ECE 455 Information and Coding Theory

Catalog Data:
EE ID&WS455 Information and Coding Theory (3 cr.). WSU EE 451. Introduction to information theory; information content of messages; entropy and source coding; data compression; channel capacity data translation codes; fundamentals of error correcting codes; linear block and convolutional codes; introduction to trellis-coded modulation. Prereq: Math 330, Stat 301. Meets for 50 min. 3 times/week.

Textbook:
Applied Coding and Information Theory by Wells, Prentice-Hall, 1999.

References:
None

Coordinator:
Richard B. Wells, Associate Professor of Electrical and Computer Engineering

Objectives:
1. Understand the difference between "data" and "information" in a message.
2. Learn how to analyze and measure the information per symbol emitted from a source.
3. Learn how to analyze the information-carrying capacity of the communication channel.
4. Learn how to design source compression codes to improve the efficiency of information transmission.
5. Learn how to design data translation codes to tailor the transmitted data sequence to the constraints of the channel.
6. Learn how to adapt and tailor known error control codes for use in particular applications.

Relationship to Program Objectives:
The support of program objectives (lettered) by course objectives (numbered) is identified by the bulleted entries in the following table.

	A	B	C	D	E
1	•				
2	•	•			
3	•	•	•		
4	•	•	•	•	
5	•	•	•	•	
6	•	•	•		

Prerequisites by Topic:
1. Elementary probability and statistics
2. Linear algebra

Topics:
1. Information sources and entropy
2. Data compression coding
3. Channel models
4. Equivocation and mutual information
5. Markov processes and information rate
6. Data translation coding
7. General properties of linear block error control codes
8. Cyclic error correcting codes
9. Designing and customizing block codes
10. Convolutional error correcting codes

Computer Usage:
Mathcad

Laboratory Projects:
None

ABET engineering topics content:
Engineering Science: 1.5 credits
Engineering Design: 1.5 credits

Assessment Tools:
1. Weekly quizzes
2. Four one-hour exams
3. One two-hour final exam

Desired Course Outcomes:
1. Students will demonstrate ability to evaluate the information rate of various information sources.
2. Students will demonstrate ability to design lossless data compression codes for discrete memoryless sources.
3. Students will demonstrate ability to evaluate the information capacity of discrete memoryless channels and determine possible code rates to achievable on such channels.
4. Students will demonstrate an ability to compensate for channel memory through the design of appropriate data translation codes.
5. Students will demonstrate an understanding of the mathematical theory of linear channel codes for error detection and correction.
6. Students will demonstrate the ability to select and design simple linear block error correcting codes.
7. Students will demonstrate an ability to implement cyclic block codes using feedback shift register logic circuits.
8. Students will demonstrate ability to select and design simple convolutional codes.
9. Students will demonstrate an understanding of and ability to implement the Viterbi decoding algorithm.

Relationship of Desired Course Outcomes to Desired Program Outcomes:
The relationship between desired course outcomes (numbered) and desired electrical engineering program outcomes (lettered) is illustrated by the bulleted entries in the following table.

	a	b	c	d	e	f	g	h	i	j	k	l	m
1	•						•						•
2	•		•		•		•				•	•	
3	•						•				•		•
4	•		•		•		•				•		
5	•						•					•	•
6	•		•				•					•	
7	•		•		•		•				•	•	
8	•		•				•					•	
9	•		•				•						•