MATH/ECE 641 SYLLABUS, Spring Semester, 2002 Academic Year
Lec. 1, MWF 11:00 - 11:50 AM, B211 Van Vleck

Prof. Richard A. Brualdi
Office: 725 Van Vleck Hall

Text is:
Error-Correcting Codes ...
student ed., by O. Pretzel

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Office Hours: Tues. (11:00-11:50 AM), Wed. (1:20-2:10 PM), Fri. (9:55-10:45 AM)
WWW: http://www.math.wisc.edu/~brualdi

I have a DoIT email list for this course to communicate with you.

Please read carefully

Course Content As the title *Introduction to Error-Correcting Codes* suggests, Math/ECE 641 is a first course on coding theory with emphasis on linear codes and covering the basics of the subject. It is essential that the student have a good knowledge of basic linear algebra; some knowledge of abstract algebraic systems (finite fields, polynomial rings and ideals, ...) is very helpful. We shall have to develop some of the theory of finite fields. This is necessary even if one is only interested in binary codes.

Briefly, the topics covered in the course include: Shannon's fundamental theorem on the capacity of a channel, the quest of coding theorists to realize the Shannon capacity, linear codes, basic parameters of codes and their relationships, perfect codes - Hamming and Golay codes, dual codes, weight enumerators and the MacWilliams identities for the dual code, Reed-Muller codes, cyclic codes, Reed-Solomon codes (used on compact disks), BCH codes, bounds on code parameters, encoding and decoding techniques, Goppa codes, ... In order to construct and investigate codes, we will have to develop finite fields sufficiently to get a good computational understanding of their construction, arithmetic, and algebra.

The book has been intentionally chosen to be a fairly elementary one containing the basics in detail; **I intend to supplement the book from time to time and to go into some more detail in the lecture**. I expect that all student will be in attendance and participate in every class. There is more to the course than simply getting a good grade.

Exercises I will assign regular exercise sets - some from the book and probably some supplementary ones. Since the class is so large and I do not expect to be able to find a qualified grader, the following procedure will be used: **For each exercise set, you should hand in all solutions and indicate on the first page the problem that you think was the hardest that you solved, the solution you are most proud of or for which you have a mathematically elegant solution, or ... .** I will read this solution and quickly check and record that you have solved the other problems (I will give no comments on these). I intend to spend only 1 to 1/2 hours on each set, so they should be written neatly, with care and in good English.

While you can discuss the exercises with classmates, **the work you hand in should be your own write-up and not copied from someone else**, and I would expect in general for such people to select a different "favorite" solution. The assigned homework will

be scaled to 100 points. I allow myself the possibility to increase someone's scaled homework score based on class participation. For this I need to know your name, so I recommend that you identify yourself when you speak to me, ask a question in class, etc. **Problem assignments will be posted on my web page under the section for this course.**

Exams It is unusual for me to give in-class exams in this course, but with such a large class I have no other choice. So there will be **three in-class exams** during the semester (**each worth 100 points**), but no final exam (the last exam will be on the last day of classes and will not be cumulative) - see the accompanying schedule. I do not intend to give make-up exams.

Exam Schedule

- Exam 1: Monday, March 4.
- Exam 2: Friday, April 19.
- Exam 3: Friday, May 10.

Approximate Chapter Schedule

Grades These will be based on a **total of 400 points** (see above).

Attendance As already mentioned, it is expected that each student will be present at all of the classes. Office hours are for students who need additional help beyond that given in the class; they are not substitutes for class.

Note to McBurney Disability Resource Center students: Students of the Center who are recommended for some accomodation (e.g., extended time on exams) should contact me about this no later than January 30.

The Department of Mathematics; Van Vleck Hall (VV):

Chair: A. Adem (219 VV)

Associate Chair: D. Uhlenbrock (421 VV)

Department Administrator: G. Novara (223 VV)

Undergraduate Advisor: G. Mari-Beffa (309 VV)

TA Supervisor: R. Wilson (411 VV)

Undergraduate Secretary: P. Conklin (203 VV)

Sexual Harrassment Contact Persons: G. Benkart (817 VV), D. Rivard (B207 VV)

Access and Accomodation Coordinator: D. Uhlenbrock (421 VV)

Faculty Minority Liaison: D. Rider (821 VV) [Information available concerning diversity and multicultural issues (e.g. support services, academic internships and grants/fellowships). Prof. Rider is also available to discuss minority students' concerns about mathematics courses: 263-3603, drider@math.wisc.edu)]