ECU 447 SIGNAL COMPRESSION

Pre-Requisites: ECU 303, ECU 306

Module 1: (9 hours) Compression Techniques – Lossless and Lossy Compression – Modeling and Coding – Mathematical Preliminaries for Lossless Compression – Huffman Coding – Minimum Variance Huffman Codes – Extended Huffman Coding – Adaptive Huffman Coding – Arithmetic Coding – Application of Huffman and Arithmetic Coding, Golomb Codes, Run Length Coding, Tunstall Codes

Module II: (9 hours) Dictionary Techniques – Static Dictionary – Adaptive Dictionary- LZ77, LZ78, LZW - Applications – Predictive Coding – Prediction with Partial Match – Burrows Wheeler Transform – Sequitur- Lossless Compression Standards (files, text, and images, faxes), Dynamic Markov Compression

Module III: (12 hours) Mathematical Preliminaries for Lossy Coding – Rate distortion theory: Motivation; The discrete rate distortion function R(D); Properties of R(D); Calculation of R(D); R(D) for the binary source, and the Gaussian source,Source coding theorem (Rate distortion theorem); Converse source coding theorem (Converse of the Rate distortion theorem) - Design of Quantizers: Scalar Quantization – Uniform & Non-uniform – Adaptive Quantization – Vector Quantization – Linde Buzo Gray Algorithm – Tree Structured Vector Quantizers – Lattice Vector Quantizers – Differential Encoding Schemes.

Module IV: (12 hours) Mathematical Preliminaries for Transforms , Subbands, and Wavelets – Karhunen Loeve Transform, Discrete Cosine Transform, Discrete Sine Transform, Discrete Walsh Hadamard Transform – Transform coding - Subband coding – Wavelet Based Compression – Analysis/Synthesis Schemes – Speech, Audio, Image and Video Compression Standards.

Text books:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Publishers., Second Edn., 2005.
2. David Salomon, “Data Compression: The Complete Reference”, Springer Publications, 4th Edn., 2006.

Reference books:

Toby Berger, “Rate Distortion Theory: A Mathematical Basis for Data Compression”, Prentice Hall, Inc., 1971.
K.R.Rao, P.C.Yip, “The Transform and Data Compression Handbook”, CRC Press., 2001.
R.G.Gallager, “Information Theory and Reliable Communication”, John Wiley & Sons, Inc., 1968.
Ali N. Akansu, Richard A. Haddad, “Multiresolution Signal Decomposition: Transforms, Subbands and Wavelets”, Academic Press., 1992
Martin Vetterli, Jelena Kovacevic, “Wavelets and Subband Coding”, Prentice Hall Inc., 1995.