Module MATH 1812 - Algorithms v2 (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

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MATH 1812: Algorithms

Module Details

Module Code:	MATH 1812
Module Long Title:	Algorithms APPROVED
Banner Title:	Algorithms
Version:	2
Valid From:	Sept 2023 (September 2023)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	JOHN BUTLER
Module Coordinators:	JOHN BUTLER (04 September 2023 to ---)
School Responsible:	School of Mathematics & Statistics
Campus:	City Campus
Module Overview	This module introduces the learner to basic algorithms and their implementation. The theory and application of this subject is a cornerstone of computer science and data analytics. The module does not assume a prior knowledge of computer science.
Indicative Syllabus	• Data types and structures. Problem specification, divide and conquer, stepwise refinement, top down, bottom up, algorithms, pseudo-code. • Array, lists, stacks, queues, trees, abstract data types. • Summations, products, permutations, factorials and Fibonacci numbers • Network algorithms for connnecting and counting groups • Internal and external sorting algorithms. Sorting Terminology and notation. Various sorting algorithms. Empirical comparison of sorting algorithms. • Searching algorithms, searching arrays, dynamic data structures, trees. • Encryption and decryption methods • Pseudorandom number generators, middle-square method. • Nodal representations of function with applications for example neural networks.
Learning and Teaching Methods	The module will be delivered by a combination of lectures and tutorials. The student self-study will include the use of the programming language introduced earlier in their studies to implement the algorithms.

Module MATH 1812 - Algorithms v2 (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Define different data structures
MLO2	Identify the steps of an algorithm
MLO3	Analyse the issues involved in algorithm complexity and performance
MLO4	Design and implementation of sums and products algorithms
MLO5	Design and implementation of network nodal connections. Nodal representation of functions
MLO6	Design and implementation of sorting algorithms
MLO7	Design and implementation of searching algorithms
MLO8	Design and implementation of random number generating algorithms
MLO9	Design and implementation of encryption and decryption algorithms

Requisites

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Assessments

Formal Examination

Assessment Type	Written Examination	**% of Total Mark for Module**	70
Indicative Week	Week 14	**Learning Outcomes**	1,2,3,4,5,6,7,8,9
Assessment Threshold:	35	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Other Assessment(s)

Assessment Type	Artefact	**% of Total Mark for Module**	30
Indicative Week	Week 1	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	39
Self Directed	61
Hours (up to 100 for 5 ECTS credits)	100.00

Recommended Reading List

Recommended Book Resources

Robert Sedgewick,Kevin Wayne. (2011), Algorithms, Addison-Wesley Professional, p.955, [ISBN: 032157351X].

Module MATH 1803 - Discrete Mathematics I v1 (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

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MATH 1803: Discrete Mathematics I

Module Details

Module Code:	MATH 1803
Module Long Title:	Discrete Mathematics I APPROVED
Banner Title:	MATH 1803 Discrete Mathematics
Version:	1
Indicative NFQ level:	Level 8
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	MAEV P MAGUIRE
Module Coordinators:	MAEV P MAGUIRE (03 October 2019 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module introduces the learner to areas in discrete mathematics such as Number Systems, Boolean Algebra and Set Theory.
Indicative Syllabus	**Number Systems** Binary, octal, denary and hexadecimal number systems. Conversion from denary to any number system and from any number system to denary. Horner's method of conversion. Conversion from octal to hexadecimal via binary and vice versa. Binary arithmetic. One's (1's) complement method for subtracting binary numbers. **Boolean Algebra** Basic laws of Boolean Algebra- AND, OR, NOT operators. Truth tables. Proof by perfect induction. Algebraic simplification of Boolean expressions. De Morgan's theorem for complements. Use of Karnaugh maps for simplification of Boolean expressions. Applications to switching circuits. **Set Theory** Algebra of sets, power sets, cardinality. Representation using Venn diagrams. Cartesian product of sets. Relations. Properties of relations – transitive, reflexive and symmetric. Definition of functions as subsets of relations. Composition of functions. Properties of functions – injective, surjective and bijective.
Learning and Teaching Methods	2 hours lectures and 1 hour tutorial session per week supplemented by notes and problem sheets.

