

## **Postgraduate Research Scholarships 2024/25**

Applications are now open for a range of postgraduate research scholarships.

- **MIC Doctoral Award**  
fee waiver + €12,600 annual stipend; application deadline: 26 April 2024
- **MIC Doctoral Studentship Award**  
fee waiver + €6,900 annual stipend; Application deadline: 26 April 2024
- **MIC Postgraduate Studentship Award**  
fee waiver + €6,900 annual stipend; Application deadline: 26 April 2024
- **Departmental Assistantship Award**  
fee waiver + €6,900 annual stipend; Application deadline: 17 May 2024

To be considered for any of these Awards, applicants should identify a research topic and supervisor (see below), and complete a [research postgraduate application](#).

Further information on the PGR scholarship schemes is available on the [College website](#).

Prospective applicants are encouraged to contact the Head of Department, Dr Bernd Kreussler, at the earliest opportunity: [Bernd.Kreussler@mic.ul.ie](mailto:Bernd.Kreussler@mic.ul.ie)

### **Department Overview**

The department of Mathematics and Computer Studies (including Business and Accounting) is one of the largest departments in the Faculty of Arts in Mary Immaculate College.

The department has staff members based in Thurles and in Limerick who publish their research findings in leading international journals. Research activity and postgraduate research supervision expertise in this department span these diverse subject areas: Mathematics, Computer Studies, Business Studies, and Mathematics Education. More detailed research profiles and sample research projects are laid out below.

Postgraduate research students will be supported in their research through regular and professional contact with friendly, supportive, knowledgeable and experienced department staff in their research subject area.

Further information about the department is available at [the department website](#).

## Staff Research Interests and Sample Research Projects

In addition to the sample projects listed below, PhD projects are available on an individual basis, taking into account background, experience and research interests of the applicant. MA projects different from these sample projects are available on an individual basis as well.

### Mathematics

#### Dr Stephen Coughlan

*Research Interests:* Algebraic Geometry, classification and moduli of projective algebraic varieties.

*Sample MA Project:* Moduli spaces of algebraic varieties. The background to this project is in the classification of algebraic surfaces from the early 20th century and/or the classification of algebraic 3-folds from the 1980s. The main aim will be to study examples of surfaces or 3-folds in the explicit algebraic geometry style. This will involve commutative algebra, possibly using a computer, and will lead to the study of families and moduli spaces.

#### Dr Norbert Hoffmann

*Research Interests:* Algebraic Geometry, moduli spaces of vector bundles and principal bundles over algebraic varieties.

*Sample MA Project:* Examples of Algebraic Vector Bundles. After introductory work on Algebraic Geometry that prepares for the study of some algebraic vector bundles, the main aim of this project would be to investigate a specific class of examples.

#### Dr Derek Kitson

*Research Interests:* Operator theory, discrete geometry, combinatorics.

*Sample MA Project:* Rigidity and flexibility of frameworks. Frameworks are ubiquitous in engineering, the natural sciences and technology. They model everything from bridges and mechanical linkages to the molecular bonds of proteins and communication channels in autonomous multi-vehicle systems. The flexibility of a framework (or lack thereof) is often central to its functionality. The goal of the project is to develop new techniques for determining when a given framework is flexible by applying elements of linear algebra, graph theory, functional analysis and operator theory.

#### Dr Bernd Kreussler

*Research Interests:* Algebraic Geometry, the structure of twistor spaces, and stability conditions on triangulated categories.

*Sample MA Project:* A Study of Deformations of Coherent Sheaves. This involves acquiring basic knowledge in commutative algebra and algebraic geometry before background material on deformations of coherent sheaves on particular algebraic varieties will be studied. The main aim of the project is the construction of concrete examples in a certain interesting set-up.

### **Dr Arundhathi Krishnan**

*Research Interests:* Operator algebras with a focus on non-commutative probability.

*Sample MA Project:* Algebraic Central Limit Theorems. This involves acquiring a basic understanding of noncommutative probability spaces and studying some preliminaries on the combinatorics of pair partitions. The main aim of the project is to (attempt to) formulate an algebraic central limit theorem in the context of the infinite braid group using different sets of generators.

### **Dr Cian O'Brien**

*Research Interests:* Combinatorial and algebraic structures arising from alternating sign matrices.

*Sample MA Project:* Alternating Sign Hypermatrices and Characterisations of Latin-like Squares. Alternating sign matrices are a class of matrices with deep connections to a wide variety of areas in mathematics and beyond. A Latin square is an  $n \times n$  grid containing numbers from  $\{1, 2, \dots, n\}$  with each number occurring exactly once in each row and column. A Sudoku puzzle is a well known example. A connection has recently been made between Latin squares and a 3-dimensional version of alternating sign matrices called an alternating sign hypermatrix (ASHM). At present, these Latin-like squares can only be recognised by finding the corresponding ASHM, and there is no known set of necessary and sufficient rules for what its entries can be. After some introductory study of these objects, the aim of this project would be to find further necessary conditions on the entries of a Latin-like square.

