

Syllabus for MATH 400 - 01, Directed Reading

Topics in Coding Theory

College of the Holy Cross, Fall 2023

Instructor: Dr. Neranga Fernando

Office: Haberlin 310

E-mail: nfernand@holycross.edu

Office phone: 508-793-2458

Office hours: Anytime I am in the office

Meeting times and location: 3:30pm - 4:30pm on Tuesdays and 3pm - 4pm on Fridays, Swords 330

Course Objectives: The students will learn the fundamentals of Coding Theory that are required to conduct research during the semester.

Recommended Reading:

Coding theory. The Essentials. In: Monographs and Textbooks in Pure and Applied Mathematics, vol. 150. Marcel Dekker, Inc., New York (1991). Hoffman D.G., Leonard D.A., Lindner C.C., Phelps K.T., Rodger C.A., Wall J.R.

Course materials: All announcements, materials and grades will be posted on Canvas.

Homework Assignments:

There will be six homework assignments during the semester.

Grading: The course grade will be determined as follows:

Homework: 90% (15% each)

End-of semester Presentation: 10%

Academic Honesty:

A necessary prerequisite to the attainment of the goals of the College is maintaining complete honesty in all academic work. Students are expected to present their own work in exams and in any material submitted for credit. Students may not assist others in presenting work that is not their own. Offenders are subject to disciplinary action. A violation of the Department Policy on Academic Integrity will result in a 0 for that quiz or exam, and a letter describing the occurrence of academic dishonesty will be sent to the Chair of the Department of Mathematics and Computer Science and your Class Dean.

For more on Academic Integrity see: <https://www.holycross.edu/academics/programs/mathematics-and-computer-science/node/211581/academic-integrity>

Schedule of Topics

Introduction to Coding Theory

- Error Detecting Codes

Linear Codes

- Parity-Check Matrices
- Equivalent Codes
- Distance of a Linear Code
- MLD for Linear Codes

Perfect and Related Codes

- Perfect Codes
- Hamming Codes
- Extended Codes
- The Golay Code
- Reed-Muller Codes

Cyclic Linear Codes

- Polynomials and Words
- Introduction to Cyclic Codes
- Polynomial Encoding and Decoding
- Dual Cyclic Codes

BCH Codes

- Finite Fields
- Minimal Polynomials
- Cyclic Hamming Codes
- BCH Codes

Reed Solomon Codes

- Codes over $GF(2^r)$
- Reed-Solomon Codes
- Decoding Reed-Solomon Codes
- Berlekamp-Massey Algorithm