Signal Processing for Robotics & Control					AR-307
Rota annually WS	**Duration** 1 Semester	**Semester** 3rd (Semester)	**SWS** 3 SWS	**Credit Points** 5	**Workload** 150 h

1 Modul structure

Course (Abbreviation)	Type/ SWS	Presence	Self study	Credits
a) Signal Processing for Robotics & Control (SPRA)	Lecture/ 2 SWS	30 h	60 h	3
b) Signal Processing for Robotics & Control (SPRA)	Tutorial/ 1 SWS	15 h	45 h	2
c) Signal Processing for Robotics & Control (SPRA)	Integrated practical Training 4 Students	(4 h)		

2 Language

English

3 Content

1. Signals & Systems: Discretisation, Quantisation, Sampling Theorem, Linear Time Invariant Systems.
2. Linear Transformations of Signals: Linear Matrix Transformations, Filtering, Convolution, Discrete Fourier Transformation, Fast Fourier Transformation, Wavelet Transformation. Detection & Estimation: Matrix Decompositions, QR-Decomposition, Eigen- and Singular Value Decomposition, signal detection, channel estimation, state space system identification, model reduction.
3. Adaptive Signal Processing: Real time environments, QRD-RLS algorithm, LMS algorithm.
4. Signal Processing Architectures: Micro processor, digital signal processor, Field Programmable Gate Array (FPGA), Application Specific Integrated Circuit (ASIC).
5. Designing a Signal Processing System: Algorithm, Architecture, Implementation, Hardware/Software Partitioning, System-on-Chip.

Literature:

- Digital Signal Processing. Principles, Algorithms, and Applications, John G. Proakis, Dimitris G. Manolakis, Macmillan, 3nd edition, 1996
- Discrete-Time Signal Processing. A.V. Oppenheim, R.W. Schafer. Prentice Hall, 2nd edition, 1999.

4 Goals

This course provides the students with a solid background in signal processing algorithms and architectures. Various applications in Robotics & Control are used as examples. For various applications the student should be able to determine possible algorithmic and architectural realizations and to evaluate their efficiency.

5 Examination Requirements

All students are requested to solve four take home problems. A practical course "Digital Signal Processor - Basics and Applications" (4 hours) is also required. The final exam will be an oral (30 minutes) or written (2 hour) exam, depending on the number of participants (form will be announced second week of course).

6 Formality of Examination

☒ Module Finals ☐ Accumulated Grade

7 Module Requirements (Prerequisites)

8	**Allocation to Curriculum:** Program: Automation & Robotics, Field of study: Robotics, Process Automation, Cognitive Systems
9	**Responsibility/ Lecturer** *Prof. Dr. J. Götze/*Prof. Dr. J. Götze