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Convert from denary number systems to any other number systems and vice versa;
MLO2	Use Horner's method of conversion;
MLO3	Use binary arithmetic;
MLO4	Subtract binary numbers using 1's complement method;
MLO5	Understand Boolean Algebra arithmetic;
MLO6	Simplify Boolean expressions both algebraically and by using Karnaugh maps;
MLO7	Apply Boolean algebra to switching circuits;
MLO8	Understand the algebra of sets;
MLO9	Compute the cartesian product of sets;
MLO10	Define and identify properties of relations and functions.

Requisites	
Assessment Threshold	Exam must exceed 35%

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Assessments

Formal Examination			
Assessment Type	Written Examination	**% of Total Mark for Module**	70
Indicative Week	Week 15	**Learning Outcomes**	1,2,3,4,5,6,7,8,9,10
Assessment Threshold:	35	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description LO 1-10			

Other Assessment(s)			
Assessment Type	In Class Test	**% of Total Mark for Module**	30
Indicative Week	Week 6	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description LO 1-5			

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	39
Self Directed	61
Hours (up to 100 for 5 ECTS credits)	100.00

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MATH 1801: Foundation Mathematics

Module Details

Module Code:	MATH 1801
Module Long Title:	Foundation Mathematics APPROVED
Banner Title:	Foundation Mathematics
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	10
ISCED Code:	0541 - Mathematics
Current Coordinator::	CORMAC BREEN
Module Coordinators:	• PAUL MOLLOY (04 April 2019 to 06 December 2021) • CORMAC BREEN (06 December 2021 to ---)
School Responsible:	School of Mathematics & Statistics
Campus:	City Campus
Module Overview	This module covers the basic areas of mathematics. The high tutorial content encourages the learner to complete problem sheets and so lay a strong foundation for other more advanced areas of mathematics.

Indicative Syllabus	**Arithmetic** : Integers, powers and indices, fractions and decimals, fractional powers and logarithms. **Basic Algebra** : Manipulation of symbols, formulae and equations, factorisation, inequalities. **Straight Lines** : Different forms of the equation of a straight line, intersection of two lines, linear inequalities. **Quadratics** : The quadratic curve, quadratic equations and roots, completing the square, applications. **Further Algebra** : Arithmetic and geometric progressions, sigma notation, polynomials, remainder and factor theorems, partial fractions. **The Binomial Theorem** : Factorial notation, combinations, the expansion of $(1+x)^n, n \in \mathrm{N}$, the General Binomial Theorem. **Trigonometry** : The unit circle, radian measure, trigonometric functions and their graphs, relationships between angles, compound angles, cosine and sine rules, solution of triangles, changing products to sums and sums to products. **Complex Numbers** : The imaginary unit i, addition, multiplication and division of complex numbers, geometric representation, conjugate and modulus, polar form. De Moivre's theorem. Roots of a complex number. Complex polynomials, the remainder and factor theorems. The fundamental theorem of algebra. **Functions** : Domain, codomain, range. One-one, onto and bijections. Composition of functions. Inverse functions including trigonometric functions. **Induction** . Prove simple results by induction.
Learning and Teaching Methods	Lectures supported by problem-solving sessions and the use of mathematical software packages.

Module MATH 1801 - Foundation Mathematics v1 (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Manipulate and simplify arithmetic and algebraic formulae and equations
MLO2	Sketch the graphs of straight lines and quadratic functions
MLO3	Use the Binomial Theorem for approximations
MLO4	Solve triangles
MLO5	Perform operations on complex numbers
MLO6	Find the compositions and inverse of functions.

