Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MAT353	Combinatorics	5	3	0	0	3	5

Prerequisites	
Admission Requirements	

Language of Instruction	French
Course Type	Elective
Course Level	Bachelor Degree
Objective	This course presents the fundamental principles, structures, and techniques of enumerative and structural combinatorics. It covers bijective reasoning, generating functions, partially ordered sets, graphs and trees, Catalan structures, permutations, partitions, Young tableaux, and classical combinatorial correspondences. The course also aims to develop students' ability to construct rigorous combinatorial arguments and to identify common structures in seemingly disparate counting problems.
Content	This course offers an introduction to combinatorics through the study of finite sets and finite functions, counting principles, generating functions, relations and graphs, partially ordered sets and lattices, trees, permutations, partitions, and arrays. Classical enumerative families, such as Catalan configurations, binary trees, polygonal triangulations, and integer partitions, are studied along with the bijections that connect them. The course concludes with the study of Young tableaux and the Robinson-Schensted-Knuth correspondence, illustrating the interaction between enumeration, algebraic structure, and combinatorial algorithms.
References	Introduction à la combinatoire Notes de cours Professeur : François Bergeron

Theory Topics

Week	Weekly Contents
1	Recall on sets, functions, and bijections
2	Cardinalities of sets, the pigeonhole principle, the inclusion-exclusion principle, sequences and generating series
3	Relations, graphs, isomorphisms, equivalences, partitions
4	Orders, lattices, paths in a directed graph
5	Trees, endofunctions
6	Binary trees, triangulations of a polygon
7	Exam
8	Solutions of the exam
9	Catalan configurations and bijections
10	Permutations, inversions, partitions
11	Ferres diagrams, Euler's pentagonal theorem
12	Young tableaux, Robinson-Schensted-Knuth correspondence
13	Student presentations
14	Student presentations