MATH 220 (3 units)
Coding Theory

Tu Th 4pm-5:15pm in S141
California State University, Fresno
Spring 2014

Instructor : Dr. Stefaan Delcroix
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E-mail : sdelcroix@csufresno.edu
Web Page : http://zimmer.csufresno.edu/~sdelcroix
Office Hours : Tu Th 11am-12:45pm and 3pm-3:45pm
Prerequisites : MATH 151, MATH 152, graduate standing
Textbook : Lecture notes, available on my web page
Course Description : basic concepts in coding theory, properties of linear and non-linear codes, standard decoding algorithms, cyclic codes, BCH-codes.
Course Goals : The goals of this course are to

- provide students with the elementary theory of error-correcting codes.
- provide students with several examples of linear codes and decoding algorithms.
- provide students with an in-depth analysis of BCH-codes.
- create an appreciation for the value and importance of error-correcting codes.

Primary Learning Outcomes : At the completion of the course, students will be able to:

- perform calculations with the Hamming distance and Hamming weight.
- define basic concepts of linear codes.
- calculate the minimum weight of a linear code using a parity check matrix.
- perform standard array and syndrome decoding for small linear codes.
- encode and decode Hamming codes.
- decode Reed-Muller codes using majority logic decoding.
• use cyclotomic cosets to find the degrees of the irreducible factors of \(x^n - 1\) over finite fields \(GF(q)\) with \(\gcd(n, q) = 1\).

• find the generator polynomial of cyclic codes.

• find the idempotent generator of binary cyclic codes.

• construct BCH-codes via their generator polynomial.

• construct calculation tables for finite fields.

• perform practical calculations in finite fields to decode BCH-codes using the PGZ-algorithm and the Key Equation.

**Grading Policy** : I will use the following grading scheme :

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>25%</td>
</tr>
<tr>
<td>Exam I and II</td>
<td>20% each</td>
</tr>
<tr>
<td>Final Exam</td>
<td>35%</td>
</tr>
</tbody>
</table>

\[
\text{A : 85\% - 100\%} \\
\text{B : 70\% - 84\%} \\
\text{C : 60\% - 69\%} \\
\text{D : 50\%-59\%} \\
\text{F : 0\% - 49\%}
\]

**Web Page** : My web page is

http://zimmer.csufresno.edu/~sdelcroix

It will contain important information about this course: homework assignments, solutions to homeworks and exams, etc.

**Homework** : I will assign homework almost every Thursday. It will be posted on my website. You will have one week to hand in the homework in class. No late homework will be accepted. You may work with others in class on assignments, as this may help you to better understand the material. However, copying someone else’s assignment will not be tolerated. That is, assignments must show individual work and ideas, and your solutions must be written by you in your own words.

**Exams and Final** : There will be two in-class exams and one take-home final. Each exam will consist of two parts and cover a specific unit of material while the final is comprehensive. No make-up exams are given unless you have an extremely good reason for not taking the exam at the scheduled time. If possible, notify me ahead of time if you will not be able to take the exam at the scheduled time.

**Attendance** : Attendance is required! If you are absent from class, it is your responsibility to check on announcements made while you were absent.
**Students with Disabilities**: Upon identifying themselves to the instructor and the university, students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Service to Students with Disabilities in the Henry Madden Library Suite 1202 (278-2811).

For required syllabus statements about **Students with Disabilities, the Honor Code, Cheating and Plagiarism, Computers, Disruptive Classroom Behavior, and Copyright Policy**: see

http://www.fresnostate.edu/academics/policies-forms/instruction/syllabus.html

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**SUBJECT TO CHANGE**

This syllabus and schedule are subject to change in the event of extenuating circumstances. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

**IMPORTANT DATES**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>Monday 1/20</td>
<td>Martin Luther King holiday - no classes</td>
</tr>
<tr>
<td>Thursday 2/13</td>
<td>Last day to add classes with permission/</td>
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<tr>
<td></td>
<td>Last day to drop classes without a serious</td>
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<tr>
<td></td>
<td>and compelling reason</td>
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<tr>
<td>Monday 2/17</td>
<td>Presidents’ Day - no classes</td>
</tr>
<tr>
<td>Thursday 2/20</td>
<td>Exam I</td>
</tr>
<tr>
<td>Monday 3/31</td>
<td>Cesar Chavez holiday-no classes</td>
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<tr>
<td>Tuesday 4/1</td>
<td>Exam II</td>
</tr>
<tr>
<td>Monday 4/14 till Friday 4/18</td>
<td>Spring Recess - no classes</td>
</tr>
<tr>
<td>Tuesday 4/15</td>
<td>Last day to withdraw from class for serious</td>
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<tr>
<td></td>
<td>and compelling reasons</td>
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<tr>
<td>Wednesday 5/7</td>
<td>Last day of instruction</td>
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<tr>
<td>Monday 5/12 till Thursday 5/15</td>
<td>Final semester examinations</td>
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**TAKE-HOME FINAL FOR THIS CLASS**

DUE IN PB 354 FRIDAY MAY 16 by noon