Requisites	
Assessment Threshold	Exam 35%

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Assessments

Formal Examination

Assessment Type	Written Examination	**% of Total Mark for Module**	70
Indicative Week	Week 15	**Learning Outcomes**	1,2,3,4,5,6
Assessment Threshold:	35	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Other Assessment(s)

Assessment Type	In Class Test	**% of Total Mark for Module**	30
Indicative Week	Week 7	**Learning Outcomes**	1,2,3
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	52
Tutorial	26
Self Directed	122
Hours (up to 100 for 5 ECTS credits)	200.00

Module MATH 1810 - Introduction to Scientific Python v1 (Year/Cycle:1 / Semester:Semester 1 / Delivery Type: Mandatory)

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MATH 1810: Introduction to Scientific Python

Module Details

Module Code:	MATH 1810
Module Long Title:	Introduction to Scientific Python APPROVED
Banner Title:	Intro to Scientific Python
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	STEPHEN O SULLIVAN
Module Coordinators:	STEPHEN O SULLIVAN (20 October 2019 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	

This module introduces the learner to programming for mathematical sciences through Python. The learner will acquire the skills necessary to write basic programs to investigate problems in mathematics. These skills will form the foundation for further computational modelling using Python.

Indicative Syllabus

- Variables.
- Comments.
- Printing output.
- Mathematical expressions; modules; the *math* module and its functions. Motion under gravity; normal distribution.

- Lists; w *hile* and *for* loops. Arithmetic and geometric series; factorial.
- Boolean expressions and *if* statements. Piecewise functions.
- Scope and ternary operators.
- Input; exceptions.
- *NumPy* module; arrays; function vectorization. Inverting matrices; solving linear systems.
- Plotting; the *Matplotlib* library.
- Classes, methods. Attributes. Protection of attributes. Motion under gravity revisited.

Learning and Teaching Methods

The module will be delivered through a combination of lectures and tutorials. Learning will be supported through provided sample programs and laboratory sessions.

Module MATH 1810 - Introduction to Scientific Python v1 (Year/Cycle:1 / Semester:Semester 1 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Execute Python statements.
MLO2	Use variables, mathematical expressions, functions and obtain program output.
MLO3	Access mathematical modules and built-in functions.
MLO4	Implement while and for loops and make use of lists.
MLO5	Make use of conditional expressions and if statements.
MLO6	Write their own functions and handle user input.
MLO7	Analyse program errors and debug code effectively.
MLO8	Use the NumPy module for array manipulation and vectorization of functions.
MLO9	Generate well-formatted plots of output using the matplotlib module.
MLO10	Create classes of objects containing member functions and variables.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)

Assessment Type	Practical Assignment	**% of Total Mark for Module**	100
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6,7,8,9,10
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No

Assessment Description
n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	52
Self Directed	48
Hours (up to 100 for 5 ECTS credits)	100.00

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MATH 1809: Mathematical Laboratory

Module Details

Module Code:	MATH 1809
Module Long Title:	Mathematical Laboratory APPROVED
Banner Title:	Mathematical Laboratory
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	10
ISCED Code:	0541 - Mathematics
Current Coordinator::	PAUL MOLLOY
Module Coordinators:	PAUL MOLLOY (04 April 2019 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module allows the learner to use the computer effectively for areas of other modules. It covers Microsoft Excel which is widely used in the workplace. It also uses various mathematical software such as R (a language for statistical computing and graphics) and Latex (a document preparation system for high-quality typesetting)
	Excel (10 weeks) To include: Entering and formatting text & numbers ; Adjusting column heights and row widths and applying borders & shading ; Insert rows & columns: Select multiple rows & columns Understanding relative and absolute referencing ; Construction of simple formulae Use of AutoSum Calculate Sum; Maximum; Minimum, Average ; Using the Insert function Use of IF statement; Creating and formatting charts. Conditional formatting. **LaTex** (5 weeks) Introduction to LaTex and using it to write equations; typesetting advantages and disadvantages. **R** (9 weeks) Introduction to R – a sample R session: invoking the R system and modes of operation (interactive, batch). Integrated Development Environments for R (e.g. Rstudio). The source() command. Extending R: installing additional packages.

