

EE 532 – Communication Theory II – 3 hours
(old: EE 532 - Information Theory - 3 hours)
Elective course

1. *New catalog description*

Digital communication systems; modulation; demodulation; maximum likelihood detection; tradeoffs between bandwidth and power; bit error rate; channel coding techniques: block coding, convolutional coding and iterative decoding; mutual information; channel capacity; trellis-coded modulation; synchronization. Prerequisite: EE 531 Communication Theory I.

(old: 1. 2006-2007 Catalog description

Coding theory; memory and memoryless systems. Prerequisite: EE 530)

2. *Prerequisites by topic*

- a Modulation: analog and digital
- b Optimum receiver structures
- c Probability theory

3. *Textbook(s) and/or other required material*

Required: Digital Communications, 2nd edition, by B. Sklar, Prentice-Hall, 2001.

4. *Class Schedule*

Three sessions per week, each 50 minutes, for 14 weeks

5. *Topics Covered (Outcomes influenced)*

- Channel capacity theorem (7 a, b)
- Communication trade-offs (7 a, b, c, d)
- Intersymbol interference (7 a, b, c, d)
- Channel equalizers (7 a, b, c, d)
- Power limited and bandlimited systems (7 a, b, c, d)
- Channel models (7 a, b, c, d)
- Code rate and redundancy, parity check bits (7 d, e, f)
- Vector space (7 d, e, f)
- Generator matrix, generator polynomial (7 d, f)
- Feedback shift register implementation of systematic codes (7 d, f)
- Maximum likelihood decoding (7 d, e, f)
- Galois field theory (7 e, f, g)
- Non-binary (Reed-Solomon) encoding and decoding (7 d, f)
- Interleaving and deinterleaving (7 f, g)
- Iterative decoding – Turbo codes, Low density parity check codes (7 a, b, c, d)
- Simulation techniques using MATLAB and SystemView (7 e, f, g, h, i)

6. *Contribution of course to meeting the professional component*

Engineering science - 30%, Engineering design - 70%

7. *Course Outcomes (Program outcome contributions): In learning the course topics, the student will attain the following outcomes. (note – graded deliverables measure performance relative to the outcomes)*

- a The student will understand influence of noise to information-carrying signals during transmission. (9 A, B, C, D)
- b The student will understand fundamental limits of communication systems. (9 A, B, C, D)
- c The student will understand trade-offs among SNR, bandwidth, and probability of error. (9 A, B, C, D)
- d The student will understand need of channel coding and decoding. (9 A, B, C, D)
- e The student will understand relationship between modulation and coding. (9 A, B, C, D)
- f The student will analyze and construct linear block codes. (9 A, B, C, D)

- g The student will analyze and construct convolutional encoders. (9 A, B, C, D)
- h The student will understand iterative coding techniques (9 A, B, C, D)
- i The student will understand trade-offs between modulation and coding. (9 A, B, C, D)
- j The student will simulate communication systems using simulation software, MATLAB and SIMULINK. (9 A, B, C, D)

8. *Grading policy*

The final grade will be determined by the combined numerical results of all exams, homework scores, and take-home exam problems including computer projects.

Exam 1	25%
Exam 2	25%
Final Exam	30%
Homeworks and computer projects	20%

A grade of C corresponds to meeting the minimum competency required to understand course topics and meet course objectives.

9. *Relationship of course to program outcomes*

label	Program Outcomes (A Graduate from the program will:)	Contribution
A	have knowledge of the mathematical and scientific foundation of electrical engineering	Strong
B	have knowledge of and the ability to apply techniques and technology of electrical engineering	Strong
C	complete a design project sequence, culminating in a capstone project at or near the professional level	Moderate
D	understand that acquisition of new knowledge is needed for success in the electrical engineering profession	Moderate
E	meet Bradley's general education requirements which are based on the principles of liberal education	NA
F	have experience in communicating technical information and working on teams	Moderate
G	understand the importance of professional and ethical behavior	Moderate

10. *Prepared by:* In Soo Ahn 5/21/2008