Subject title: Digital Audio Processing

Subject code: EIE563

Credit value: 3

Responsible staff and department:
Dr Chris, Y.H. Chan, EIE

Pre-requisite:
Nil

Recommended background knowledge:
Knowledge of digital signal processing.

Mutual exclusions: Nil

Learning approach:
| Lecture/Tutorial | 33 hours |
| Practical/Case Study | 9 hours |

Assessment:
| Continuous Assessment | 60% |
| Examination | 40% |
| Total | 100% |

Objectives:
This course focuses on digital audio processing techniques and their applications. This syllabus is designed to fill the gap between the hardcore theory of various digital signal processing techniques and their applications in various real-world digital audio products and services. Students are expected to be able to handle digital audio processing and design, and have a deep understanding of the topics in the field after completing this course successfully.
Keyword syllabus:

1. Fundamentals of DSP
   Fourier transform; Time-frequency analysis; Multirate systems; Filter bands etc.

2. Fundamentals of Digital Audio
   Sampling; Dithering; Quantization; Dynamic Range; SNR; Technical terms in the field etc.

3. Digital Audio Recording
   Recording process; Input lowpass filtering; Sample-and-hold circuit; Oversampling; Analog-to-digital
   conversion; Dithering; Noise shaping; Post-processing.

4. Digital Audio Compression
   Critical bands; threshold of hearing; Amplitude masking; Temporal masking; Waveform coding;
   PCM, DPCM; Perceptual coding; Coding techniques: Subband coding and Transform coding; Codec
   examples.

5. Digital Audio Encoding
   CIRC encoding; EFM modulation; Merging bits; NRZI encoding; synchronisation; Error detection;
   Error concealment; Error correction; Audio Bitstream Formats etc.

6. Digital Audio Reproduction
   Reproduction process; Model; Digital-to-audio Conversion; Sampling-and-hold circuit; Filtering;
   Oversampling; Noise shaping; Sigma-delta modulation; Equalisation; Post-processing; Practical
   implementation issues.

7. Digital Audio Restoration
   Detection of Pops/Clicks/Pulses; Estimation of corrupted samples; Techniques: Prediction-error
   detection, LS gap filling, Bayesian approaches etc.; Background noise reduction; Short-time spectral
   attenuation etc.

8. Case Study of System/Codecs
   MP3; MP3-Pro; CD; MD; DVD-Audio; AC-3; Dolby digital; Surround; SRS Surround system;
   TWIN-VQ etc.

9. Digital Audio Broadcasting
   Standards; Technology used etc.

10. Multimedia Applications of Digital Audio
    Application examples; MIDI etc.

Indicative reading list and references:

5. Selected papers in IEEE Transactions and international journals.

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