## **Mathematics Education**

### **Dr Maria Ryan**

*Research Interests:* Mathematics anxiety among primary school students, post-primary school students, pre-service school teachers, undergraduate students and adults.

*Sample MA Project:* Exploring the extent of mathematics anxiety in the secondary school context. Taking an action research or case study approach this research project would involve investigating mathematics anxiety (MA) among second level students with emphasis on evaluating the impact on MA levels of new or existing teaching methods, or various types of assessment and evaluation, or employing the use of educational technologies. Variations on this topic and research approach will also be considered.

### **Dr Páraic Treacy**

*Research Interests:* Mathematics curriculum change at secondary level; teaching and assessment methods in tertiary level mathematics; STEM Education.

*Sample MA Project:* Integrating mathematics and science in the classroom. This project would involve examining the means by which pupil learning in both mathematics and science can be achieved simultaneously. Furthermore, a suitable approach will be applied in the classroom, the impact of which will be analysed through case study research.

## **Business studies**

### **Dr Deirdre Brady**

*Research Interests:* Business and the arts; reflective writing in supply chain management.

*Sample MA Project:* The Role of Reflective Learning Journals in Management Education. This project examines the potential impact of using reflective learning journals (RLJ) in management education and the value of RLJ in curriculum design and skills development. It aims to uncover through qualitative case study research, the influence and impact of critical reflective writing practices in professional and personal development contexts.

*Sample MA Project:* Business and the Arts: Creative Enterprises and the Cultural Economy. This interdisciplinary project explores the impact of the arts and creative enterprises on the cultural economy. It aims to examine the intersections of art and commerce, past and present, from a business, sociological and cultural perspective.

### **Dr Patrick Buckland**

*Research Interests:* Intersection of leadership, organisational behaviour, and gender within higher education; transformative potential of AI in education.

*Sample MA Project:* Enhancing Educational Accessibility and Evaluating AI Chatbots as Support Tools for Students with Disabilities. This project investigates the attitudes of third-level students with learning difficulties towards AI chatbots as academic support tools, focusing on their perceived effectiveness, accessibility, and inclusivity. It aims to uncover insights into how chatbots can be optimised to meet the unique needs of these students, thereby enhancing their learning experience.

### **Dr Marian Carcary**

*Research Interests:* IT management and digital transformation, IT and organisational capability maturity, digital technology adoption (including AI technologies) within the education sector, student digital literacy, community leadership.

*Sample MA Project:* Voluntary community leadership in the context of post primary education. This research project examines the role of post primary teachers as voluntary community leaders through the lens of community leadership theories and frameworks. Based on qualitative research, this project seeks to deepen understanding of the drivers, barriers, impact and manifestation of voluntary community leadership roles among post primary teachers (e.g. during the COVID 19 pandemic) and formulate the findings into a coherent community leadership theoretical contribution in the context of post primary education.

*Sample MA Project:* Post primary school readiness for the era of Generative AI. Teaching and learning in all facets of education are increasingly impacted by advances in technology. This research project examines the potential impact of Generative AI in post primary schools in Ireland, considering benefits and challenges to its use and the readiness of schools to embrace such technologies for the benefit of future teaching and student learning. Based on a mixed methods research approach, the findings from this study are intended to inform policy recommendations to support the adoption of Generative AI in Irish post primary education.

**Dr John McCarthy**

*Research Interests:* Problem-based learning, management education, innovation, scenario planning in strategy.

*Sample MA Project:* Scenario thinking and planning to enable business model robustness. Organisations utilise scenario thinking and planning to create and explore plausible futures. The aim of this proposed project would be to explore the process by which organisations take created scenarios and stress-test how robust their current business models are.

**Dr Rebecca Purcell**

*Research Interests:* Identity in Teacher Education; Entrepreneurial Education; Teacher Entrepreneurship.

*Sample MA Project:* An Investigation of Teacher Entrepreneurship. This research explores Teacher Entrepreneurship, that is, teachers engaged in entrepreneurial activity alongside their teaching role. Historically, teaching and entrepreneurship were commonly practised together, as teachers in the 19th and early 20th Century sought to supplement their incomes, and maintain family enterprises. Anecdotally, we hear of this practice continuing today, with perhaps other motivations and needs coming to the fore, as related to identity and achievement. This exploration of teacher entrepreneurs is pertinent given the increased focus on entrepreneurship in education policy and curricula. This research will contribute to the entrepreneurship literature, and the literature of entrepreneurship education and issues of teacher identity.