## Module Code
CS7028

## Module Name
Audio, Video and Sensor Technologies

## Module Short Title
N/A

## ECTS weighting
10 ECTS

## Semester/term taught
Semester 1 and 2

## Contact Hours
Semester One – 11 two-hour lectures, 11 one-hour lectures, 20 hours assignments
Semester Two – 11 one-hour lectures, 11 two-hour lectures, 20 hours assignments

## Module Personnel
Aidan Maguire, Vivienne O’Kelly, Jack Cawley

## Learning Outcomes

### Audio Technologies (Semester One) – Jack Cawley

On successful completion of the module, students will be able to:

- Understand the nature of sound
- Use a mixing control and Digital Audio Workstations (DAWs)
- Use Virtual Studio Technology (VST plug-ins)
- Set up microphones for recording voice and acoustic instruments
- Conduct an audio recording session in a sound recording studio
- Control the audio in a live performance
- Create audio software using the Pure Data visual programming environment.

### Introduction to Sensor Technologies (Semester Two) – Adam Taylor (TBC)

This module affords an overview of the fundamentals of physical computing, providing the tools for basic circuit building and electronics, programming with Arduino, sensor and actuator construction, and communication between Arduino and the processing IDE.

### Moving Image for Digital Applications (Semester One) – Aidan Maguire and Vivienne O’Kelly

This module aims to familiarize students with key concepts and debates surrounding the moving image. Theories of representation are explored alongside the development and expansion of the moving image in society. Questions of realism will be discussed; the conventions of commercial narrative cinema will be considered, along with strategies of representation that interrogate notions of transparency. Works that offer alternative approaches to form, that seek to expand the possibilities of the moving image and re-imagine the role of the spectator shall be the focus of weekly discussion. A diverse range of influential theoretical, critical and cultural perspectives related to the study of the moving image will be illustrated via screenings of relevant material.

## Module Learning Aims

### Audio Technologies
- Provide a practical introduction to digital audio technology for beginners
- Illustrate suitable techniques for the development of systems for interactive sound
Moving Image for Digital Media Applications

Lectures in the first semester aim to familiarize students with key concepts and debates surrounding the moving image. Contact hours are comprised of both teaching & viewing time slots.

Contact hours in the Second Semester are comprised of camera, lighting and editing workshops. Attendance at all lectures and workshops over the two semesters is compulsory.

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<tr>
<th>Module Content</th>
<th>Audio Technologies</th>
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<tr>
<td>Introduction to Sound and Acoustics: Acoustic waves; Time and Frequency; Decibels and loudness; Inverse Square Law; Transducer systems</td>
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<tr>
<td>Room Acoustics and Psychoacoustics: Pitch, Loudness and Timbre; Impulse responses; Room acoustics: Early Reflections, diffuse field; Psychoacoustic parameters: IACC, LE, LF; Absorbers, diffusers and room treatment</td>
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<tr>
<td>Digital and Analog Audio: Sampling Rate; Bit depth; AD/DA conversion; Sampling theorem; Dynamic Range</td>
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<td>Mixing Console Workflow: Gain control; Equalizers; Panning, summing and master faders; Auxiliary channels; Phantom power; Pre-amplification; Pre- and Post-fader control; Cabling and standards</td>
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<td>Microphones: Dynamic microphones; Condenser microphones; Microphone Directivity; Proximity effect</td>
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<td>Multitrack Recording – Digital Audio Workstations (DAWs): Introduction to audio sequencing; Sequencer basics; Monitoring; Click track recording; Editing; Stereo Mixdown</td>
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<td>Audio Signal Processing: Equalizers; Reverberation; Dynamic Range Processing; Modulation Effects; Distortion; Pitch Correction</td>
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<tr>
<td>Mixing in DAWs: Panning; Equalization; Automation; Inserts; Sends; Mixing for video and games</td>
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<td>Recording Techniques: Monophonic microphone placement; Stereophonic Recording Techniques: Intensity stereo recording, Coincident stereo recording, ORTF, Binaural Audio</td>
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<td>Stereophonic Mastering: Master bus signal processing; Mastering for CD/DVD; The loudness wars; Dithering; Compression &amp; Codecs</td>
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<td>MIDI: How MIDI works; Basic MIDI commands; General MIDI; MIDI Interfaces; MIDI in sequencers; Quantization; Virtual Instruments (VST plug-ins)</td>
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<td>Introduction to Surround Sound: Overview of Multi-Channel Audio Technology; 5.1 Surround sound basics; Setting Up for Surround Sound on commercial loudspeaker layouts; Surround Audio calibration</td>
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<td>Mixing and mastering for 5.1 surround sound: Surround Panning; Surround Sound signal processing; Reverberation control; LFE Channel considerations; Stereo Compatibility; Discrete Vs. Matrixed Surround Sound; Dolby Digital Encoding</td>
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<tr>
<td>Interactive Sound Control with Pure Data (PD): Introduction to Real-time Audio Signal Processing; Audio I/O control with PD; Multichannel Audio in PD; Audio Filtering and DSP with PD; MIDI in PD</td>
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Introduction to Sensor Technologies