Indicative Syllabus	Simple commands in R including left-to-right and right-to-left assignments. Accessing help locally and online. R classes and objects: vectors, lists, arrays, matrices, tables and data frames. Creating each type of object and rules for allowing/disallowing mixed classes within an object. Accessing elements of each object type. Object attributes. Special values: NA, NULL, NaN. Inf etc. R programming using logical operators (e.g. ==, !, |, &) and control flow structures (e.g. if, for, while, else, []). Reading external data sets into data frames from comma and general delimited files and data stored in a Excel spreadsheets. The colnames and rownames attributes. Rules for mixed classes in columns and class coercion. Ordering and forming subsets of vectors, lists and data frames. Attaching and detaching data frames, search paths and with() function. Basic summary statistics: numeric summaries including measures of location and dispersion. Calculating summary statistics by groups (factors). Factors and factor levels. Tables and cross-tabulations with two or more factors. Functions in R: inbuilt and user defined. User defined functions with one two or more named arguments. Local and global assignments and function returns. Loading user defined functions automatically at start up. Plotting: Plots in R. The default plotting device and calling multiple devices. Standard plots such as scatterplots, histograms, bar charts, pie charts. Specifying colours and other plot attributes. Adding lines (including the least squares line) and text to a plot. Curve sketching and adding curves to plots. Adding legends with colour, character and line keys. Customising axes. Outputting plots to other devices, e.g. pdf, jpg, pgn devices. Introduction to data visualisation using R. Plotting in 3 dimensions (e.g. the rgl package). Introduction to R dynamic reporting (e.g. sweave, knitr, Markdown)

Module MATH 1809 - Mathematical Laboratory v1 (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Use basic commands in Excel and simple Math formulae
MLO2	Use some of the more advanced features of Excel such as IF statements
MLO3	Use Excel to generate plots of data
MLO4	Use Excel for conditional formatting
MLO5	Creating, saving and printing documents created using LaTex
MLO6	Write programmes in R including the use of logical and control flow structures. Be able to programme novel functions with named arguments and create the main object types and classes in R.
MLO7	Read data into R from different types of external sources, sort and subset the resulting data frame and produce summary statistics and high-quality plots.
MLO8	Output results from R including data sets, tables and plots for use in technical reporting.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)

Assessment Type	In Class Test	**% of Total Mark for Module**	100
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6,7,8
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lab	52
Self Directed	48
Hours (up to 100 for 5 ECTS credits)	100.00

Module MATH 1808 - Mathematical Modelling I v2 (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type:Mandatory)

APPROVED

MATH 1808: Mathematical Modelling I

Module Details

Module Code:	MATH 1808
Module Long Title:	Mathematical Modelling I APPROVED
Banner Title:	Mathematical Modelling
Version:	2
Valid From:	Sept 2023 (September 2023)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	DANA MACKEY
Module Coordinators:	DANA MACKEY (04 September 2023 to ---)
School Responsible:	School of Mathematics & Statistics
Campus:	City Campus
Module Overview	This module introduces basic techniques in mathematical modelling of real world problems, while building teamwork and communication skills. The various stages of the modelling process, such as finding a suitable mathematical formulation, theoretical and computational analysis and assessing the suitability of the final solution, will be examined.
Indicative Syllabus	This module is structured around a number of modelling projects (to include assessments and practice projects). Examples of mathematical topics involved are: exponential decay and growth, periodic phenomena and oscillations, discrete models described by difference equations, compartmental models described by systems of difference equations, etc. The models studied are inspired by practical problems in areas such as Physics, Biology, Finance, Environmental Science, and many others.
Learning and Teaching Methods	Discussion-based lectures, team work (under the lecturer's guidance) and computer laboratory sessions. The class is divided into groups, who are responsible for the preparation, submission and oral presentation of the projects. Each member of the group must present one of the projects.

