



**MERCER**  
COUNTY COMMUNITY COLLEGE

## COURSE OUTLINE

**Course Number**  
**CMN254**

**Course Title**  
**Live Sound Reinforcement**

**Credits**  
**3**

**Hours:**  
**Lecture/Lab/Other**  
**2 lecture/2 lab**

**Co- or Pre-requisite**  
**Pre-requisite: CMN153**

**Implementation**  
**Semester & Year**  
**Spring 2022**

### **Catalog description:**

Basic principles of live sound reinforcement. Emphasis on signal flow, acoustic, sound reinforcement set-ups and installation, signal processing, microphone selections and placement. Includes setting up sound systems and mixing live music. Topics include microphones, recording equipment, control consoles, reproduction techniques, amplification, distribution, loudspeaker systems, frequency response, decibels, and dynamic range.

**General Education Category:**  
Not GenEd

**Course coordinator:**  
Scott Hornick, 609-570-3716, hornicks@mccc.edu

### **Required texts & Other materials:**

Author: Scott Hunter Stark Publisher: Artist Pro Publishing Date Published: 9<sup>th</sup> Printing, 2004, Live Sound Reinforcement  
ISBN: 0-918371-07-4

### **Course Student Learning Outcomes (SLO):**

#### ***Upon successful completion of this course the student will be able to:***

1. Demonstrate conceptual and working knowledge of the basic principles of the behavior of sound in various environments through classroom discussion, written assignments, and audio laboratory exercises, and use appropriate technical and musical terminology in articulating these concepts. [Supports ILGs #1,3,4,10,11; PLOs #6,7]
2. Demonstrate conceptual and working knowledge of the basic principles of sound reinforcement systems through classroom discussion, written assignments, and audio laboratory exercises. [Supports ILGs #1,3,4,10,11; PLOs #6,7]
3. Proficiently set up and operate a variety of live sound reinforcement equipment, including but not limited to: microphones and other transducers, amplifiers and preamplifiers, effects processors, stage monitoring systems, main speaker systems, digital and analogue mixing boards in a variety of scenarios ranging from lectures in small rooms to large outdoor music festivals. [Supports ILGs #4,10,11; PLOs #6,7]
4. Create typical sound system configurations for live sound reinforcement; Maintain and keep in good working order a variety of live sound reinforcement equipment. [Supports ILG #4,10,11; PLOs #6,7]

5. Manage all aspects of a live sound reinforcement event, including booking, staffing, load- in/out, set-up, rigging, sound check, running, and troubleshooting. [Supports ILGs #1,2,4,10,11; PLOs #6,7,8]
6. Read and create stage plots, input lists, and contract riders. [Supports ILGs #1,4,10,11; PLOs #6,7,8]
7. Work on teams, teach others, serve customers, negotiate and work well with people from culturally diverse backgrounds. [Supports ILGs #1,6,8,9,10,11; PLOs #6,7,8]

### **Course-specific Institutional Learning Goals (ILG):**

**Institutional Learning Goal 1. Written and Oral Communication in English.** Students will communicate effectively in both speech and writing.

**Institutional Learning Goal 2. Mathematics.** Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

**Institutional Learning Goal 3. Science.** Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

**Institutional Learning Goal 4. Technology.** Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

**Institutional Learning Goal 6. Humanities.** Students will analyze works in the fields of art, music, or theater; literature; philosophy and/or religious studies; and/or will gain competence in the use of a foreign language.

**Institutional Learning Goal 8. Diversity and Global Perspective:** Students will understand the importance of a global perspective and culturally diverse peoples

**Institutional Learning Goal 9. Ethical Reasoning and Action.** Students will understand ethical frameworks, issues, and situations.

**Institutional Learning Goal 10. Information Literacy:** Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

**Institutional Learning Goal 11. Critical Thinking:** Students will use critical thinking skills understand, analyze, or apply information or solve problems.

### **Program Learning Outcomes for Entertainment Technology - Music Tech AAS (PLO)**

6. Demonstrate entry-level professional competence as a sound technician.
7. Set up sound reinforcement equipment.
8. Demonstrate entry-level competence as a technical manager in the entertainment industry.

