



Foundation Course in Professional Audio

Introduction

This document sets out the content of a foundation course in professional audio technology in summary, giving an overview of each module in the course.

The course is designed to give a learner an understanding of the professional audio environment with sufficient skills to begin to play a useful role in such an environment, be it live sound, recording or radio studios. It also serves as a thorough orientation in this field, allowing the learner to make more informed career choices. Wherever possible the content has been aligned with registered unit standards in the interests of quality and usefulness to the learner.

Overall Learning Outcomes: The course is designed to equip learners to:

- Operate basic audio equipment with reference to user manuals.
- Understand the working principles and purpose of basic audio system components.
- Connect simple audio systems together.
- Perform simple trouble shooting tasks . isolate faulty component at equipment level in a system and give basic diagnosis of problem.
- Perform and interpret basic measurements of level, distortion and frequency response.
- Make up cables and do basic wiring.
- Communicate effectively with peers, users and technical experts verbally and in writing using correct terminology.
- Apply listening skills to identify common faults (eg distortion, phase, freq. resp. errors, overdriving) and understand quality references (know what good sound sounds like)
- Be aware of the limits of their knowledge and expertise.
- Be curious and enquiring, committed to independent self development and keeping abreast of developments in their field of work.

The course assumes matric level proficiency in English maths and science.

In order to achieve the above outcomes a foundation of knowledge, understanding and skills are required. This is set out in the modules below.

The course is designed as an intensive four weeks of full time participation (250 hours of learning with short assignments and self-work). The maximum training group size is 20 learners with one facilitator and one assistant.

The course modules are designed so that they can be easily adapted to be offered as separate short courses as part of a longer term strategy.

Course notes will be in the form of a printed manual and a CD version that will allow interactive navigation of the content in a browser. The use of the interactive version will be used to facilitate the development of basic computer skills.

1 Resources

The training facility comprises three spaces:

- A fully functional radio studio comprising state of the art digital technology optimised for low maintenance and ease of operation. This includes facilities such as telephone call management, station playout management, guest facility, content generation and recording.
- A work room for reading, lectures and group assignments.
- A lab with PC workstations, test equipment and sample components.

Other Equipment includes a simple sound reinforcement rig.

2 Course Contents

The following section details content covered in the course modules, ideas for practical exercises and notes on evaluation.

In summary:

Electricity and Signals; their Transmission and Distribution	3 days
Sound and Listening	2 days
Components of Audio Systems	4 days
Digital Audio	1 day
Operation and application of Equipment	6 days
Audio Measurements	2 days
TOTAL	18 days

The remaining time will be used for overflow assessment and dealing with issues that arise during the course. This will vary for one group to another.

The modules are not expected to run in isolation or in strict sequence. The times indicated should be seen as the total time allocated to that particular set of subject matter.

Module 1: Electricity and Signals, Their Transmission and Distribution		Time: 3 days
Content	Practical	Assessment
<p>Refresher: voltage, current, AC, DC, electrical circuits, power</p> <p>Working with high voltages: (220VAC mains) safety, wiring plugs, earthing, earth leakage, circuit breakers. Single phase, 3 phase.</p> <p>Analogue audio signals: frequency & bandwidth, phase, impedance, matching, dynamic range, noise & interference. Demonstrate waveforms of single tones noise music, spectral display.</p> <p>Digital signals: Concept of binary signalling. cursory treatment of binary numbers. Difference between digital and analogue signals. Bandwidth. Audio signal transmission: Balanced audio - twisted pair, shielding. Unbalanced . coaxial cable, loudspeaker cable. Cable losses. Distribution of signals using parallel connection and distribution amplifiers.</p> <p>Data signals: network connections</p> <p>Telephone signals:</p> <p>Optical: Infra red, Fibre optic</p> <p>Radio transmission: modulation</p>	<p>Make up power cables or wiring using 15A and IEC mains connectors.</p> <p>Make up audio cables and wiring using XLR and Jack connectors.</p> <p>Measure voltages between live, neutral and earth.</p> <p>Measure audio voltages from line amp and from power amp.</p> <p>Acquaintance with distribution board, earth leakage and circuit breakers.</p> <p>View, generate & listen to various audio signals on wave editor.</p>	<p>1.1. Make Cables (Formative)</p> <p>1.2 Written multiple choice test reviewing concepts. (Formative)</p>

Learning Outcomes:

- Can apply basic calculations to determine the relationship between power, voltage and current.
- Have a working knowledge of AC, DC and frequency.
- Understand and practice safety precautions when working with high voltages and high power equipment.
- Can make up and repair cables connecting standard audio components together.
- Working appreciation of analogue and digital signals, and their difference.
- Understand signal transmission in cables with respect to conductor size, shielding and signal distortions.

Module 2: Sound and Listening		Time: 2 days
Content	Practical	Assessment
<p><i>Some of this content will be reinforced or referred to in other modules.</i></p> <p>Hearing: mechanism, care of hearing, threshold shift and hearing damage.</p> <p>Acoustics: propagation of sound, reflections, resonance, radiation, wavelength, room modes, sound reinforcement. Demonstrate live and dead spaces, room modes.</p> <p>Listening skills: identifying distortions, stereo image, out of phase stereo, sound quality, identifying individual instruments.</p>	<p>Listen to a variety of loudspeakers of different quality and size and note differences.</p> <p>Demonstrate sound levels.</p> <p>Position sources in a stereo field Identify individual instruments in a recording</p> <p>Find peaks and nulls for a specific (low) frequency in a room.</p> <p>Visit anechoic chamber</p> <p>Visit recording studio</p>	<p>2.1 Listening test using unfamiliar, specially prepared recordings. (Formative)</p> <p>.</p>

Learning Outcomes:

- Able to identify audio distortions and faults by listening.
- Attain internal quality references (know what good quality sound is)
- Understand and exercise safety precautions in terms of sound pressure levels.
- Basic working knowledge of acoustics.