Module MATH 1808 - Mathematical Modelling I v2 (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Identify the mathematical component in various physical or practical problems
MLO2	Construct and analyze continuous mathematical models based on exponential and periodic functions
MLO3	Construct and analyze discrete models based on difference equations and systems
MLO4	Efficiently deal with open-ended problems, making and refining assumptions as the work progresses.
MLO5	Use software (such as Maple, Excel, Powerpoint etc.) as problem-solving and presentation aids.
MLO6	Gain collaboration and presentation skills.

Requisites

Assessment Threshold	35% on each individual project and the presentation marks

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)

Assessment Type	Project	**% of Total Mark for Module**	100
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
Continuous Assessment: 1) Written reports on each of the (typically 3-4) modelling projects, submitted as a team (80% of the final mark); 2) Oral presentation of each project by one member of the team (20% of the mark).

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	52
Self Directed	48
Hours (up to 100 for 5 ECTS credits)	100.00

Recommended Reading List

Recommended Book Resources

F.R. Giordano, W.P. Fox, S.B. Horton and M.D. Weir. (2008), A first course in Mathematical Modelling, Cengage Learning.

Module PROF 1801 - Professional Development 1 v1 (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type: Mandatory)

APPROVED

PROF 1801: Professional Development 1

Module Details

Module Code:	PROF 1801
Module Long Title:	Professional Development 1 APPROVED
Banner Title:	Professional Development 1
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	MAEV P MAGUIRE
Module Coordinators:	MAEV P MAGUIRE (03 October 2019 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module and the subsequent Stage 2 module develop the skills and attributes required by students and graduates in mathematical sciences to enhance their employability and develop their research skills and ability to work in a professional, technical environment. This module focusses on communication and develops writing and presentation skills. The module also explores important elements of planning, time management, appropriate, informed communication and team working.
	Written communication Introduction to the importance of written communication that is formal, clear and concise. Use of MS Word. Formatting fonts and paragraphs and using the clipboard, special characters and character sets. Planning a document: how to use styles, tables of contents, headers /footers (page numbers and other document fields), pagination (page and section breaks) and margins, proof-reading tools including search/replace. Use of cross-referencing and footnotes. Reviewing a document: track changes and comments. Creating a template. Examples of formal writing: avoiding colloquialism, use of tone/voice, avoiding abbreviations, other forms of informality. Formal letter writing and curriculum vitae. Structure of a report: use of executive summary, abstracts, contents, bibliographies, references, appendices. Using figures and tables appropriately. Inclusion and manipulation of figures and tables in MS Word. Captions, tables of figures and cross-referencing. Typesetting equations and mathematical conventions for writing equations. Using MS Word and Equation Editor. Use of special symbols and character sets.

Indicative Syllabus	Introduction to critically evaluating written documents, summarising and precis. Recognising and avoiding plagiarism and the consequences. **Presentations** Importance of clear presentations: presentation style, appearance and professionalism, planning and realistic expectations, how to practice. Use of MS Powerpoint. Planning a presentation, structure, creating a style and use of templates. Master slides. Creating a presentation. Assessing the appropriate tone and formality: considering the audience, slide content, the message, use of colour, transitions. Embedding media. Making a presentation: timing, preparation, first impressions and the influence of the presenter, available facilities. **Project work and group working** Time management and planning. Scoping. Working as a group: allocation of roles, teamworking, resolving conflict, achieving and marking individual contributions and outcomes.
Learning and Teaching Methods	Lectures, tutorials and direct feedback. Students will be required to produce documents and presentations, critique their own and the work of others and make presentations. The module will have a strong element of peer-feedback and, as part of self-directed learning, self-appraisal and independent work.

