

# Audio- / Videosignalverarbeitung Advanced Digital Signal Processing Digital Signal Processing 2

## **Seminar 1** WS 2017/2018

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# Organization

- Thursday (even weeks), 13:00-14:30pm  
(K 2003A)
- Thursday (odd weeks), 09:00-10:30pm  
(K 2002A)

# General information (1)

## a) Homework assignments:

- Every two weeks (5-6 in total)
  - Solve with Python
  - Can be done in groups of **max 3** people
  - Show and explain your solution in seminars
    - You can show a homework **only** during the seminar
    - Bring your laptop if it is possible, otherwise an USB stick
    - **Submission via email is not possible**

# General information (2)

## b) Quiz

- Weekly
- Test related to the latest content of the lecture
- Sign in at moodle2 (<https://moodle2.tu-ilmenau.de/>)
- Pass the Quiz until the next lecture
- **Deadlines** will be announced in moodle

# General information (3)

- The homework points account for 30% of the final grade. The exam accounts for the other 70%.
- Real example:
  - With the 98% for seminars and a good grade in the exam you get 1.0
  - With the 0% for seminars and still a good grade in the exam you would get 2.7
- Gained points will only be added after passing the exam

$$\text{Final\_grade} = 0.3*(0.25*\text{Quizzes}+0.75*\text{HWs})+0.7*\text{Exam}$$

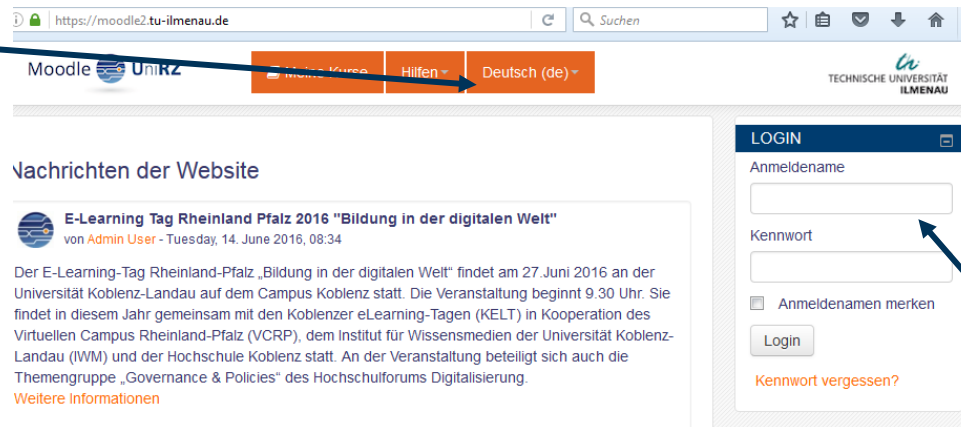
# General information (4)

## Rules:

- Play out audio using Python (verification)
- Use of functions
- Delayed submission without justified reason = -20% from your grade
- Every next attempt = -10% from your grade

# Moodle (1)

## Change of language



- E-learning platform
- Quizzes, slides, assignments and announcements
- Follow the link:  
<https://moodle2.tu-ilmenau.de/>

Sign in with your university username and password

# Moodle (2)

## 1.Click

- Proceed as following:
- Fakultät EI --> Institut für Medientechnik --> FG Angewandte Mediensysteme --> AVS/ADSP/DSP II

### Course categories

#### ▼ Fakultät EI

- ▶ Fakultätsübergreifendes Institut für Werkstofftechnik
- ▶ Institut für Elektrische Energie- und Steuerungstechnik
- ▶ Institut für Informationstechnik
- ▶ Institut für Medientechnik
  - ▶ FG Angewandte Mediensysteme (9)
  - ▶ FG Audiovisuelle Technik (15)
  - ▶ FG Kommunikationswissenschaft (11)
  - ▶ FG Medienproduktion (9)

## 2.Scroll

#### 🗑 AVS / ADSP / DSP II

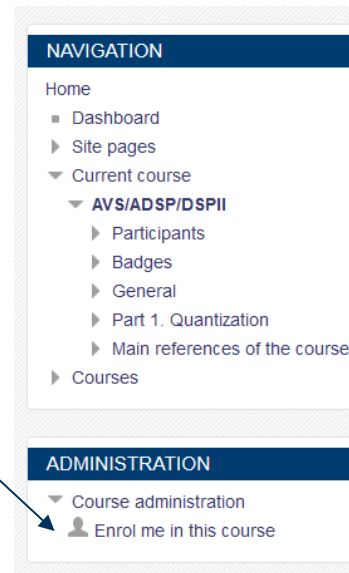
Teacher: Oleg Golokolenko  
Teacher: Gerald Schuller

## 3.Click



# Moodle (3)

- Enroll in course



- Follow the Moodle for new materials, announcements and quizzes
- Participate in Forums

# Python

- **Python**
  - Open source
  - Pre-installed in Linux (easy to install extra libraries → Linux is better)
  - Installation for Windows (original): <https://www.python.org/downloads/>
  - Installation for Windows (all in one): <https://python-xy.github.io/downloads.html>
- **Python tutorial:** <https://docs.python.org/3/tutorial/>

# Homework assignment (1/3)

## 1. Generate 3 different signals

a) Triangular wave

b) Sinusoidal wave

- normalized frequency of 0.1
- $freq_{norm} = \frac{f}{f_s}$ , where  $f$  - frequency of the signal and  $f_s$  - sampling frequency
- Range = -1 to 1

c) Use *Track48.wav* audio signal from our *Moodle* page

- For reading a file into Python use library *scipy.io.wavfile*
- For playing it back – *pyaudio* (beware of types of variables: *string* ↔ *int*)

→ Use full and 25 dB under full range signals

→ Plot and listen to the signals

→ What is the difference between full and under full range signals?

# Homework assignment (2/3)

## 2. Quantize and reconstruct \*.wav audio signal

- Uniform quantization with 8 bit accuracy
  - Implement Mid-tread and Mid-rise quantizers
  - Calculate the quantization error for both of them
  - Which one is better and why?
- $\mu$ -law quantization with 8 bit accuracy
  - $y = \text{sign}(x) \cdot \frac{\ln(1+255 \cdot |\frac{x}{A}|)}{\ln(1+255)}$
  - $x = \text{sign}(y) \cdot \frac{(256^{|y|}-1)}{255} \cdot A$
- Plot and listen to the quantized signal
- Compare results of uniform and  $\mu$ -law quantization

# Homework assignment (3/3)

3. Determine SNR for all the signals. SNR should be calculated in dB.

$$SNR = 10 * \log_{10} \left( \frac{\text{Signal Energy}}{\text{Quantization Error Energy}} \right)$$

- What stands out when comparing the SNRs of the sinusoidal and the triangular wave?
- Please, use *subplot()* for making the plots