

# ATEC-101: Fundamentals of Audio Technology

Time: Wednesday 2:10pm - 4:50pm  
Location: Katzen 135

Professor: William Brent  
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Office hours: M/Th/F: 2:00pm - 4:00pm

Textbook: Rumsey and McCormick, Sound and Recording (6<sup>th</sup> edition)

## Summary

ATEC-101 introduces the subject of audio technology via physical and perceptual aspects of sound itself. The characteristics of a variety of microphones and loudspeakers are considered from both technical and aesthetic points of view. The anatomy of other hardware present in a typical signal chain will also be covered. Essential digital audio concepts will be explained and, when possible, demonstrated through clear example. This background will inform our understanding of the digital signal processing behind some common plug-in utilities and effects. We will close with issues related to modeling space in stereo and surround sound configurations. There will be two assignments over the course of the semester, providing the opportunity to engage with course material in a more direct fashion. In combination with the practical experience offered in ATEC-102, this will solidify some of the information covered in Rumsey and McCormick's extensive textbook.

## Assignments

The assignments are designed to provide students with first-hand experience dealing with sonic and technical phenomena discussed in the lectures and text. They will be given on the dates below, and are due the following week at the start of class.

- Assignment 1: September 8, 2010
- Assignment 2: October 13, 2010

## Midterm & Final exam

- Midterm: 10/06/10
- Final exam: 12/13/10
- NOTE: you must be present for the final exam

## Grading breakdown

- Attendance: 10%
- Assignments: 25%
- Midterm exam: 30%
- Final exam: 35%

## Policies

- Make-up exams will only be considered in extreme circumstances (medical emergency, death in the immediate family, etc.)
- Late assignments will be accepted with a penalty of one letter grade reduction per day. Assignments are due in class at 2:10pm. If you are unable to attend class when an assignment is due, you must contact me before the due date so that we can agree on a different arrangement.

## Academic Integrity/Plagiarism

The Academic Integrity Code for the American University describes standards for academic conduct, rights and responsibilities of members of the academic community, and procedures for handling allegations of academic dishonesty. Academic dishonesty as defined by the Code includes, but is not limited to: plagiarism, inappropriate collaboration, dishonesty in examinations (in-class or take-home), dishonesty in papers, work done for one course and submitted to another, deliberate falsification of data, interference with other students' work, and copyright violations (including both document and software copyrights). Copies of the Academic Integrity Code are available from the Office of the University Registrar.

Plagiarism is defined as taking the language, ideas, or thoughts of another, and representing them as your own. If you use someone's ideas, cite them; if you use someone's words, clearly mark them as a quotation. Plagiarism includes using another's computer programs or pieces of a program. Consult one of the many "writer's guides" that are available in the library and bookstores for citation practices. All instances of plagiarism will be reported to the Dean of the College of Arts and Sciences for appropriate action.

# Overview of Chapters & Topics

## 1. What is Sound?

- Compression/rarefaction
- Speed of sound
- Wavelength
- Harmonic/inharmonic spectra
- Phase
- Translating sound to electricity
- Decibels
- Reverberation
- Standing waves

## 2. Auditory Perception

- Physiology of the ear
- Frequency/pitch
- Amplitude/loudness
- Perceiving space
- Auditory Illusions

## 3. Microphones

- Dynamic
- Capacitor
- Ribbon
- Polar patterns
- Stereo microphones
- Radio microphones

## 4. Loudspeakers

- Moving coil
- Fringe designs
- Passive/active crossovers
- Subwoofers
- Arrangement

## 5. Mixers

- Professional multi-track mixers
- Grouping
- Standard capabilities
- EQ
- Metering
- Automation
- Analog vs. digital
- Control surfaces
- Mixing techniques

## 6. Analog Recording

- Magnetic tape recording
- Mechanical aspects of tape machines
- Continuous vs. discrete

## 7. Noise Reduction

- Methods
- Dolby
- Noise gates
- Digital noise extraction

## 8. Digital Audio Principles

- Digital vs. analog
- Decimal, binary, hexadecimal
- Sampling theory
- A/D conversion
- D/A conversion
- Sample-rate and bit-depth conversion
- DSP techniques
- Data reduction

## 12. Lines and Interconnection

- Balanced/unbalanced cable
- DI boxes
- Patchbays

## 13. Plug-ins and Outboard Equipment

- Utilities vs. effects
- Software vs. hardware
- Graphic EQ
- Compression/Limiting
- Delay
- Reverb
- Frequency shifting

## 14. MIDI and Synthetic Audio Control

- MIDI fundamentals
- MIDI I/O
- Channels
- Control messages
- Note on/off
- Velocity
- Aftertouch
- Polyphony
- Pitch bend
- System exclusive messages
- Sound generation units
- Sequencing

## 15. Synchronization

- Timecode
- Digital vs. analog synchronization
- Jitter
- MIDI time code

## 16. Two-channel Stereo

- Binaural stereo
- Stereo formats
- Stereo microphone techniques

## 17. Surround Sound

- Quadrophonic
- 5.1 systems and standards
- LFE
- Proprietary surround systems
- Ambisonics
- Surround monitoring
- Surround recording techniques
- Panning techniques