Module PROF 1801 - Professional Development 1 v1 (Year/Cycle:1 / Semester:Semester 1 & 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Use MS Word to write formal written communications and reports appropriate for the mathematical sciences and for interactions with business and industry.
MLO2	Develop an appreciation of the importance of style, tone and the use of appropriate communication methods.
MLO3	Critically evaluate and summarise their own work and that of others.
MLO4	Create suitable, formal presentations appropriate for academic audience in mathematical sciences and professional business audiences.
MLO5	Demonstrate an understanding of the importance of workload planning, time and project management and the dynamics and techniques of working as a team.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Other Assessment(s)	100.00%

Assessments

Other Assessment(s)

Assessment Type	In Class Test	**% of Total Mark for Module**	100
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	52
Self Directed	48
Hours (up to 100 for 5 ECTS credits)	100.00

Module MATH 1802 - Calculus I v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

APPROVED

MATH 1802: Calculus I

Module Details

Module Code:	MATH 1802
Module Long Title:	Calculus I APPROVED
Banner Title:	Calculus
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Jan 2019 (January 2019)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	PAUL MOLLOY
Module Coordinators:	• MAEV P MAGUIRE (03 October 2019 to 05 January 2022) • PAUL MOLLOY (05 January 2022 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module introduces the learner to differentiation and integration. It also covers the areas of curve sketching and series and sequences. It provides the student with the solid foundation in calculus, sequences and series, and vectors required for the development of later aspects of the programme.
Indicative Syllabus	**Differential Calculus** Functions, limits, continuity. Differentiation from first principles. Rules and techniques of differentiation. Mean Value Theorem. Curve sketching. Inverse functions including trigonometric functions. Implicit differentiation. **Integral Calculus** Concept of the Riemann integral including upper and lower sums. Mean Value Theorem for integrals. Fundamental Theorem of Integral Calculus. Methods of integration – substitution, parts and partial fractions. Areas. **Sequences and Series** Convergence of sequences. Fundamental theorem on monotonic sequences. Convergence of series. Tests for convergence. Power series.
Learning and Teaching Methods	Lectures supported by problem-solving sessions and the use of mathematical software packages.

Module MATH 1802 - Calculus I v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Evaluate finite and infinite limits
MLO2	Differentiate simple functions from first principles and use the rules of differentiation
MLO3	Sketch the graphs of functions using a systematic schema
MLO4	Perform implicit differentiation
MLO5	Evaluate integrals using the various rules
MLO6	Test sequences and series for convergence and divergence

Requisites

Assessment Threshold	Examination: 35%

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Assessments

Formal Examination

Assessment Type	Written Examination	**% of Total Mark for Module**	70
Indicative Week	Week 14	**Learning Outcomes**	1,2,3,4,5,6
Assessment Threshold:	35	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Other Assessment(s)

Assessment Type	In Class Test	**% of Total Mark for Module**	30
Indicative Week	Week 7	**Learning Outcomes**	1,2,3,4
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	52
Self Directed	48
Hours (up to 100 for 5 ECTS credits)	100.00

Module MATH 1811 - Introduction to Mechanics with Python v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type: Mandatory)

APPROVED

MATH 1811: Introduction to Mechanics with Python

Module Details

Module Code:	MATH 1811
Module Long Title:	Introduction to Mechanics with Python APPROVED
Banner Title:	Intro to Mechanics with Python
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Jan 2019 (January 2019)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	Nicole Beisiegel
Module Coordinators:	• STEPHEN O SULLIVAN (20 October 2019 to 06 December 2021) • Nicole Beisiegel (06 December 2021 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	

This module develops students' use of Python as a mathematical programming and simulation tool in the context of mechanics. It introduces the learner to the basic principles and equations of mechanics with the emphasis on observing solutions and developing physical intuition. The module will exploit the fundamental, classical laws of mechanics and physics that govern the motion of particles and bodies. In particular, the dynamics of particles, governed by the laws of Newton will be explored. The module does not assume a prior knowledge of applied mathematics and physics.

Indicative Syllabus

- What is mechanics and particle motion? The Cartesian coordinate frame. Mass and forces. Displacement, velocity and acceleration. Standard units and dimensions.
- Using Python to illustrate a given path or trajectory: identifying physical variables.

