Subject Description Form

Subject Code	EIE563
Subject Title	Digital Audio Processing
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Knowledge of digital signal processing. Calculus, linear algebra and basic statistics. Some programming (preferably MATLAB)
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.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the fundamentals of audio processing and associated techniques. b. Solve practical problems with some basic audio processing techniques. c. Design simple systems for realizing some applications with some basic audio processing techniques.
Subject Synopsis/ Indicative 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 Reproduction Reproduction process; Model; Digital-to-audio Conversion; Sampling-and-hold circuit; Filtering; Oversampling; Noise shaping; Sigma-delta modulation; Equalization; Post-processing; Practical implementation issues. 6. 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. 7. Case Study of System/Codecs MP3; MP3-Pro; CD; DVD-Audio; AC-3; Dolby digital; SRS Surround system etc. 8. Digital Audio watermarking Time-domain techniques, frequency-domain techniques.

Teaching/Learning Methodology

Method	Remarks
Lectures	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	Supplementary to lectures and are conducted with smaller class size if possible; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed.
Laboratory sessions	Students will make use of the software MATLAB to simulate various image processing techniques and evaluate their performance.

Teaching/Learning Methodology	Intended Subject Learning Outcomes		
	a	b	c
Lectures	✓	✓	✓
Tutorials	✓	✓	✓
Laboratory sessions	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Test	20%	✓	✓	✓
2. Quiz	15%	✓	✓	✓
3. Laboratory assignments and reports	20%	✓	✓	✓
4. Examination	45%	✓	✓	✓
Total	100%			

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial (13 weeks, 3 hours per week)	39 Hrs.
Other student study effort:	
▪ Homework and self-study	66 Hrs.
Total student study effort	105 Hrs.

Reading List and References

1. K.C. Pohlmann, *Principles of Digital Audio*, 5th ed., McGraw-Hill, 2005.
2. K.C. Pohlmann, *Advanced Digital Audio*, SAMS, 1991.
3. S.J. Godsill and P.J.W. Rayner, *Digital Audio Restoration - A Statistical Model-Based Approach*, Springer-Verlag, London, 1998.
4. U. Zolzer, *Digital Audio Signal Processing*, Wiley, 1997.
5. Selected papers in IEEE Transactions and international journals.