

## Liverpool John Moores University

Title: AUDIO SIGNAL PROCESSING  
Status: Definitive  
Code: **4514STE** (118561)  
Version Start Date: 01-08-2016

Owning School/Faculty: Electronics and Electrical Engineering  
Teaching School/Faculty: Liverpool Institute for Performing Arts

Team	Leader
Karl Jones	Y

**Academic Level:** FHEQ4      **Credit Value:** 12      **Total Delivered Hours:** 31.5  
**Total Learning Hours:** 120      **Private Study:** 88.5

### Delivery Options

Course typically offered: Semester 2

Component	Contact Hours
Lecture	20
Workshop	10

**Grading Basis:** 40 %

### Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	SP DESIGN	SIGNAL PROCESSING DESIGN (INDIVIDUAL)	25	
Practice	CREATIVE	CREATIVE SIGNAL PROCESSING (GROUP)	25	
Exam	EXAM	WRITTEN EXAM	50	1.5

### Aims

*This module is designed to enhance and build on the basic knowledge gained regarding signal processing in Core Recording Skills. The primary aim is to provide a detailed understanding of the fundamental technical operation of software and hardware signal processing and their applications. The syllabus can be broadly broken into three areas; design and building simple time based processors, using*

software based processing and using studio hardware. The workshops and assessments will reflect these three areas.

The content includes a significant amount of technical theory to provide a solid foundation in understanding the methods used to design and apply typical signal processing. Students are also encouraged to relate their technical knowledge with their creative aspirations and to be able to realise a wide range of processing techniques in different applications.

## Learning Outcomes

After completing the module the student should be able to:

- 1 Design their own time delay based signal processing algorithms for audio processing effects.
- 2 Recall the principles of common types of signal processing and their parameters.
- 3 Explain how signal processing can be used in both remedial and creative applications.
- 4 Apply signal processing to creatively manipulate audio signals for artistic and aesthetic purposes.

## Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

SIGNAL PROCESSING DESIGN (IND)	1	2
CREATIVE SIGNAL PROCESSING	3	4
WRITTEN EXAM	2	3

## Outline Syllabus

### *Relationship of Signal Processing to Popular Music*

*As a problem solving tool; As a creative tool in audio manipulation; Historical Background; Effects and Processors Definition*

### *Delay and Echo*

*Delay and Psychoacoustics; Delay Parameters; Block Diagrams; Phase Cancellation; Comb Filtering; Mono Delay; Multitap Delay; Stereo Delay; Tempo Delay; Applications*

### *Modulation Effects*

*LFO Modulation; Tremolo (AM); Vibrato (FM); Autopan; Ring Modulation; Comb Filtering; Generic Parameters; Phaser; Flanger; Chorus; Mono and Stereo; Applications*

### *Reverb*

*Reverberation Theory; Natural Reverberation; Plate; Spring; Digital; Schroeder Model; Convolution; Generic Parameter Definitions; Mono and Stereo; Multichannel;*

## *Perceptual Issues; Applications*

### *Equalisation, Filters and Distortion*

*Frequency, pitch and timbre; Filter parameters; Filtering effects on waveform; Comparing analogue and digital filters; Shelf; Parametric; Graphic; Dynamic filters; Harmonic distortion; Overdrive; Bitcrusher; Perceptual Issues; Applications*

### *Compression and Limiting*

*Dynamic Range; Peak and Average Levels; Frequency Content of Signals; Generic Parameters; Downwards / Upwards Compression; Limiting; De-Essing; Multiband Compression; Sidechain; Position in Signal Chain; Side Effects; 2-Stage Compression; Parallel Compression; Applications*

### *Expansion and Gating*

*Downwards / Upwards Expansion; Generic Parameters; Corrective Gating; Creative Gating; Sidechain; Ducking; Componders; Noise Reduction; Applications*

### *Pitch and Time Effects*

*Relationship between pitch, frequency and time; FFT; Vocoder; Pitch Shifting / Correction; Time Expansion / Compression; Harmonisers; Autotune; Applications*

### *Psychoacoustic Enhancement*

*Psychoacoustic Principles; Aural exciters; Spatialisers; Bass enhancement; Mastering Process; Applications*

### *Using and Combining Signal Processing*

*Automation; Recall; Presets; MIDI Controllers; SYSEX Backup and Control; Signal Processing within the mix; Applications*

### *Creative Signal Processing*

*Historical perspective; Examples; Experimental music; Sound effects; Popular music;*

## **Learning Activities**

This module is delivered by weekly lecture and workshops. The lectures will be used to introduce the technical content and to offer demonstrations of various types of signal processing. The workshops provide a supervised session in which the practical design and application of the processing can be investigated from following a series of set tasks.

## **Notes**

Students are expected to spend significant time using studio and software resources in addition to conducting some basic research in order to support the syllabus.