Module 3: Basic Audio System Building Blocks		Time: 3-4 days
Content	Practical	Assessment
<p>Transducers: mechanical vibration to electrical signal and vice versa.</p> <p>Microphones . basic types of construction, sensitivity, handling, pick-up patterns, phantom power.</p> <p>Loudspeakers: frequency range and size, woofer, squawker, tweeter, crossover, passive active, ported and sealed enclosures.</p> <p>Signal processing: Amplifiers: gain, preamp, line, power, bridged. Mixers: filters, level setting, routing, effects.</p> <p>System diagrams & symbols</p> <p>Examples of typical audio systems . sound reinforcement, radio studio.</p> <p>(visit to recording studio, and possibly large sound reinforcement rig.)</p> <p>Recording devices: Analogue: tape, vinyl disc. Digital: CD, DVD, Mini disk, hard disk, prof. Formats ?? Limitations</p>	<p>listen to difference between ported and sealed enclosures. Speaker positioning.</p> <p>Dismantle cheap loudspeaker</p> <p>Observe mismatched loads.</p> <p>Use small loudspeaker as a microphone.</p> <p>(in groups) Set up system comprising microphone, mixer, CD player/recorder, power amplifier, loudspeakers.</p>	<p>3.1 Audio System Components. Written test covering content. (Formative)</p> <p>3.2 Compile soundscape using self-recorded material.</p>

This module forms an essential foundation, providing embedded knowledge required for Module 6; use of equipment.

Learning Outcomes:

- Understand working principles and purpose of basic audio system components.
- Working knowledge of safety precautions and practices to ensure equipment is protected from damage and people protected from harm.
- Make and edit simple recordings.

Module 4: Digital Audio		Time: 1-2 days
Content	Practical	Assessment
Digitising: sampling, quantisation, noise, resolution, dynamic range, errors, cursory overview of conversion schemes. Encoding, compression, storage Industry standards	Investigate quantisation noise for different word lengths (e.g. 8 bit 16 bit) using wave editor.	4.1 Digital audio assignment.

Learning Outcomes:

- Understand principles of quantisation and sampling.
- Understand the basic meaning of commonly used terminology.
- Understand the concept of data compression as applied to digital audio.

Module 5: Audio Measurements		Time: 2 days
Content	Practical	Assessment
Typical causes of errors and distortions Measurement of level: dB, Voltage, Current Power Frequency analysis: Sweep, discrete tones, noise, real signals Distortion: THD Practical, everyday implications and applications	Simulate errors. As a group Compile test report for sample equipment.	5.1 Audio Measurement practical assignment.

Learning Outcomes:

- Understand typical causes of distortions and signal errors.
- Understand the concept of frequency response, amplitude and harmonic distortion.
- Working understanding of the concept of the decibel.
- Able to operate simple test equipment to measure amplitude, frequency response and distortion.

Module 6: Using Equipment		Time: 5-6 days
Content	Practical	Assessment:
Microphone choice and positioning.	This is all practical	6.1 Set up up sound reinforcement rig. (summative)
Loudspeaker placement.	Experiment with microphone:	6.2 Operate community radio studio. (summative)
Equipment location. (considering power sources ventilation, safety cable runs losses interference etc.)	Proximity effect, pickup pattern.	
Setting gain in system to maximise headroom.	Workshop troubleshooting	
Powering equipment		
Trouble shooting practices		
Set up and operate sound reinforcement system.		
Making studio and field recordings.		
Operation of community radio studio.		

Learning Outcomes:

- Have a systems overview of audio equipment in terms of radio studio and sound reinforcement.
- Make recordings.
- Operate equipment.
- Care for equipment.
- Troubleshoot faults and take basic remedial action, repairing where possible.
- Understand limits of own skill and knowledge in addressing faults.
- Able to communicate effectively verbally and in writing to technical experts and users / clients.
- Able to make effective use of equipment handbooks.
- Basic computer literacy
- Apply relevant safety precautions.
- Liaise with and cooperate with others effectively in getting work done.

3 Methodology

The content is delivered by means of lectures, practical exercises, group work, demonstrations and visits to facilities, self study, assignments, written and practical tests. One trainer will facilitate the course for its duration with an assistant for practical exercises etc. Experts and key figures in the industry will be invited to address the learning group and answer questions.

Collaborative learning: Part of the approach is to encourage the group to teach one another. The group may be split into smaller teams who will be exposed to different topics and then required to teach one another what they have learned. This provides opportunity for consolidation and feedback to the trainer to gauge how much has been learned. Each learner will be assigned a specific topic or relevant issue to acquaint themselves with and then present their learning to the rest of the group. This encourages self learning capacity and collaboration.

Integrated learning: Wherever possible the course will make use of an integrated approach, which is closer to real life, than dealing with subjects in isolation. It is anticipated that much of the course will revolve around the community radio studio as a system, using its components for demonstration and hands-on work. The possibility of getting the group as a team to build the studio as a set of assignments and exercises from the various modules should be investigated. One lesson or session may cover topics in a number of modules to link them and reinforce a systems understanding of the subject. The times indicated in the modules are estimates, indicating the level of detail covered and attention considered necessary.