EECE 503A: Audio Engineering

Catalog Description
The course is taught in a blended learning format and introduces students to the audio engineering discipline. Topics include properties of sound sources (including musical instruments), the human perception of sound (psychoacoustics), acoustical design of audio rooms (room resonance, reverberation, isolation, etc.), study and design of various types of electro-acoustical transducers (microphones, speakers, and analog tape recorders), operation of analog and digital audio production consoles, digital audio principles (coding, standards, transmission, media, etc.), and musical instrument digital interface (MIDI). The course introduces and uses Avid’s ProTools digital audio production suite as a tool for audio applications.

Required/Elective
Elective for ECE
Elective for CCE

Prerequisites by topic
1. Electronic Circuits, EECE311
2. Signals and Systems, EECE340

Co-requisite
Topics are complemented with a related work in the Audio Lab (SRB, Room TBA).

Textbook:
Notes provided by the instructor

References
M. Bosi, R.E. Goldberg, “Intro to Digital Audio Coding and Standards”, Springer, 2003

Course objectives

1. An understanding of the basic principles of sound engineering, audio production techniques and the music business
2. An understanding of audio wave theory
3. An understanding of human psychoacoustics
4. An understanding of room acoustics and materials used in the design and acoustical treatments of audio rooms
5. An overview of the design and application of audio transducers (microphones, analog tape recorders and speakers)
6. An overview of digital audio, coding technologies, storage media and transmission protocols
7. The basic background in audio engineering that will allow them to practice in this field, and will form the foundation for more advanced courses in audio engineering
8. Research materials related to various topics covered to expose them to team work, market products and contemporary technologies
9. The basic skills needed to use Pro-Tools to record, edit, mix and master an audio/soundtrack projects

Course Topics

1. Introduction to the Music Production Business
2. Physics of Sound
3. Psychoacoustics
4. Room Acoustics
5. Electroacoustical Transducers I: Microphones
6. Electroacoustical Transducers II: Speakers
7. Electroacoustical Transducers III: Analog Tape Recorders
8. Audio Production Consoles
9. Digital Audio
10. Musical Instrument Digital Interface - MIDI

Lab Topics

1. Digital Audio Manipulation using ProTools
2. Instrument Characterization and Speech Processing
3. Microphone Characteristics and Digital Audio Recording
4. Stereophony and Derivative Soundscapes

Lab experiments will be conducted using:

- Pro-Tools 8.0 multi-track recording, editing, mixing and mastering software from Avid
- MBox2 44.1kHz, 24-bit dual-channel audio Data Acquisition (DAQ) System
- AKG C-414 condenser microphone
- Rode NT-5 Stereo condenser microphones
- Shure SM and Beta dynamic microphones
- AKG Studio head-sets
Course Outcomes

1. Are introduced to the area of Sound Engineering as an integrated engineering field, have an understanding of the working environment, and are familiar with the people and skills associated in the production of musical projects
2. Understand Psychoacoustics and cultivate ear training skills
3. Understand sound waveform and spectrum characteristics, are familiar with popular musical instruments and their tonal characteristics
4. Develop skills needed to design the acoustics of various types of recording studios
5. Understand microphone design, application and placement techniques
6. Understand the basics of ATR and their digital counterparts
7. Understand MIDI technology and its applications in the industry
8. Understand digital audio technology
9. Understand audio signal processors (reverb, delays, phasers, flangers, pitch shifters) and applications
10. Understand speaker design and placement
11. Possess the basic skills needed to record, mix, edit and manipulate audio events using Pro-Tools
12. Understand the various mediums used for the recording, storage, reproduction and transmission of audio signals in the digital and analog domain

Resources of the course:
Web references, learning objects, Audio/Video examples
Audio Engineering Society (AES) publications, articles and engineering reports

Professional components:
Engineering topics: 65%, General education: 20%, Mathematics and physics: 15%

Evaluation methods
1- Class participation using TurningPoint® technology (15%)
2- Audio Labs (40%)
3- Midterm (15%)
4- Final (30%)

Person(s) who prepared this description
Mihran Gurunian, May 2005

Last Revised by
Mihran Gurunian, February 2013