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

NP-TEL

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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.

		Total	40

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.*
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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