling | | |
| Module Code | UFMFY7-30-3 | Level | Level 6 |
| 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:** The syllabus includes:

Decision Problems under Conditions of Uncertainty. Single attribute utility functions, first and second order stochastic dominance, axioms of utility, utility elicitation. Risk analysis using simulation.

Structuring decision problems. Decision trees, assessment of decision structure. Assessing probabilities. Elicitation methods: Assessment probabilities for rare events, fault and event trees. Measurement of judgmental skill: calibration, Brier scores. Biases in probability assessment.

Revision of Opinion. Bayes' theorem, the expected value of perfect and imperfect information.

Descriptive Decision Models. Lexicographic and semi-lexicographic ordering, elimination by aspects, satisficing prospect theory. Decision Problems involving Multiple Objectives under conditions of certainty. Resource allocation problem.

Introduction to Game Theory. The prisoner's dilemma. Two-person zero-sum games and linear programming. Algorithmic Game Theory. Modelling Network Traffic using Game Theory. Braess' paradox. Heuristics.

Markov processes. Transition Matrices, Absorbing States, Steady States. Application to business.

Introduction to Optimisation in Decision Modelling, the scope of Mathematical Programming (MP). Types of Linear and Combinatorial Optimisation models.

Linear Programming Applications and Models. Multi-objective Optimisation and Goal Programming. Dynamic Programming and Shortest Path problems. Network Flow Optimisation.

The use of specialist MP languages (such as AMPL, GAMS, CMPL, OPL).

Integer Programming Models for Discrete Optimization, Branch-and-Bound methods for Integer Programming, Applications of Integer Programming.

Computational Complexity. Optimisation and combinatorial problems where heuristics are needed. The Travelling Salesman Problem as a representative example.

Basic Local Search approach. The evaluation function. Neighbourhood structures. Hill climbing. Local and global optimums. Intensification and Diversification strategies. Evolutionary Algorithms.

**Teaching and Learning Methods:** The module will be delivered by lectures, workshops and tutorials. The lectures will be used to outline the main concepts and to demonstrate the application of decision modelling methods.

The workshops, tutorials and computer laboratory classes will develop model building and problem solving skills. The aim will be on developing an appreciation of how the methods work and the use of computer programs to implement them rather than an undue emphasis on hand cranking through the algorithms. To prepare for assessment, students are expected to undertake self-directed learning in addition to the directed learning which supports taught classes.

Contact time 75 hours
Assimilation and development of knowledge 150 hours
Assessment 75 hours
TOTAL 300 HOURS

Scheduled teaching hours takes the form of:
Whole group lectures, used to deliver new material and to consolidate previous material, and workshop sessions used for case studies and more challenging examples;
Small-group tutorials and computer laboratory class, with activities designed to reinforce analytical and modelling skills.

| Part 3: Assessment | | | |
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| Component A consists of an examination, which assesses students' understanding of the module's concepts and techniques, and their ability to apply them in various situations and problems.<br><br>Component B consists of a coursework, which assesses students' ability to critically apply concepts and techniques of the module. | | | |
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| First Sit Components | **Final Assessment** | **Element weighting** | **Description** |
| Written Assignment - Component B | | 20 % | Coursework element 1 |
| Written Assignment - Component B | | 30 % | Coursework element 2 |
| Examination - Component A | ✓ | 50 % | Written examination (2 hours) |
| Resit Components | **Final Assessment** | **Element weighting** | **Description** |
| Written Assignment - Component B | | 50 % | Coursework |
| Examination - Component A | ✓ | 50 % | Written examination (2 hours) |

**Part 4: Teaching and Learning Methods**

Learning Outcomes

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

| | **Module Learning Outcomes** |
|---|---|
| MO1 | Show a detailed knowledge and understanding of the decision analysis techniques and the mathematical programming techniques presented and their application |
| MO2 | Understand how individuals and groups of individuals make decisions and tackle complex decisions in a rational manner |
| MO3 | Use a number of decision analysis and mathematical programming techniques to model problems and support decision making |
| MO4 | Critically evaluate the above techniques through knowledge of their rationale and underpinning assumptions |

Contact Hours

| **Contact Hours** | |
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| **Independent Study Hours:** | |
| Independent study/self-guided study | 225 |

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| | **Total Independent Study Hours:** | 225 |
| | **Scheduled Learning and Teaching Hours:** | |
| | Face-to-face learning | 75 |
| | **Total Scheduled Learning and Teaching Hours:** | 75 |
| | **Hours to be allocated** | 300 |
| | **Allocated Hours** | 300 |
| Reading List | *The reading list for this module can be accessed via the following link:*<br><br>https://uwe.rl.talis.com/modules/ufmfy7-30-3.html | |