

# EEE 6585 Digital Processing of Speech Signals

**Credits:** 3 credits

**Textbook, title, author, and year:** Discrete-Time Speech Signal Processing by Thomas F. Quatieri. Prentice Hall. ISBN-10: 013242942

**Reference materials:** L. Rabiner and R. Shafer, *Digital Processing of Speech Signals*, Prentice Hall, 1978.  
P. Loizou, *Speech Enhancement: Theory and Practice*, CRC Press, 2007.

**Specific course information:** Scope: Speech production models, characteristic features of speech and their detection, synthesis, enhancement, compression, recognition.

**Catalog description:** A course in digital modeling, processing, and representation of speech signals, short time Fourier analysis, speech spectrograms, linear predictive coding, person-machine communication by voice.

**Prerequisites:** EEE 5502 Digital Processing of Signals

**Specific goals for the course:** To introduce the fundamentals of speech signal processing and related applications. This course will present the basic principles of speech analysis and speech synthesis, and it will cover several applications including speech enhancement, speech coding and speech recognition.

## **Brief list of topics to be covered:**

- I. Speech production model (source-system model)
- II. Speech perception
  - a. Classes of speech sounds (consonants, vowels, etc.)
  - b. Spectral characteristics of consonants and vowels, formants
- III. Speech analysis techniques
  - a. Pitch detection
  - b. Endpoint detection
  - c. Voiced/Unvoiced detection
- IV. Speech synthesis techniques
  - a. Formant-based speech synthesizers (e.g., KLATT synthesizer)
  - b. Articulatory speech synthesizers
- V. Speech recognition
  - a. Feature extraction algorithms (e.g., mel-frequency cepstrum coefficients)
  - b. Dynamic-time warping
  - c. Hidden-Markov Models
- VI. Speech enhancement
  - a. Spectral subtraction methods
  - b. Wiener filtering
- VII. Speech compression
  - a. ADPCM
  - b. Linear-predictive coders, analysis-by-synthesis techniques (e.g. CELP)
  - c. Speech and audio coding standards (e.g., VSELP, MPEG)