- Newton's laws governing the motion of particles. Physical interpretation.
- Laws of constant acceleration, particles falling under gravity, projectiles. Determine a simple trajectory and illustrate its simple dynamics using Python. (e.g. trajectory of a ball, lunar lander).
- Concepts of energy and momentum.
- Use Python to illustrate energy conservation/loss and illustrate collision dynamics. Concepts of work and friction.
- Simple linear two body collisions: conservation of momentum and coefficient of restitution.
- Python models of linear two body collisions.

Learning and Teaching Methods

The module will be delivered by a combination of lectures and tutorials. The student self-study will include the use of the programming language introduced earlier in their studies and may include programming notebooks designed to illustrate and explore mechanics.

Module MATH 1811 - Introduction to Mechanics with Python v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Recognise the laws of physics governing particle motion. Use appropriately the laws of constant acceleration and understand their origin.
MLO2	Use Python to visualise and reproduce particle motion: e.g. falling masses, projectiles.
MLO3	Demonstrate physical intuition and an understanding of fundamental physical quantities and how to represent them: time, displacement, velocity, acceleration, force, momentum, energy.
MLO4	Model simple linear collisions with Python.
MLO5	Explore, model and illustrate simple dynamics using the Python programming language.
MLO6	Understand the role of simulation and develop a deeper proficiency with Python.

Requisites

Assessment Threshold	

Examination 35%

Module Content & Assessment

Assessment Breakdown	**%**
Formal Examination	50.00%
Other Assessment(s)	50.00%

Assessments

Formal Examination

Assessment Type	Written Examination	**% of Total Mark for Module**	50
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6
Assessment Threshold:	35	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description

n/a

Other Assessment(s)

Assessment Type	Practical Assignment	**% of Total Mark for Module**	50
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5,6
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Online	**Pass/Fail**	No

Assessment Description

n/a

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	52
Self Directed	48
Hours (up to 100 for 5 ECTS credits)	100.00

Module MATH 1804 - Linear Algebra I v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

APPROVED

MATH 1804: Linear Algebra I

Module Details

Module Code:	MATH 1804
Module Long Title:	Linear Algebra I APPROVED
Banner Title:	Linear Algebra
Version:	1
Indicative NFQ level:	Level 6
Valid From:	Jan 2019 (January 2019)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0541 - Mathematics
Current Coordinator::	FIONA MURRAY
Module Coordinators:	• SUSAN LAZARUS (10 April 2019 to 10 July 2023) • FIONA MURRAY (10 July 2023 to ---)
School Responsible:	School of Mathematics & Statistics
Campus:	City Campus
Module Overview	This module introduces the learner to systems of linear equations, vectors and matrices.
Indicative Syllabus	**Linear Equations** Introduction to systems of linear equations. Gaussian and Gauss-Jordan elimination. Homogeneous and non-homogeneous equations. Introduction to matrices and their use in writing linear equations. **Matrix Algebra** Row operations and elementary matrices. Row equivalent matrices. Matrix inverse and its evaluation. Use of matrix inverses in the solution of linear equations. Transpose of a matrix. Symmetric matrices. Diagonal and triangular matrices. **Determinants**

	Cofactors. Properties of determinants. Adjoint matrix and the evaluation of the inverse of a matrix. Cramer’s rule. Non-trivial solutions of homogeneous equations. **Vectors** Vectors in two and three dimensions. Dot and cross products. Components of a vector. Norms. Lines and planes in three dimensions.

Learning and Teaching Methods	Lectures supported by tutorials.

