

# RAT-1320: AUDIO TRANSDUCERS

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## Cuyahoga Community College

### Viewing: RAT-1320 : Audio Transducers

**Board of Trustees:**

March 2020

**Academic Term:**

Fall 2020

**Subject Code**

RAT - Recording Arts & Technology

**Course Number:**

1320

**Title:**

Audio Transducers

**Catalog Description:**

Theory, characteristics and operation of various microphone types, loudspeakers, crossovers and speaker/room monitoring considerations.

**Credit Hour(s):**

3

**Lecture Hour(s):**

1

**Lab Hour(s):**

4

## Requisites

**Prerequisite and Corequisite**

RAT-1300 Introduction to Recording, and RAT-1311 Studio Operations, or departmental approval.

## Outcomes

**Course Outcome(s):**

Identify speaker system specifications and describe their effect on characteristics of sound.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Describe driver characteristics. (size, mass, dampening, frequency response, sensitivity, coverage angle).
2. Identify and describe active and passive crossover networks.
3. Identify and describe speaker cabinet types. (bass reflex, acoustic suspension).

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**Course Outcome(s):**

Identify microphone types and specifications and describe their effect on characteristics of sound.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Describe various microphone types. (dynamic, ribbon, condenser, boundary, tube, solid state, specialty).
  2. Describe various polar patterns types. (omnidirectional, cardioid, hyper-cardioid, shotgun, figure 8, mid-side).
  3. Describe electrical creation of polar patterns.
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**Course Outcome(s):**

Explain and apply mic selection and recording techniques for common acoustic instruments.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Demonstrate mic selection and techniques for acoustic and electric guitar.
  2. Demonstrate mic selection and techniques for bass guitar.
  3. Demonstrate mic selection and techniques for piano.
  4. Demonstrate mic selection and techniques for acoustic drums.
  5. Explain mic selection and techniques for leslie speakers.
  6. Demonstrate mic selection and techniques for vocals.
  7. Explain mic selection and techniques for brass instruments.
  8. Explain mic selection and techniques for strings.
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**Course Outcome(s):**

Explain and demonstrate signal transmission and routing techniques in the recording studio.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Explain balanced and unbalanced connections.
  2. Identify common audio connectors and cable types. (TS, TRS, XLR, TT, speakon, instrument cable, speaker cable)
  3. Demonstrate noise management techniques.
  4. Demonstrate over-under cable wrapping.
  5. Explain various signal levels. (mic-level, line-level, instrument-level)
  6. Apply split board configuration techniques to pass audio signals.
  7. Apply patchbay signal routing techniques to pass audio signals.
  8. Explain impedance characteristics.
  9. Explain and demonstrate the use of D.I. boxes.
  10. Explain and demonstrate the use of re-amp boxes.
  11. Demonstrate the creation of a cue mix.
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**Course Outcome(s):**

Explain principles of room acoustics and describe their effect on audio signals.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Explain phase and polarity and their effect on audio signals.
2. Explain the 3-to-1 rule.
3. Explain room construction and its effect on the acoustic properties of a physical space.
4. Explain basic acoustic principles in a home studio environment.

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**Course Outcome(s):**

Identify characteristics of common acoustic instruments and demonstrate appropriate application of these characteristics in a recording scenario.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Explain various instrument pickups designs. (single coil, humbucking, piezo, active, passive)
  2. Explain instrument intonation and setup.
  3. Demonstrate the creation of low, medium, high gain tones.
  4. Choose appropriate guitar and bass amplifiers and cabinets.
  5. Identify and explain drum and cymbal types. (kick, snare, toms, hi hat, ride, crash, splash, china)
  6. Explain drum shell characteristics. (material type, size)
  7. Explain drum head selection. (single and double-ply, dampening)
  8. Demonstrate and explain drum tuning.
  9. Demonstrate drum hardware operation.
  10. Demonstrate assembly of a drum kit.
  11. Explain the design of pianos. (upright and grand pianos)
  12. Explain basic dynamic range control device operation.
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**Methods of Evaluation:**

