COURSE SPECIFICATION DOCUMENT

Academic School / Department: Science, Innovation & Technology

Programme: Mathematics and Data Science

***FHEQ* Level:** 4

Course Title: Mathematics of Argument and Reasoning

Course Code: MATH 4102

Total Hours: 160
Timetabled Hours: 45
Guided Learning Hours: 15
Independent Learning Hours: 100

Credits: 16 UK CATS credits
8 ECTS credits
4 US credits

Course Description:
This course presents the mathematics of arguments and reasoning by introducing students to concepts in logic and discrete mathematics. It examines the nature of logic, propositional and deductive logic, tautologies and contradictions, algebra of sets, relations, Boolean functions, and graph theory. The topics covered will include propositional calculus, methods of deduction, and quantification theory, leading to an introduction to first order logic, proof by induction and recursive relations. Valid and invalid argument forms and their tests will be performed. Matrix algebra and determinants and their applications in solving systems of equations will be covered.

Applications of these concepts to logical networks, switching circuits and network analysis will be investigated.

Prerequisites:
None

Aims and Objectives:
This course gives a basic introduction to

- Formal logic, and the mathematics of argument.
- Algebra of sets and the process of formal mathematical proofs and deductions.
- Basic concepts of logic and discrete mathematics.
- Develop specific mathematical form to analyse and test the concept of validity and mathematical proofs.
- Essential concepts of propositional, predicate calculus, relations, functions, and some applications.
- Applications of matrix algebra to solving systems of equations.

Programme Outcomes:
MATH AI, BI, CI, DI

A detailed list of the programme outcomes is found in the Programme Specification. This is maintained by Registry and located at:
https://www.richmond.ac.uk/programme-and-course-specifications/

Learning Outcomes:
By the end of this course, successful students should be able to:

- Understand the argument structure and its evaluation and be able to analyse propositional logic by use of logical operators and truth tables and apply truth statements in a formal and logical manner.
- Understand the basic elements of symbolic algebra and be able to practice formal logical and deductive thinking commonly used in discrete mathematics and mathematical proofs that involves induction and recursive relations.
- Understand the algebra of sets and first order logic, graph theory and matrix algebra and be able to apply learned concepts to logical networks, switching circuits and network analysis.
- Understand how to apply matrix algebra to solve systems of linear equations and interpret the results both analytically and geometrically.

Indicative Content:

- Introduction to basic concepts, valid arguments, logical form and argument structure and evaluation
- Logical operators
- Propositional calculus and validity of arguments Predicate calculus
- Sets and relations
- Proof by induction
- Recursion and combinatorics
- Boolean functions
- Matrix algebra
- Graph Theory

Assessment:
This course conforms to the University Assessment Norms approved at Academic Board and located at: https://www.richmond.ac.uk/university-policies/

Teaching Methodology:
This course will be delivered face to face through a combination of lectures and interactive sessions. In addition to classroom activities, there are guided learning elements that are tutor led and arranged through Blackboard. These activities can be asynchronous online sessions, flipped classrooms, set readings with discussion boards or set guest lectures for example. Set activities are monitored by the instructor to ascertain student engagement. Students are encouraged to prepare for class and to play an active part, to raise questions, following-up ideas and interact with a wide range of provided material.

Indicative Text(s):

Davies, S., (2023) *A Cool, Brisk Walk Through Discrete Mathematics*, version 2.2. USA: University of Mary Washington.

Garnier, R. and Taylor, J. (2010) *Discrete Mathematics: Proofs, Structures and Applications*. 3rd edn. London: CRC Press.

See syllabus for complete reading list.

Change Log for this CSD:

Nature of Change	Date Approved & Approval Body (School or AB)	Change Actioned by Registry Services
First edition	Nov 2024	