- Introduction to Sensor Technology: Providing an overview of Physical Computing / Introduction to the fundamentals of Electronics / Introduction to the components and tools used in the course.
Introduction to Physical computing

Basic Electricity and Electronics: Introduction to Electricity; Ohm’s Law; What is a circuit; Reading a Resistor Chart; Reading a Schematic; Principles of Electromagnetic transduction; Using a solder-less breadboard to build a prototype circuit.

Sensors and Actuators: Digital and Analogue sensors and actuators

Introduction to the Arduino: Introduction to fundamentals of programming with Arduino/ Simple I/O using DigitalWrite() and DigitalRead() / Building a simple circuit using a sensor and an actuator.

Introduction to the Arduino Board: Elements of the Microcontroller board; Introduction to the Software IDE; Setting up Arduino: port and board specifications

Exercise one: Blinking an LED

Introduction to Programming: Comments; Functions; Constants; DigitalWrite(); DigitalRead(); delay(); Variables; Conditional statements; Comparison operators; Boolean operators; Arithmetic Expressions

Exercise Two: Using a PushButton to control the LED

Homework: Read through B. Evans, Arduino Programming Notebook PDF

Introduction to Arduino: More advanced Input and Output/ Using Analog Sensors for complex input/Using PWM.

Class to have read through fundamentals of Arduino code. Quick revision of programming fundamentals from week two.

Introduction to new Concepts: for loop; AnalogRead(); AnalogWrite()

Introduction to Pulse Width Modulation: Using PWM for analogue input and output

Exercise One: Modify the Blinking LED sketch to produce variable patterns (using the for loop)

Exercise Two: Fade LED in and out (use for loop to increment a value) and using PWM.

Exercise Three: using analogue input to control the actuator LDR, Thermoresistor, Rotary switches.

Introduction to Arduino: Introduction to Serial Communication/ Introduction to more complex sensors i.e. an accelerometer.

Introduction to Serial Communication: Introduction to Serial Monitor; Initialising Serial Communication

Using Analog/Input and Output for complex input and output

Exercise One: driving a simple motor

Exercise Two: Using Complex Sensors: i.e. An accelerometer

Building a Sensor: Revision: Building a Sensor, Hacking everyday Objects to create interactive Environments

Revision: The fundamentals of programming with the Arduino.

Quick Overview of interaction design using homemade sensors (examples from design and media art).

Exercise One: Making a simple pressure pad and interfacing with an Arduino sketch from week 3.

Exercise Two: Hacking everyday objects to make sensors: Keyboards, mouse, toys, piezo buzzers.

Interfacing Arduino with other Software Applications: Interfacing Arduino with Processing for complex interaction, Overview of Class Assignment

Examples of Projects which interface Arduino with Processing, Max/MSP and PD.
### Interfacing Arduino with the Processing IDE
- Overview of class assignment

#### Moving Image for Digital Applications
Specific topics addressed in this module include:
- Narrative and narration
- Editing
- Mise-en-scène
- Screen Media and the Politics of Representation
- Documentary Film and Video
- Projection in Performance
- Moving Image and Interactive Installation
- Old Media, New Media and the Contemporary Media Landscape
- Camera, Lighting and Editing in Practice
- Digital Video Specifications
- Exposure Control & Colour Balance
- Camera Controls
- Audio Recording
- Composition & Framing
- Lighting Techniques
- Post Production

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<tr>
<th>Module Pre Requisite</th>
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<td>Module Co Requisite</td>
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<th>Assessment Details</th>
<th>Assessment is by continuous assessment with projects and essays in each part of the module.</th>
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<td>Module approval date</td>
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<td>Academic Year of Data</td>
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