King Fahd University of Petroleum & Minerals

Department of Mathematics and Statistics

Applied & Computational Algebra MATH655-F01 (Semester 211)

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Textbook: S. R. Nagpaul and S. K. Jain, *Topics in Applied Abstract Algebra*, Brooks/Cole Series in Advanced Mathematics, Brooks Cole; 1st edition (2004).

Math 655: Applied & Computational Algebra
Description: Contents vary. Concepts and methods in algebra which have wide applications in mathematics as well as in computer science, systems theory, information theory, physical sciences, and other areas. Topics may be chosen from fields of advanced matrix theory; algebraic coding theory; group theory; Gröbner bases; or other topics of computational and applied algebra.
Prerequisites: Graduate Standing, Consent of the Instructor

Syllabus

Topic(s)	Week
Ch 0. PRELIMINARY ALGEBRAIC CONCEPTS 0.1 Sets, Mappings, Relations, and Binary Operations 0.2 Groups and Semigroups 0.3 Cyclic Groups, Order of an Element, and Direct Product 0.4 Subgroups of a Group 0.5 Quotient Groups and Homomorphisms	1
0.6 Applications of Groups in Number Theory 0.7 Rings and Fields 0.8 Finite Fields	2
Ch 3. ALGEBRAIC CRYPTOGRAPHY 3.1 Substitution Ciphers 3.2 Algebraic Enciphering Algorithms and Classical Cryptosystems	3
3.3 Block Ciphers and Advanced Encryption Standard 3.4 Public-Key Cryptosystems	4
Ch. 4. CODING THEORY 4.1 Introduction to Error-Correcting Codes	5
4.2 Linear Codes	6
4.3 Cyclic Codes 4.4 BCH Codes	7
Revision. Midterm Exam: Wednesday 20.10.2021.	8
Ch 5. SYMMETRY GROUPS AND COLOR PATTERNS 5.1 Permutation Groups 5.2 Groups of Symmetries	9
5.3 Colorings and Color Patterns 5.4 Action of a Group on a Set 5.4 Burnside Theorem and Color Patterns	10
Ch 6. WALLPAPER PATTERN GROUPS 6.1 Group of Symmetries of a Plane 6.2 Wallpaper Pattern Groups	11
6.3 Change of Basis in $\mathbb{R}^2$ 6.4 Point Groups and Lattice Types	12
6.5 Equivalence of WP Groups 6.6 Classification of Point Groups	13
6.7 Classification of WP Groups 6.8 Sample Patterns	14
Revision and Catch Up	15

Grading Policy	
Midterm	25%
Final Exam	35%
Homework	10%
Projects	15%
Quizzes	15%