### **Units of study in detail – Unit Student Learning Outcomes:**

**Unit I** [Introduction to Sound Reinforcement Systems] [Supports Course SLOs #2,4]

**Learning Objectives**

***The student will be able to:***

- Write an essay that describes the fundamental building blocks of a sound reinforcement system. Included in the essay will be descriptions and uses for the following components: transducers, amplifiers, signal processors, microphones, mixers and accessory units, equalizers, amplifiers, pre-amplifiers, power amplifiers, speakers and crossovers.
- Draw a basic system layout of a simple sound reinforcement system

**Unit II** [The Physics of Sound and Hearing] [Supports Course SLO #1]

**Learning Objectives**

***The student will be able to:***

- Explain in his/her own words the following terms; sound waves, cycle, reverberation amplitude, frequency, wavelength, the sine wave, resonance, sound spectra, phase and interference, and other related terms.
- Explain and analyze the relationship between the fundamental frequency, harmonics, wave form, and phase and how it relates to the musical note and what we hear.
- Describe the physical structure of the ear including attributes of the ear such as frequency response, loudness compensation, the time line of hearing, perception of intensity and direction.
- Explain the concepts of the missing fundamental, frequency loudness warp, the precedence effect.
- Analyze the impact on what one hears given these characteristics.

**Unit III**      **[Audio Measurement Terms and Concepts]** [Supports Course SLO #1,2]

**Learning Objectives**

***The student will be able to:***

- Analyze a frequency response curve and interpret how it will affect tonal quality.
- Compare and contrast the terms, db, db spl, dBu, dBm, dbv.
- Describe in writing Basic Gain Structure and analyze a working system's gain structure.
- Define and analyze the various forms of distortion that may be introduced in a sound system and evaluate the impact of distortion on the fidelity of a sound system.
- Use Ohm's law to calculate power, current, voltage and resistance.
- Describe the concept of impedance. Identify impedance values for the various audio components.
- Compare and contract instantaneous peak vs. RMS, vs. average. Calculate the power output of an amplifier using each method.

**Unit IV**      **[Microphones]** [Supports Course SLOs #1,2,3,4]

**Learning Objectives**

***The student will be able to:***

- Identify the different design types of microphone and describe the major characteristics of each type including their structure.
- Identify and describe the basic directional patterns of microphones and choose which type is best for different types of music, room acoustics and applications.
- Interpret pickup pattern variations by frequency using various charts and graphs published by the manufacturer.
- Write clear instructions on the effective use of microphones for talent.
- Describe the differences between balanced and unbalanced microphone circuits and choose the proper type for various applications.
- Identify and describe all issues of microphone impedance, sensitivity and distortion. Choose the appropriate microphone for a given application and level match it to the correct input.
- Write a one page paper of wireless microphones, their types, uses and applications.

**Unit V**      **[The Audio Production Console/Mixer]** [Supports Course SLOs #1,2,3,4]

**Learning Objectives**

***The student will be able to:***

- Write a two page paper (with block diagrams) describing basic mixer functions including input attenuation, fader, gain, potentiometer, auxiliary sends, sub masters, masters, etc.

- Identify and describe the inputs and outputs of a mixer with associated characteristics and the type of equipment or components to which they are connected.
- Achieve a workable gain structure.
- Describe and explain the difference between TRS and XLR connectors and draw a pin-out for each that identifies polarity and ground.
- Connect microphones, musical instruments, recorded music sources such as CD players, DAT Players, I-Pod, monitor amps, house amplifiers and external processors to a basic mixer.
- Operate digital and analogue mixers for live productions.

## **Unit VI [Loudspeakers and Associated Components] [Supports Course SLOs #1,2,3,4]**

### **Learning Objectives**

#### ***The student will be able to:***

- Identify and explain the various basic design concepts of loudspeakers.
- Identify and explain the different types of speaker enclosures and discuss the characteristics of each.
- Identify, explain and discuss the characteristics of basic horns including low, mid and hi frequency horns.
- Choose the proper type of horn for a given application.
- Identify and explain the various types of low and mid frequency cone drivers.
- Identify and describe the various characteristics of cone drivers such as stiffness, excursion and rigidity.
- Draw a basic diagram of a cone driver and a horn driver.
- Interpret driver frequency response curves and on and off-axis response curves, and evaluate the impact on the fidelity of the sound reproduced.
- Explain and calculate the impact of speaker impedance, speaker cable wire size, length and resistance variables on the transfer of power to the speaker and the damping factor for the low frequency driver.
- Describe the concept of a passive and active speaker crossover including crossover frequency and crossover slope.
- Interpret the frequency response curves of crossover networks.
- Describe the physical construction of an inductor and a capacitor and explain the electrical characteristic of each.
- Calculate the reactance of an inductor and capacitor at any given frequency.
- Design a simple 6db/octave three-way passive crossover network.
- Choose a speaker system for any given sound reinforcement application.
- Connect a loudspeaker system with proper placement in an assigned venue.
- Calculate impedance loads when connecting multiple speakers in series or parallel.

