CS7028: Audio, Video and Sensor Technologies

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<th>Module Code</th>
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<tr>
<td>Module Name</td>
<td>Audio, Video and Sensor Technologies</td>
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<tr>
<td>Module Short Title</td>
<td>N/A</td>
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<tr>
<td>ECTS weighting</td>
<td>10 ECTS</td>
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<tr>
<td>Semester/term taught</td>
<td>Semester 1 and 2</td>
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| 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, Adam Taylor |

### 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.

### 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.

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

- Assess the technical requirements for producing a video.
- Operate professional camera and apply shooting techniques.
- Produce professional quality video projects
- Recognise common terms and practices in the creation of a video
- Shoot / light an interview with edited cutaway sequences
Introduction to Sensor Technologies (Semester Two) – Adam Taylor

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.

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 manipulation

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.

Students will be given a practical introduction to video production including camera controls, composition, lighting and editing. This will give the students the opportunity to effectively / confidently use video production as part of a multimedia project

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.

Module Content

Audio Technologies
- **Introduction to Sound and Acoustics**: Acoustic waves; Time and Frequency; Decibels and loudness; Inverse Square Law; Transducer systems
- **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
- **Digital and Analog Audio**: Sampling Rate; Bit depth; AD/DA conversion; Sampling theorem; Dynamic Range
- **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
- **Microphones**: Dynamic microphones; Condenser microphones; Microphone Directivity; Proximity effect
- **Multitrack Recording – Digital Audio Workstations (DAWs)**: Introduction to audio sequencing; Sequencer basics; Monitoring; Click track recording; Editing; Stereo Mixdown
- **Audio Signal Processing**: Equalizers; Reverberation; Dynamic Range Processing; Modulation Effects; Distortion; Pitch Correction
- **Mixing in DAWs**: Panning; Equalization; Automation; Inserts; Sends; Mixing for video and games
- **Recording Techniques**: Monophonic microphone placement; Stereophonic Recording Techniques: Intensity stereo recording, Coincident stereo recording, ORTF, Binaural Audio
- **Stereophonic Mastering**: Master bus signal processing; Mastering for CD/DVD; The loudness wars; Dithering; Compression & Codecs
- **MIDI**: How MIDI works; Basic MIDI commands; General MIDI; MIDI Interfaces; MIDI in sequencers; Quantization; Virtual Instruments (VST plug-ins)
- **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

- **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

- **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

**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

Practical topics include:

- **Introduction to Digital Video**
  - Introductions
  - Course Outline

- **Digital Video Specifications**
  - Sensors: CMOS, CCD
  - Video formats
  - Pixel Aspect ratio
  - Frame rates
  - Resolution
  - Scan Method

- **Exposure & Colour Balance**
  - Aperture
  - Shutter Speed
  - ISO / Gain
  - White Balance

- **Introduction to Camera Systems**
• Audio techniques for video production
  o Diegetic, Non Diegetic Sound
  o Types of microphones
  o Microphone placement
  o Room tone & Ambient Sound

• Framing & Shot Types
  o Shot Size
  o Composition theory
  o Head room & Looking room
  o Depth of Field
  o Cutaways

• Lighting
  o Safety
  o Hard & Soft Light
  o Colour Temperature
  o Gels & reflectors
  o 3 Point lighting
  o Lighting Ratios

• Editing with Final Cut Pro
  o Creating a new Final Cut Pro project
  o File formats
  o Capturing Footage
  o Editing
  o Exporting Movies

Introduction to Sensor Technologies

• Introduction to Sensor Technology: Providing on 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

Recommended Reading List

Students will be given recommended reading on a weekly basis, and will also be expected to read broadly beyond the topics covered during lectures.

Module Pre Requisite

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<th>Module Co Requisite</th>
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<td>Assessment Details</td>
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