

AUDIO 117 - INTRO TO MUSIC TECHNOLOGY

COURSE LEARNING OUTCOMES (CLOs)

1. Define the similarities and differences between an analog and a digital audio system.
2. Define the relationship between sample rate and frequency response, and bit depth and dynamic range in a digital audio system.
3. Demonstrate basic analog synthesizer programming concepts.
4. Demonstrate basic Mac computer operating system navigation and keyboard shortcut skills.
5. Demonstrate general knowledge of MIDI protocol, MIDI Software and Hardware.
6. Describe the importance of the Futurist Movement of the early 20th century as an influence on the Musique Concrete movement of the 1950's

COURSE OUTLINE

I. Acoustic sound properties and the electronic reproduction of sound

- A. Physical properties of sound
 1. Simple Harmonic Motion- Frequency and Amplitude
 - a. Using graphs to plot SHM
 2. Speed of sound through different mediums
 3. How frequency corresponds to pitch
 4. Audio spectrum- frequency range of human hearing
 5. Wavelength formulas- calculate physical lengths of periodic waves in air
 6. Harmonic series- natural oscillation properties of acoustic instruments
 7. Comparison of the Just Intonation and 12-TET tuning systems
- B. Electronic analog reproduction of sound
 1. Basic concepts of how analog sounds are electronically reproduced
 2. Lab Project- Phase relationship using sine waves generators and oscilloscope
 - a. Adding sine waves of equal frequency and amplitude and adjusting phase
 3. Study the construction of common complex wave forms (square, triangle and sawtooth)
- C. How complex sound waves can be synthesized from simple wave forms (Additive Synthesis)
 1. Lab project- Construct complex waves using sine wave generators

II. Brief History of Electronic Music

- A. Significant events in early sound technology
 1. Thomas Edison- held first patent on the phonograph in 1878
 2. Lee DeForest- inventor of the Triode Audion in 1906 (The Vacuum Tube)
- B. Important inventions, inventors, composers and performers of electronic music

1. Thaddeus Cahill and the Telharmonium
 - a. First significant electromechanical musical instrument
 - b. Electromechanical hybrid. Pre-amplification era
 - c. First Muzak?

2. Leon Theremin and his Theremin (watch video)
 - a. First significant all electronic musical instrument
 - b. Clara Rockmore - Theremin virtuoso
 - c. The Theremin goes to Hollywood

3. The Futurist movement in Italy 1909-1935
 - a. Luigi Russolo and The Art Of Noises- Industrial lifestyle influences art and culture
 - b. Edgard Varese- "Organized Sound"
 - c. Discuss how the Futurist movement influenced Electronic music

4. Musique Concrete - Taped Music
 - a. Pierre Schaefer- French radio engineer .Created first piece of Musique Concrete in 1948
 - b. Karlhienz Stockhausen- German composer of Electronic and Taped music
 - c. Bebe and Louis Barron- 1956,First all electronic film score "The Forbidden Planet"

5. RCA Mark I synthesizer at Columbia-Princeton Electronic Music Center
 - a. Vladimir Ussachevsky- Sonic Contours
 - b. Otto Luening- Fantasy In Space

6. Raymond Scott - Circle Machine, Clavivox and Electronium
7. Don Suchla - Controlled Voltage Modules
8. Bob Moog and the Modular Moog Synthesizer
 - a. Wendy Carlos - Switched On Bach- first commercial success of an all electronic album
 - b. Keith Emerson - The Moog and Rock Music
 - c. Mini Moog - First commercial performance-oriented synthesizer
 - i. Chick Corea- Synthesizer virtuoso, Jazz/Rock fusion pioneer
 - ii. Jan Hammer- Synthesizer virtuoso. Jazz/Rock fusion pioneer

9. Isao Tomita – Sound design master using the Moog Modular Synthesizer
 - a. Electronic versions of Debussy, Stravinsky and Holst.
 - b. Back to Earth concert 1986- Largest Multi-Media concert

10. Electronica - The Techno movement

III. Analog Synthesis

- A. Fundamentals of analog synthesizers - modular concept
 - 1. Voltage Controlled Modules
 - a. VCO-voltage controlled oscillator
 - b. VCA-voltage controlled amplifier
 - c. VCF-voltage controlled filter
 - 8. Control Voltage Sources
 - 1. Envelope generators
 - 2. CV keyboard
 - 3. LFO-low frequency oscillator
 - 4. Sample and Hold generator
- C. Lab Project- Synthesize natural sounds and instruments using analog synthesizers
 - 1. Acoustic Jazz Bass
 - 2. Wind Storm with random gusts
 - 3. Bowed Violin

IV. Basic digital audio and sampling

- A. How are sounds "digitized" using AD conversion
 - 1. Binary and Hexadecimal numbers system
 - 2. Sample Rates- The Frequency component of sound
 - a. Nyquist Theorem
 - b. Aliasing
 - 3. Bit Depth- The Amplitude component of sound
 - a. Quantization
 - b. Quantization Error
 - c. Signal-to-Error Ratio
 - d. Dither
- B. Discussion: Define the similarities and differences between an analog and a digital audio system.

VI. Basic MIDI and General MIDI

- A. MIDI history, specifications and applications are discussed
- B. Setting up a MIDI network

1. Daisy chain
2. Star network
- C. General MIDI specifications – 1.0 and 2.0
 1. Standard MIDI program
 2. MIDI drum and percussion map
 3. Standard MIDI files
- D. Lab project- Sequencing drum and bass music using MIDI keyboard

VII. Computers and Music

- A. Internal components
 1. Mother Board
 2. CPU
 3. RAM and ROM
 4. Cache
 5. Media drives- SSL, Hard Disk and Optical
- Drives B. I/O
 1. USB- 2.0 3.0
 2. Firewire- IEEE1394
 3. Thunderbolt- new technology from Intel and Apple
- C. Music software
 1. Sequencing software
 2. Music notation software
 3. DAW- Digital Audio Workstations
- D. Music oriented peripherals
 1. Audio interfaces
 2. MIDI interfaces
 3. Control Surfaces