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| Module Name | **Signals and Systems** |
| Module Responsibility | *Prof. Dr. Martin Golz* |
| |  |  |  | | --- | --- | --- | | Qualification Targets | *The students will get the opportunity to* | | | - | *Analyse typical problems of signal processing,* | | - | *Comprehend integral transforms of continuous functions,* | | - | *Comprehend the discrete Fourier transforms of sequences,* | | - | *Comprehend and apply the discrete Fourier transform,* | | - | *Comprehend and apply digital filters,* | | - | *Comprehend and apply spectral estimation of stochastic signals,* | | - | *Comprehend and apply time-frequency analysis,* | | - | *Know some of the mathematical background issues.* |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | ***Contents*** | ***Know &***  ***Comprehend*** | ***Apply*** | ***Analyse & Evaluate*** | ***Synthesise*** | | *Fourier integral* | X |  |  |  | | *Fourier series* | X |  |  |  | | *Convolution integral* | X | X |  |  | | *Sampling theorem & aliasing* | X | X | X |  | | *Diskrete Fourier transform* | X | X | X |  | | *Linear time-invariant systems* | X | X | X |  | | *stochastic processes, spectral estimation* | X | X | X |  | | *Time-Frequency analysis* | X | X | X |  | | |
| Module Contents | *8. Introduction*  *9. Fourier integral*   *9.1.*  *Integral transforms, Fourier kernel*   *9.2.*  *Dirichlet conditions, properties*   *9.3.*  *Elementary signals*   *9.4.*  *Signal energy, signal power, decibel, band width 10. Fourier series*  *11. Convolution*  *12. Sampling theorem*  *13. Discrete Fourier transform*   *13.1. Properties*   *13.2. Discrete Walsh transform, z-transform*  *14. Linear, time-invariant systems*   *14.1. Properties*   *14.2. Impulse response, transfer function, Bode plot*  *14.3. Pole-Zero plot, stability*   *14.4. State space description*  *15. Stochastic signals*   *15.1. Properties*   *15.2. Probability density function*   *15.3. Wiener-Khinchin theorem, power spectral density*  *15.4. Cepstrum*   *15.5. Spectral estimation*   *15.6. Applications*  *16. Time-frequency analysis*   *16.1. Short-time Fourier transform*   *16.2. Gabor series*   *16.3. Wavelet transform*   *16.4. Applications* |
| Teaching methods | - *Frontal lectures with*   o *Digital presentation slides,* |

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|  | o *Demonstration programs*  - *Exercises held in the computer pool*  o *Programming with MATLAB and signal processing toolbox*  o *Clarification of open issues* |
| Requirements for Participation | *No formal requirements*  *Basic knowledge in linear algebra, analysis, statistics* |
| Literature | *The following books are recommended:*  - *Oppenheim (1997) Signals and systems. Prentice Hall*  - *Haykin, van Veen (2003) Signals and systems. Wiley*  - *Percival, Walden (2000) Wavelet methods for time series analysis.*  *Cambridge University Press* |
| Applicability | *This module is an obligatory subject.*  *An appropriation to similar majors is possible under stipulation of their examination regulations.* |
| Effort / Total Workload | *Total 150 hours. Attendance: 60 hours, Self-Study: 45 hours, Exam Preparation 45 hours* |
| ECTS / Emphasis of the Grade for the final Grade | *5 CP (Emphasis of the Grade for the final Grade 5/120)* |
| Performance Record | *Oral examination (30 minutes)* |
| Semester | *1st Semester* |
| Frequency of Occurrence | *Once during the academic year* |
| Duration | *One semester* |
| Type of Course | *Obligatory subject* |