F19PB Pure Mathematics B

COURSE DETAILS
Course Code: F19PB
Full Course Title: Pure Mathematics B
SCQF Level: 9
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL
Undergraduate: Yes
Postgraduate Taught: Yes
Postgraduate Research: No

COURSE AIMS
The objective of the module is to introduce and develop the methods of discrete mathematics, with an emphasis on combinatorial enumeration and its applications.

LEARNING OUTCOMES – SUBJECT MASTERY
By the end of the course, students should be able to:

- apply the basic notations of naive set theory and prove simple theorems in this context;
- apply basic counting arguments such as the rule of sums, the rule of products and the inclusion-exclusion principle to enumerative problems;
- apply permutations and the right type of selections in combinatorial problems;
- use the binomial coefficients in related counting problems;
- apply grid routes and Catalan numbers where appropriate in counting problems;
- represent a partition as a Ferrers diagram and use this representation in simple arguments;
- compute recursively partitions, Stirling and Bell numbers;
- work with equivalence relations;
- compute with formal power series;
- derive generating functions for simple series;
- apply group theory to counting problems with symmetry;
- prove simple theorems in the context of graph theory;
- count various colourings of a given graph;
- apply bipartite graphs in matching problems;
- know the basic definitions of directed graphs and quivers.

Ideas of discrete mathematics and their applications, seen both historically and in the context of modern problems

Use of algorithms as practical tools and for the exploration of ideas

LEARNING OUTCOMES – PERSONAL ABILITIES
Use logical reasoning to prove theorems
Organize complex calculations in a clear manner

**SYLLABUS**

Naive set theory: Basic definitions of sets and functions, cardinality of a set, operations with sets, infinite sets.

Counting arguments: Counting principles, enumerative combinatorics, binomial coefficients, Catalan numbers, partitions, Stirling numbers, formal power series, generating functions, group actions and Burnside's lemma.

Graph theory: Graphs and isomorphisms between graphs, colouring of graphs, bipartite graphs and matching problems, directed graphs, quivers, finite categories.

**COURSE RELATIONSHIPS**

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<th>School</th>
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<td>Pre-Requisite</td>
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**LOCATION AND ASSESSMENT METHODS**

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