

Error Correcting Codes - Video course

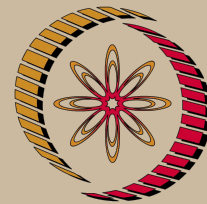
COURSE OUTLINE

This course is typically meant for an Masters-level or final-year BE student. Error-correcting codes are in widespread use for data storage as well as most forms of communication where reliability is of importance. Examples range from compact discs to deep-space communication.

This course will cover both classical error-correcting codes such as BCH, Reed-Solomon and convolutional codes as well as the more modern class of iteratively decodable codes, low-density, parity-check codes in particular.

COURSE DETAIL

Sl. No.	Topics	No.of Hours
1	Course overview; Basics of binary block codes for the binary symmetric channel; Mathematical preliminaries: groups, subgroups and cosets.	4
2	Linear block codes; Bounds on the size of a block code; Bounded and maximum-likelihood decoding of binary block codes; standard array decoding.	5
3	Basics of convolutional codes; the Viterbi decoding algorithm.	3
4	The generalized distributive law (GDL).	4
5	The GDL perspective on the Viterbi and BCJR decoding algorithms; Turbo codes in brief.	3
6	LDPC codes.	4
7	Fields; Polynomials rings; construction of finite fields.	3
8	Deducing the structure of a finite field; Subfields and cyclotomic cosets.	5
9	The finite field (Fourier) transform; cyclic codes via finite field transforms.	4
10	BCH and Reed-Solomon codes; decoding of BCH and RS codes.	5



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Electronics & Communication Engineering

Pre-requisites:

1. Linear algebra, probability theory, some exposure to transform theory.

Additional Reading:

1. Tom Richardson and Ruediger Urbanke, *Modern Coding Theory*, Cambridge University Press, 2008.
2. W. C. Huffman and V. Pless, *Fundamentals of Error-Correcting Codes*, Cambridge University Press, 2003.
3. Shu Lin and D. J. Costello, *Error-Control Coding*, Second Edition, Pearson Press, 2004.
4. George C. Clark and J Bibb Cain *Error-Correction Coding for Digital Communications*, Plenum Press, 1981.
5. A. J. Viterbi and J. K. Omura, *Principles of Digital Communication and Coding*, McGraw Hill, 1979.
6. R. Roth, *Introduction to Coding theory*, Cambridge University Press 2006.
7. S. Wicker, *Error-Control Systems for Digital Communication and Storage*, Prentice-Hall, 1995.
8. R. E. Blahut, *Algebraic Codes in Lines, Planes and Curves*, Cambridge University Press, 2008.

9. S. A. Vanstone and P. C. van Oorschot, *An Introduction to Error Correcting Codes with Applications*, Kluwer Academic Press, 1989.

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References:

1. P. V. Kumar, M. Win, H-F. Lu, C. Georghiades, "Error-Control Coding Techniques and Applications", Chapter 17 in *Optical Fiber Telecommunications IV-B: Systems and Impairments*, Editors: Ivan P. Kaminow and Tingye Li, Elsevier Science Press, 2002.
2. F. J. MacWilliams and N. J. A. Sloane, *The Theory of Error-Correcting Codes*, North-Holland, 1977.