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	demonstrate a thorough knowledge of systems of linear equations
MLO2	use matrices and determinants to solve equations
MLO3	calculate with vectors in two and three dimensions
MLO4	determine the equations of lines and planes in three dimensions

Requisites	

Assessment Threshold	35% on Invigilated Examination

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Assessments

Formal Examination			
Assessment Type	Written Examination	**% of Total Mark for Module**	70
Indicative Week	Week 14	**Learning Outcomes**	1,2,3,4
Assessment Threshold:	35	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description n/a			

Other Assessment(s)			
Assessment Type	In Class Test	**% of Total Mark for Module**	30
Indicative Week	Week 8	**Learning Outcomes**	1,2
Assessment Threshold:	None	**Assessment Role**	Individual
Assessment Authenticity	Not Online	**Pass/Fail**	No
Assessment Description n/a			

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	39
Self Directed	61
Hours (up to 100 for 5 ECTS credits)	100.00

Module MATH 1805 - Statistics I v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

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MATH 1805: Statistics I

Module Details

Module Code:	MATH 1805
Module Long Title:	Statistics I APPROVED
Banner Title:	Statistics I
Version:	1
Valid From:	Sept 2018 (September 2018)
Language of Instruction:	English
ECTS Credits::	5
ISCED Code:	0542 - Statistics
Current Coordinator::	ALBERTO CAIMO
Module Coordinators:	ALBERTO CAIMO (08 April 2019 to ---)
School Responsible:	School of Mathematical Sciences (CC)
Campus:	City Campus
Module Overview	This module introduces probability theory, random variables, probability distributions and statistical inference. The fundamental laws of probability including Bayes' theorem are covered. Motivating random variables as a mapping of experimental results onto subsets of the real numbers, this module covers the mathematics of probability including the standard univariate discrete and continuous distributions. Statistical inference for a population mean/proportion are also covered. Descriptive statistics and data visualisation are briefly reviewed.
Indicative Syllabus	**Probability Theory:** Axioms of probability. Addition rule. Independence. Conditional probability. Multiplication rule. Bayes' Theorem. Counting rules, including permutation and combinations. **Discrete Random Variables:** Probability distributions and mass functions. Expected values and variances. Functions of random variables. The Bernoulli, binomial, multinomial, geometric, negative binomial and Poisson distributions; their expectations/variances. **Continuous Random Variables:** Probability density functions. Expected values and variances. Functions of a continuous random variable. The uniform, exponential and normal distributions; their means and variances. **Statistical Inference:** The Central Limit Theorem. Statistical tests for a population mean/proportion. Confidence intervals for a population mean/proportion.

Learning and Teaching Methods	Lectures supported by tutorials and computer lab sessions.

Module MATH 1805 - Statistics I v1 (Year/Cycle:1 / Semester:Semester 2 / Delivery Type:Mandatory)

Learning Outcomes	
Upon successful completion of this module the learner will be able to	
#	
MLO1	Understand the fundamental laws of probability including conditional probability and Bayes' Theorem.
MLO2	Understand random variables, probability distributions, probability mass functions and probability density functions.
MLO3	Recognise experiments where standard distributions apply and solve associated problems.
MLO4	Perform one sample hypothesis tests on a population mean/proportion and be able to report the results of such tests; understand and calculate confidence intervals for a population mean/proportion.
MLO5	Use a major statistical software package for data analysis, applying techniques covered in the module.

Requisites

Module Content & Assessment

Assessment Breakdown	%
Formal Examination	70.00%
Other Assessment(s)	30.00%

Assessments

Formal Examination

Assessment Type	Written Examination	**% of Total Mark for Module**	70
Indicative Week	Week 28	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
End of semester examination.

Other Assessment(s)

Assessment Type	In Class Test	**% of Total Mark for Module**	30
Indicative Week	See Student Handbook	**Learning Outcomes**	1,2,3,4,5
Assessment Threshold:	None	**Assessment Role**	Not yet determined
Assessment Authenticity	Not Online	**Pass/Fail**	No

Assessment Description
Mid-semester in-class test.

Module Activity

Full Time hours per semester	
Activity Type	*Duration (Hours)*
Lecture	39
Self Directed	61
Hours (up to 100 for 5 ECTS credits)	100.00