

# *Electronic Music Production: Sound recording & audio Engineering*

Overview of the syllabus :Updated 1<sup>st</sup> July 2013

**Sound Studio System:** This section includes training on different types of recording such as recording with several mikes and mixer and multi-track tape recording. It will also provide inputs on how to equip your studio by introducing them to the various equipment and systems available in the industry. This includes examining recorder mixer features, 2-track recording, blank recording, effects, MIDI studio system, synthesizers, controllers, sampler sound modules, line mixers, recording system for classical music, 4-track studio for audition tape and demo tape, 8-track studio for demo and audio cassette, 8-track digital studio, 16-track digital studio, and MIDI-digital-audio recording system. They will receive practical training on setting up a studio complete with cables, equipment connectors, and cable connectors based on the required acoustic treatment.

**Sound Signals and Sound Acoustics:** The students will learn about the characteristics of sound waves, signal characteristics of audio devices, behavior of sound in a room, echo reverberation, and how to control leaks and room resonance. They will learn to monitor speaker requirements, power amplifiers, speaker placements, head phones, and cue systems. As a special consideration for on location work, specific training will be provided so that they know the tricks for preventing hum pick up in audio cables, preventing ground loops, and reducing hum from mikes and electric guitars with the help of a hum fixing check list.

**Microphones:** The students will learn all aspects of using different types of microphones such as traducer types polar pattern, frequency response, impedance, sensitivity, signal to noise ratio, boundary microphages, miniature microphones, mini type microphones, stereo microphones, and accessories. They will learn to decide on the type of microphones to be used in different scenarios, where to place microphones, types of stereo micro techniques, surround miking musical instruments and how to record them.

**Analog Tape Recording:** Students will develop skills in handling tape recorded parts and functions such as judging specifications of microphones, operating precautions and noise reduction, preventing maintenance, cleaning the tape path, demagnetizing, aligning and calibrating the cassette track, and using magnetic tapes.

**Digital Recording:** Students will learn the difference between analog and digital recording. They will learn about the various aspects of digital recording such as digital audio system formats, DAT-tape, sub code, features, indicators,

controls, digital audio workstations, CD-R equipment needs, technology configurations, cutting the CD, modular digital multi track, and mini disc recorder mixer.

**Effects and Signal Processors:** This section provides the technical aspects of generating effects using equalizers, compressor, noise gate, delay, reverberation and enhancer, octave divider, harmonizer, tube processor, analog tape simulator, multi-effect processor, and software (plug-in-effects) sound quality glossary.

**Required Mixers and Mixing Consoles:** Students will be trained on using mixer functions, input and output connectors, input selectors, trim, channel faders, mixing circuits, master and sub master faders, meters, and tape-out jack. The tasks of a mixing professional include operating required multi track and preparing the mixer session, assigning signals to channels, setting recording levels, setting EQ, punching in, over dubbing, bouncing track, mixing down, panning, compressing, setting a balancer, and adding effects.

**MIDI-studio and Session Procedures:** Students will be guided on aspects such as how to arrange instruments, define recording order, track alignments, maintain session sheet, work out the production schedule, monitor the track sheet, set up the studio and control room, record over dubbing, handle breakdown, digitally edit the mix down tape, and transfer program to DAT.

**On-location Recording of Popular and Classical Music:** The students will be provided with tips on using two mikes out front, recording from a mixer, taping with four tracks, splitting the microphones, multi track recording in a van, placing mikes, placing audience microphones, conducting power and grounding practice, site survey, and setting up the recording console.

## **PRACTICE EXERCISES:**

Students will be attending various sound recording sessions in Delhi base studios and will have one or two workshops by Bombay based professionals for 5-7 days. Theory will be taught in two days in a week and rest of the time they will be attending and doing hands on exercise related to sound recording in different situations.

Sound recording students also has to record various direction student productions as apart of their recording exercises.

After doing the course students will be confident enough to work as independent sound recordist in any reputed studio

\* A final project song of at least 5 min have to be submitted on the completion of the course.

Teaching modules:

**Module 1 : Introduction to basics of Sound & Music**

- 1) Basics of sound ( Physics of sound and its terminology, Audible freq response of human ear, Units of sound, Sound pressure, dynamic range etc.)
- 2) Difference between sound and music (Tones, timbres and texture)
- 3) Acoustic sound and synthetic sounds (Concept of synthesizers, Oscillators, filters etc.)
- 4) Analog and digital theory  
(basic discussion, pros and cons of each)
- 5) Audio formats and conversion tools (mono & stereo, Diff between channels & tracks, Wav, mp3, AIFF file types )
- 6) Concept of a Transducer as musical instrument and microphone ( Explanation of how sound travels and in what form it is present in atmosphere etc.)
- 7) Bit rate and sample rate
- 8) Audio compression (introduction to file size compression and dynamic range compression)
- 9) Compressed and uncompressed file formats.
- 10) Sampling theory – Hardware samplers and software samplers Hearing Principle/Internal Ear Construction/Working
- 11) Threshold of Hearing/Pain/Loudness/Pitch Vs Frequency, Localization of sound/Binaural Sound/Masking
- 12) Wave/Particle Velocity/Fidelity /Bandwidth/Propagation /General. representation of waves/Harmonics/Wave length Vs frequency/Reflection(Echo/Reverberation/Delay)
- 13) Haas Effect/ White/Pink noise/Simple/Complex waves
- 14) Decibels-Pressure Voltage/Current/Different References and Derivation of Equations.
- 15) dB-Measurements on a scale and Calibrations/Construction of VU Meter/SPL (Sound Pressure Level)
- 16) Inverse Square Law/ Propagation of Sound in Air/Liquid/Solid/ Indoors & Outdoors
- 17) Magnetic Recording-Tape Width/Head Gap/O/P Vs Playback Response at different Speeds
- 18)

**Module 2 : Computer Fundamentals and ANALOG/DIGITAL**

- 1) Basics of a computer (CPU, RAM, Motherboard, Hard drives and types)
- 2) Digital audio (A-D, D-A, D-D conversions and its chain, protocols and formats)
- 3) The sound card (basic configuration, specifications and types like PCI, USB 2.0 and Firewire etc) LP Records –Construction General Overview/ RPM/ Grooves etc.

- 4) Tapes-Bias/Head gap/Magnetic flux/Amplifiers
- 5) Dynamic Range/Margin/Speed/Signal to Noise Ratio/Frequency Response
- 6) Concept Of Distortion /Distinguishing b/w Distorted Sound/Effect of Distortion On the Frequency Bandwidth
- 7) General Digital Concept- Sampling/Over Sampling/A-D and D-A conversion- Nyquist's theorem
- 8) Advantages over Analog Systems/Concept Of data Rate/ No. of Bits etc.
- 9) Concept of Interleaving/ Multiplexing in Relation to CD Basics (CLV-Constant Linear Velocity Vs Constant Angular Velocity)/Channel Encoding.
- 10) Error codes/Random Access of Files.
- 11) DAT DVC Pro/1inch,2inch,ADAT-Serial/parallel Mode of Digital Recording/CD/Optical & Magneto Optical Sound System
- 12) Sound Synthesis/MIDI

### **Module 3 : Introduction to Sound forge (editing two channel audio)**

- 1) Basic introduction of sound forge
- 2) Editing overviews and processing tools
- 3) Editing a two channel audio
- 4) Creation of loops, custom samples, medleys
- 5) Track restoration and sweetening
- 6) Introduction to DSP plugins (reverb,delay, chorus , flanger,echo etc ) and their application.
- 7) Merging of two tracks and creating minus ones using advanced editing techniques.

### **Module 4 : Basic Music theory**

- 1) Basic concepts of music notation
- 2) Treble clef, bass clef and the grand staff
- 3) Sharp and flat notes, naturals, tones and semitones
- 4) Scales and key signatures
- 5) Chords and triads
- 6) Duration of notes and rests, dotted notes
- 7) Bars and beats, time signatures
- 8) Concept of quantization using note values e.g , ,1/8, 1/16.....

### **Module 5 : Introduction to Operating systems (MAC & PC) and DAW (Digital audio workstation)**

- 1) Introduction to operating systems (Windows XP and Mac OS X), key commands and features, stability etc.
- 2) Comparison between hardware and software
- 3) Introduction to DAW's (Nuendo & Pro tools) , Their applications, features, Pros & cons etc.
- 4) Managing sessions and library content (How to correctly approach towards creating a session and maintaining the workflow)

### **Module 6 : Introduction to Song structures, Radio & TV jingles, Film background scores**

- 1) How to approach while creating a basic radio jingle and its structure
- 2) Creating a jingle for a TV AD while keeping reference visual in mind, its emotion and theme
- 3) Creating Background scores for TV serials and films
- 4) Creating a song for a private album or a film song according to situation.
- 5) Recreating a film song (minus one) entirely using electronic music sequencing
- 6) \* Practical will include listening sessions including various songs, jingles and background scores, Study of various layers of musical instruments and fx used in programming, tone selection and timbre etc. Special screenings will also be conducted.
- 7) Assignments : a) create a jingle for radio or tv of your own choice  
b) Create a song of at least 4 min duration  
c) Do the BGM of the given visual

### **Module 7 : Advanced DAW concepts**

- 1) Introduction to ASIO and optimizing the sound card with a DAW
- 2) Buffer setting and latency
- 3) Troubleshooting and data backups
- 4) Editing tools and techniques, navigation windows and menus, recording modes and tools

### **Module 8 : MIDI and its applications**

- 1) Introduction to MIDI and its basic applications in music production and film scoring
- 2) How to setup various MIDI interfaces, daisy chaining concepts
- 3) Software and hardware based sequencing, difference between the two and pros & cons of each.
- 4) Introduction to Virtual Studio Technology (VST and VSTi), VST compatible DSP plugins and Softsynths (VST instruments)

