

City University of Hong Kong

**Information on a Course
offered by Department of Electronic Engineering
with effect from Semester A in 2014/2015**

This form is for completion by the Course Co-ordinator/Examiner. The information provided on this form will be deemed to be the official record of the details of the course. It has multipurpose use: for the University's database, and for publishing in various University publications including the Blackboard, and documents for students and others as necessary.

Please refer to the Explanatory Notes attached to this Form on the various items of information required.

Part I

Course Title: Digital Audio Technology

Course Code: EE4209

Course Duration: One semester (13 weeks)

No. of credits: 3

Level: B4

Prerequisites (*Course Code and Title*): EE3210 Signals and Systems, or
EE3118 Linear Systems and Signal Analysis

Precursors (*Course Code and Title*): Nil

Equivalent Course (*Course Code and Title*): EE4207 Digital Speech And Audio Processing

Exclusive Courses: (*Course Code and Title*): Nil

Part II**1. Course Aims:**

The aim of this course is to provide students with a solid foundation in digital audio technology.

2. Course Intended Learning Outcomes (CILOs)

(state what the student is expected to be able to do at the end of the course according to a given standard of performance)

Upon successful completion of this course, students should be able to:

No.	CILOs
1.	describe the characteristics of audio signals and explain the principles of over-sampling analogue to digital conversion
2.	develop basic skills for coding audio signals digitally in time and frequency domains
3.	describe the concept and internal functioning of modern audio coding standards
4.	develop basic skills on the processing and synthesis of music signals
5.	describe the design parameters for multi-channel home audio systems

3. Teaching and Learning Activities (TLAs)

CILO 1	Teaching activities are based on lectures followed by tutorial examples on the subjects
CILO 2	Teaching activities are based on lectures followed by tutorial examples on the subjects. In addition, students are required to complete an assignment for implementing a simple audio coder to gain practical experience on audio coding
CILO 3	Teaching activities are based on lectures followed by tutorial examples on the subjects
CILO 4	
CILO 5	

Timetabling Information

Pattern	Hours
Lecture:	26
Tutorials:	13
Laboratory:	0
Other activities:	0

4. Assessment Tasks/Activities

	Type of assessment tasks	Weighting (if applicable)
Continuous Assessment	Assignments, Tests, Tutorial Quizzes, Presentation	30%
Examination	Written exam	70% 2 hours

Remarks: To pass the course, students are required to achieve at least 35% in coursework and 35% in the examination.

5. Grading of Student Achievement:

Letter Grade	Grade Point	Grade Definitions
A+	4.3	Excellent
A	4.0	
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Adequate
C	2.0	
C-	1.7	
D	1.0	Marginal
F	0.0	Failure

6. Constructive Alignment with Major Outcomes

Please state how the course contribute to the specific MILO(s)

MILO	How the course contribute to the specific MILO(s)
1, 2, 5	The course provides students with ample opportunities in the applications of mathematics, and engineering problem solving skills which are central to the aims of this program
3	Students are required to complete an assignment designed to gain practical experience in implementing a workable digital audio coding/decoding system. They need to write a report and present their work accordingly. These practical training and presentation skills are central to the aims of this program

Part III**Keyword Syllabus:**Introduction

Characteristics of audio and music signals; digitization of audio signal; bandwidth; precision, and signal-to-quantization noise ratio ; over-sampling A/D conversion; digital processing of audio signals; digital filtering; microphone and loudspeaker characteristics; sound propagation in different environments; human auditory perception; loudness and frequency masking; critical band.

Audio coding

Fundamental of data compression: lossy and lossless compression, Huffman and arithmetic coding, model-based predictive coding, time- and frequency-domain approaches.

Audio coding formats: WAV; coding formats for CD.

Waveform coding: PCM, ADPCM, Dolby DTS.

Psychoacoustic coding: Transform coding, QMF and MDCT, MPEG I, II, IV Audio, Advanced audio coding and MP3.

Lossless coding: Meridian Lossless Packing coding for DVD-Audio, Direct Stream Digital for Sony/Philips Super Audio CD, MPEG-IV ALS Predictive Lossless Coding.

Music synthesis

Musical acoustic; Time- and frequency-domain representation of sound; sinusoidal and harmonic signal; additive synthesis and non-linear synthesis; FM synthesis and Chebyshev techniques; physical modelling; wavetable synthesis; MIDI format; instrument and sequencing.

Room Acoustics and 3D Sound

Concert hall, studio and home listening room acoustics; absorption, reverberation time and Sabin calculations 3D Sound; depth perception, Sound localization/spatialization, Head-Related Transfer Function, Surround sound; Compression and expansion; Digital mixing; filtering; Dolby ProLogic; THX; Dynamic EQ.

Multimedia applications

Internet and digital audio broadcast; music jukebox.

Recommended Reading:**Text Book:**

Ken C. Pohlmann, Ken C. Pohlman: Principles of Digital Audio, McGraw Hill Text; 3rd edition (September 1995), ASIN: 0070504695.

Reference Book:

Dai Tracy Yang, Chris Kyriakakis, and C.-C. Jay Kuo: High-Fidelity Multichannel Audio Coding, EURASIP Book Series on Signal Processing and Communications, Hindawi Publishing Corporation, 2004. ISBN 977-5945-13-5

Udo Zolzer: Digital Audio Signal Processing 2nd Edition, Wiley (August 2008), ISBN 978-0-470-99785-7

Marina Bosi, Richard E. Goldberg, Leonardo Chiariglione: Introduction to Digital Audio Coding and Standards, Kluwer Academic Publishers; (December 2002), ISBN: 1402073577.

John Watkinson: Introduction to Digital Audio, Focal Press; 2nd edition (November 13, 2002), ISBN: 0240516435.

F. Alton Everest: Master Handbook of Acoustics, McGraw-Hill/TAB Electronics; 4th edition (September 22, 2000), ISBN: 0071360972.

John Watkinson: Art of Digital Audio, Third Edition, Focal Press; 3rd edition (December 2000), ISBN: 0240515870.

Jerry Whitaker and Blair Benson: Standard Handbook of Audio and Radio Engineering, McGraw-Hill Professional, ISBN: 0070067171.

John Watkinson: MPEG Handbook, Focal Press; 1st edition (September 2001), ISBN: 0240516567.

Eberhard Zwicker, H. Fastl, and H. Frater: Psychoacoustics: Facts and Models, Springer Verlag; 2nd edition (April 1999), ISBN: 3540650636.

David Howard and James Angus: Acoustics and Psychoacoustics (Music Technology), Focal Press; 2nd edition (January 3, 2001), ISBN: 0240516095.

Online Resources (if any)

NII

Returned by:

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