## **Unit VII [Amplifiers] [Supports Course SLOs #1,2,3,4,5]**

### **Learning Objectives**

#### ***The student will be able to:***

- Describe the differences between line level amplifiers, pre-amplifiers, power amplifiers, RF amplifiers and differential amplifiers by outlining the characteristics of each and identifying the typical applications for each.
- Understand and interpret manufacturer's specification sheets for power amplifier and use that information to choose the appropriate power amplifier based on the venue, the

- maximum sound levels required and speaker efficiency.
- Connect multiple speakers to the power amplifier consistent with the minimum impedance load tolerated by the power amplifier.

## **Unit VIII** [Equalizers and Signal Processing] [Supports Course SLOs #1,2,3,4,5]

### **Learning Objectives**

#### ***The student will be able to:***

- Identify and describe the basic equalizer design types. (Fixed, cut-only, fixed frequency, sweepable, parametric, etc.)
- Interpret frequency response curves to assist in setting up house and channel equalization.
- Connect and set-up automated and manual equalizers and perform a house equalization.
- Identify and describe the basic kinds of additional outboard and/or optional equipment which can facilitate the goals of sound reinforcement.
- Describe each of the characteristics of compressors and limiters and identify scenarios that require their use.
- Connect and properly adjust built-in and external compressors and limiters.
- Describe the characteristics of delay/echo and reverb units and identify each of the parameters required for adjustment.
- Connect, set-up and use delay/echo and reverb units.
- Compare and contrast analog and digital reverb and echo units.
- Use equalizers and signal processing units during live performances

## **Unit IX** [System Wiring] [Supports Course SLO #1,2,3,4]

### **Learning Objectives**

#### ***The student will be able to:***

- Cable multiple speakers using the correct wire size based on the parameters of speakers impedance, cable length and power required for the desired house sound levels.
- Effectively ground the sound reinforcement system using standard safety requirements to reduce or eliminate shock hazards.
- Cable low level and line level devices.
- Wire 3 pin XLR connectors, balance 1/4" TRS connectors and unbalanced TRS connectors.
- Identify and describe the typical audio connectors and adapters used in a sound reinforcement system.

## **Unit X** [The Practicum] [Supports Course SLOs #1,2,3,4,5,6,7]

### **Learning Objectives**

#### ***The student will be able to:***

- Maintain and keep in good working order a variety of live sound reinforcement equipment.
- Manage various aspects of a live sound reinforcement event, including booking, staffing, load-in/out, set-up, rigging, sound check, running, and troubleshooting.
- Read and create stage plots, input lists, and contract riders.
- Work on teams, teach others, serve customers, negotiate and work well with people from culturally diverse backgrounds.

**Evaluation of student learning:** [Evaluates SLOs # 1,2,3,4,5,6,7]

Achievement of the course objectives will be evaluated through the use of the following tools:

- Active participation in class
- Tests - Measuring students' comprehension of basic sound terminology and practices.
- A series of essays and short papers assessing students' comprehension of basic concepts and practices.
- A practicum where students will set up and run sound in an approved local venue.
- A series of laboratories using various types of production software used for audio production.
- The final project will be the design of a sound system for a small venue. Students are to research and prepare a 1,000 word (minimum) MS Word document outlining the proposed purchase of a sound system for the Studio Theatre (CM122) or an approved venue proposed by the student. As well as outlining the general performance requirements and listing all of the individual components, students must gather prices (either new or second-hand) and include a cost breakdown and total price to assemble and operate this 'ideal' system. This planned sound system should not include backline equipment (for example: guitar amps, drums, keyboards etc.)

<b>Evaluation Tools</b>	<b>% of Grade</b>
Unit Tests	20%
Unit Essays and Papers	20%
Practicum	25%
Final Design Project	30%
Class Participation	5%
Total	100%