**Content**

| Course Code | Course Name | Semester | Theory | Practice | Lab | Credit | ECTS |
|---|---|---|---|---|---|---|---|
| MAT473 | Ideals, Varieties, Algorithms | 7 | 3 | 0 | 0 | 3 | 5 |

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| Prerequisites | |
| Admission Requirements | |

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| Language of Instruction | French |
| Course Type | Elective |
| Course Level | Bachelor Degree |
| Objective | The purpose of this course is to learn about Groebner basis which is useful to solve some problems on algebraic varieties, especially for the solution of systems of equations, to understand how to use it in the proof of theorem extension. |
| Content | Ring theory and fields (summary), Polynomial rings and affine space, Affine varieties, Parametrization, Ideals, One variable polynomials; <br> Monomial orders, Division algorithm, Monomial ideals and Dickson's lemma, Hilbert bases theorem, Groebner bases, Properties of Groebner bases, Buchbergers algorithm, Applicaitons of Groebner bases; Elimination and Extension theorems, Resultants and the extension theorem. |
| References | Ideals, Varieties and Algorithms, D. Cox, J. Little, D. O'Shea. |

**Theory Topics**

| Week | Weekly Contents |
|------|-----------------|
| 1 | Ring theory and fields (summary) |
| 2 | Polynomial rings and affine space, Affine varieties |
| 3 | Ideals, One variable polynomials |
| 4 | Monomial orders, Division algorithm |
| 5 | Monomial ideals and Dickson's lemma |
| 6 | Hilbert bases theorem and Groebner bases |
| 7 | Preparation for the midterm examination |
| 8 | Midterm Examination |
| 9 | Properties of Groebner bases |
| 10 | Buchbergers algorithm |
| 11 | Elimination and Extension theorems |
| 12 | Unique factorization and resultants |
| 13 | Resultants and the extension theorem |
| 14 | Preparation for the final exam |