

**Course title: Computer based sound production**

**Course code: 63523**

**ECTS: 6**

**Professor: Denis Trček**

**Prerequisite knowledge:**

- It is assumed that students have finished the engineering level mathematics course(s). The following prerequisite knowledge will also be useful:
  - o Basic programming
  - o Basic programming in Java
  - o Basic understanding of Digital signal processing
  - o Basic understanding of Mathematical analysis
  - o Basic understanding of Computer networks

**Short course description:**

- The goal of this course is that students with engineering (and other) backgrounds acquire theoretical and practical knowledge in this domain for studio production, software development (engineering), or creative applications like multimedia, video, simulations, virtual reality, and computer gaming.
- After the introduction and historical overview, physics basics will be given, followed by mathematical themes (from Fourier analysis and synthesis to Gabor's acoustical quantum). Next come physiological facts, i.e., psychoacoustics and hearing perception as it is constituted in the brain. In the core of the course computing and networking themes will be covered: analog and digital signals and their conversions, quantization noise, bandwidth, dynamic range, amplification, attenuation and filtering, distortion, sound recording, etc. This will be followed by computer sound generation principles (synthesis, sampling), sound acquiring and recording devices (microphones, samplers and direct-to-disc recording). We will address standard studio equipment like mixing consoles, limiters, compressors, reverberators, equalizers.
- In the second part the protocols and formats in this domain will be covered: MIDI, IEC-60958 (AES / EBU), S/PDIF, AC-3, WAV, MP3, and synchronization mechanisms MTC and SMPTE for video and movies production. Next come program standards (APIs) like VST / Steinberg and DirectX / MS, and streaming media enabling protocols like RTP, RTCP and RTSP. Digital audio workstations ranging from professional ones (like Cubase / Steinberg and Sonar / Twelve Tone Systems) to quality open-source solutions (like Rosegarden) will be covered as well. The last topic will be sound synthesis theory and optionally sound visualization or computer-based sound creation. The lectures will be ended by professional video lectures in sound production (from recording to mixing and final production).
- Practical laboratory work will be aligned with the lectures through hands-on projects. But also, certain special topics will be covered with hands-on work during the lecturing. This includes theoretical concepts learning by using packages a'la Mathematica or MATLAB, generation of sound fonts for MIDI sequencers, music pieces creation and their recording and mixing, etc.