

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	ECD410	Information and Coding Theory	3	0	0	11

Course Objective

The objective of this course is to provide the basic concept of the information theory (mutual information, entropy, channel capacity) for wireless communication systems. The course will also provide the knowledge of source coding and channel coding which is very much useful to design an efficient communication system.

Learning Outcomes

Upon successful completion of this course, students will:

- acquire a basic knowledge about entropy, mutual information, channel capacity, source coding and channel coding,
- develop the ability to analyze the achievable throughput for any communication networks,
- be able to implement channel coding to improve the reliability of the communication system

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to random variable, Entropy, Relative Entropy, Joint Entropy, Conditional Entropy, Mutual Information, Chain Rules	8	Provides the basic knowledge on Entropy and mutual information.
2	Data-Processing Inequality, Fano's Inequality; Source Coding and Data Compression;	4	Develop the understanding on source coding technique.
3	Channel capacity, Symmetric Channels, Properties of Channel Capacity, Channel Coding Theorem; Differential Entropy, Properties of Differential Entropy, Gaussian channel, Coding Theorem for Gaussian Channels.	8	Develop the concept on channel capacity for Gaussian channels.
4	Linear Binary Block Codes, Error Detection with Linear Block Codes, Weight Distribution and Minimum Hamming Distance of a Linear Block Code, Hard-decision and Soft-decision Decoding of Linear Block Codes, Cyclic Codes, Interleaved and Concatenated Codes.	12	Understanding of various error control coding techniques and the fundamental concept behind the design of such coding scheme.
5	Convolutional Codes: Encoder Realizations and Classifications, Minimal Encoders, Trellis representation, MLSD and the Viterbi Algorithm, Bit-wise MAP Decoding and the BCJR Algorithm	10	Develops the knowledge on optimal detector for such channel coding technique.

Text Book:

1. Thomas M. Cover, and Joy A. Thomas. "Elements of information theory". John Wiley & Sons, 2012
2. Lin, Shu, and Daniel J. Costello. "Error control coding". Pearson Education India, 2001.

Reference Book:

1. Stone, James V. "Information theory: a tutorial introduction". Sebtel Press, 2015.
2. Proakis, John G., and Masoud Salehi. "Digital communications". Vol. 4. New York: McGraw-hill, 2001.
3. Gallager, Robert G. "Information theory and reliable communication". Vol. 2. New York: Wiley, 1968.