### **Module 9 : Microphone concepts and techniques**

- 1) Microphone as a transducer
- 2) Types of microphones (dynamic and condenser)
- 3) Phantom power
- 4) Directional responses of various microphones (shot gun , omni, bi directional, cardioid , hypercardioid etc)
- 5) Cables and connectors and their types, line and mic level connections, High Z connections
- 6) Choosing and setting up a microphone for recording
- 7) Recording vocals and live instruments Pressure Vs Velocity/SPL Vs Output
- 8) Types –Carbon/Electret/Condensor/Dynamic Mikes/Ribbon-Construction/Working/Polar Patterns, Directional Properties/Impedances/Access
- 9) Different Associated Cable Connections-Balanced/Unbalanced –Their Effect on Signal Flow, Construction of Balanced & Unbalanced Cables & Demonstration
- 10) Mic Stands/Boom Operation/Handling.
- 11) MONO/STEREO/Proximity Effect/Sensitivity/Overloading/Handling Of Various Mics
- 12) Concept Of PHANTOM POWER /Phasing & Their Effect On the Signal

### **Module 10 : Advanced Music production concepts in a DAW**

- 1) Channels, tracks , busses, inserts and sends
- 2) Auxes and grouping of tracks
- 3) Digital sound processing plugins (DSP), Waves plugins and others.
- 4) Advanced mixing techniques and applications
- 5) Tracking a song and mixing practicals
- 6) Digital and analog consoles and their types
- 7) Signal chains and routing

### **Module 11 : Surround formats, Frame rates for films and TV**

- 1) Frame rates, film and tv formats
- 2) Introduction to various surround sound formats like DTS, Dolby digital & Dolby digital EX, SDDS etc
- 3) Importance of frame rates while tracking for film background scores and scoring for tv
- 4) Location Sound/Pilot/Dubbing/Transfer/FX/Alignment/Optical/Magnetical
- 5) Need for Dubbing/Re Recording

- 6) 16mm 35mm 70mm IMAX/Optical/Magnetical/Basic Formats in terms of Track placement-MONO/STEREO
- 7) Editing Concept w.r.t. Stripped Magnetic Tape Along with 16mm/35mm/70mm etc. Optical (Picture). Making a Audio Splice/Cross fades.
- 8) NAGRA Recorder Descriptions inch tape /Velocity of Tape etc.
- 9) Concept of Talkback/Fold back/Feedback-Acoustic AS well as Electrical
- 10) Live Sound—Multi Track Concept/ Music tracks
- 11) LP, 1/4 inch , 1inch , 2inch tapes And Multi Track Recorders
- 12) Synchronization (Time Code)
- 13) Dolby A,B,SR, Surround, DTS,Dolby Digital,SDDS(Sony Digital Dynamic Sound)
- 14)

### **Module 12 : Virtual instruments and their application**

- 1) Spectrasonics Atmosphere, Trilogy and Stylus RMX
- 2) Reason 4.0
- 3) Xpphrase
- 4) Linplug albino, predator, blue
- 5) Vanguard
- 6) Nexus
- 7) Virtual guitarist
- 8) Real guitar
- 9) Miroslav philharmonik
- 10) Plug sound collection

### **Module 13: LOUDSPEAKERS/HEADPHONES**

- Basic Construction & Operation Principle.
- Impedances/Enclosures/Phase Effect/Axis/THD-(Total Harmonic Distortion)
- Need For Tweeters/Woofers/Headphones

Diaphragm Materials/Size/Profiles

### **Module: 14. SIGNAL PROCESSING**

- Filters/Equalizers(BandWidth,QualityFactor,Cut-off Frequency)
- Noise Reduction Principles(Digital Noise Reduction Soft wares)
- Echo/Reverb/Compressors/Limiters/Noise Gates(Attack Time, Release Time and there Effect on Output)
- Patch Base –Concept, Signal Routing
- Mixers(Analog/Digital)

### **Module: 15: ACOUSTICS**

- General Concept – Propagation of Sound Indoors
- Reflection/Absorption /Standing Waves-Live/Dead Studios /Room Modes
- Detailed Process of Control Room/Studio Design
- Various Stages Stats Involved in Design &Tools Required (Spectrum Analyzer, SPL Meter etc.)/ Noise Figure/Reverberation Time (RT)
- Isolation- Concept of Floating Floors/Ceiling etc.
- Different Absorptions Coefficient For Materials And Their Use In The Treatment of Surfaces

### **Module 16. DIGITAL AUDIO WORK STATIONS**

- General Concept-Advantage Over Analog Process
- Concept Of virtual Tracks –Clip Manager/Concept Of Cut & Paste/ Wave Form Editor-Principles of Operation/Plug-ins
- Different Exercises for Balancing Audio & using Different Softwares
- Making a PROJECT FILE Using The SOFTWARES
- Importing/Exporting Audio Files Into The Particular Project