1. Written exams
2. Technical writing
3. Lab worksheets
4. Lab exercises
5. Lab practicals

**Course Content Outline:**

1. Signal Routing Review
  - a. Split board configuration
  - b. Patch bay signal flow
2. Room Acoustics
  - a. Phase and polarity effects
  - b. The 3 to 1 rule
  - c. Room construction factors
  - d. Practical acoustics for the home studio
3. Speakers and Crossovers
  - a. Loudspeakers as transducers
  - b. Loudspeaker types
  - c. Loudspeaker driver construction
  - d. Loudspeaker enclosure types
  - e. Crossover networks
  - f. Loudspeaker performance characteristics
  - g. Monitor placement
  - h. Near field and far field monitoring
4. Signal Transmission
  - a. Balanced connections
  - b. Unbalanced connections
  - c. Common connectors
  - d. Eliminating noise
  - e. Impedance
  - f. Signal levels
5. Microphone Polar Patterns

- a. Omnidirectional
- b. Cardioid
- c. Hyper-cardioid
- d. Ultra-cardioid / Shotgun
- e. Bi-directional / Figure 8
- f. Electrical creation of polar patterns
6. Microphone Types
  - a. Ribbon microphone parts and operation
  - b. Dynamic microphone parts and operation
  - c. Condenser microphone parts and operation
  - d. Microphone polar patterns
  - e. Frequency response charts
  - f. Specialty microphone types
  - g. Microphone care
7. Stereo Recording Techniques
  - a. Understanding stereo signals
  - b. Binaural localization
  - c. Haas effect
  - d. Mono compatibility
  - e. Direct / distant / ambient microphone placements
  - f. Stereo microphone techniques
8. Electric Guitar Recording Techniques
  - a. Instrument pickup selection
  - b. Instrument intonation & setup
  - c. Low / medium / high gain tones
  - d. Amplifier / cabinet selection
  - e. Microphone selection and placement
  - f. Direct boxes / DI recording
  - g. Re-amping
9. Bass Guitar Recording Techniques
  - a. Instrument pickup characteristics
  - b. Instrument intonation & setup
  - c. Amplifier / cabinet selection
  - d. Microphone selection and placement
  - e. DI recording / Re-amping
10. The Acoustic Drum Kit
  - a. Drum / cymbal types
  - b. Drum shell characteristics
  - c. Drum head selection
  - d. Drum tuning
  - e. Drum hardware operation
  - f. Assembling the kit
11. Drum Kit Minimal Mic Techniques
  - a. Glyn Johns minimal mic technique
  - b. Recorderman minimal mic technique
  - c. Checking phase
12. Modern Drum Mic Techniques
  - a. Microphone selection & placement
  - b. Checking phase
13. Piano Recording Techniques
  - a. Anatomy of the upright piano
  - b. Anatomy of the grand piano
  - c. Microphone selection & placement
14. Organ / Keys Recording Techniques
  - a. Leslie rotating speaker
  - b. Microphone selection & placement
  - c. DI recording techniques
15. Vocal Recording Techniques

- a. Microphone selection & placement
  - b. Dynamic range control
  - c. Cue mix tips & tricks
16. Brass Recording Techniques
- a. Microphone selection & placement
17. String Recording Techniques
- a. Microphone selection & placement

## Resources

Allen, Stanley R. *Audio In Media*. 10th ed. Boston, MA: Wadsworth Cengage Learning, 2014.

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Ballou, Glen. *Electroacoustic Devices: Microphones and Loudspeakers*. Boca Raton, FL : CRC Press, 2017.

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Beranek, Leo & Mellow, Tim . *Acoustics: Sound Fields, Transducers and Vibration*. Cambridge, MA: Academic Press, 2019.

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Corbett, Ian. *Mic It!*. 1st ed. Burlington, MA: Focal Press, 2015.

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Dowsett, Peter . *Audio Production Tips*. Abingdon, UK: Focal Press, 2016.

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Eargle, John. *The Microphone Book*. 2nd. Waltham, MA: Focal Press, 2012.

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## Resources Other

Student reference headphones

[www.soundonsound.com](http://www.soundonsound.com)

[www.recordingmag.com](http://www.recordingmag.com)

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