Course description

Course abbreviation:	KKY/ZSI			
Course name:	Signal processing			
Academic Year:	2023/2024		**Printed:**	01.06.2024 09:48

Department/Unit /	KKY / ZSI			**Academic Year**	2023/2024
Title	Signal processing			**Type of completion**	Exam
Accredited/Credits	Yes, 6 Cred.			**Type of completion**	Combined
Number of hours	Lecture 3 [Hours/Week] Tutorial 2 [Hours/Week]				
Occ/max	Status A	Status B	Status C	**Course credit prior to**	YES
Summer semester	24 / -	0 / -	1 / -	**Counted into average**	YES
Winter semester	0 / -	0 / -	0 / -	**Min. (B+C) students**	10
Timetable	Yes			**Repeated registration**	NO
Language of instruction	Czech			**Semester taught**	Summer semester
Optional course	Yes			**Internship duration**	0
Evaluation scale	1|2|3|4			**Ev. sc. – cred.**	S|N
No. of hours of on-premise					
Auto acc. of credit	Yes in the case of a previous evaluation 4 nebo nic.				
Periodicity	K				
Substituted course	None				
Preclusive courses	N/A				
Prerequisite courses	N/A				
Informally recommended courses	N/A				
Courses depending on this Course	KKY/AKSZ, KKY/ROSZ, KKY/SZKUI				

Course objectives:

The goal of the course is to familiarize students with basic of information theory and methods of signal processing in both the time and also in the frequency domain.

Requirements on student

Understanding the basic principles and methods in computer signal processing. Coming to the exam will be conditioned by elaborating individual practical tasks from the area of signal processing. The exam will contain both written (test) and oral parts.

Content

The signal properties, sampling and quantization of signal, Shannon sampling theorem, signal reconstruction. Information theory, channel coding, entropy. Z-transform, Fourier analysis of continuous and discrete-time signals, convolution and correlation, discrete Fourier transform, fast algorithms for the Fourier transform evaluation, Hartley transform, Cosine transform, interpolation of the signal, filters with finite and infinite response and their design, noise and signal distortion, signal enhancement method in noise, the scaling of stochastic time-frequency domain, homomorphic signal processing, cepstral analysis, correlation analysis of signals, time-frequency signal analysis, the uncertainty principle Wavelet transform, Wigner-Villeova distribution, instantaneous frequency, analytic signal, Hilbert transform, empirical modal decomposition and Hilbert-Huang transform, order analysis - Vold-Kalman filter, full spectrum and identification of precession.

Fields of study

Guarantors and lecturers

- **Guarantors:**   doc. Ing. Mgr. Josef Psutka, Ph.D. (100%)
- **Lecturer:**   Ing. Jindřich Liška, Ph.D. (100%), doc. Ing. Mgr. Josef Psutka, Ph.D. (100%)
- **Tutorial lecturer:** Ing. Jindřich Liška, Ph.D. (100%), doc. Ing. Mgr. Josef Psutka, Ph.D. (100%)

Literature

- **Basic:** Jan, Jiří. *Číslicová filtrace, analýza a restaurace signálů*. 2., upr. a rozš. vyd. V Brně : VUTIUM, 2002. ISBN 80-214-2911-9.
- **Basic:** Uhlíř, Sovka, Čmejka. *Úvod do číslicového zpracování signálů*. Praha.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Presentation preparation (report) (1-10)	5
Practical training (number of hours)	26
Preparation for an examination (30-60)	45
Individual project (40)	40
Contact hours	39
Total:	**155**

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

Combined exam

Skills - skills achieved by taking this course are verified by the following means:

Seminar work

Competences - competence achieved by taking this course are verified by the following means:

Combined exam

Seminar work

prerequisite

Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

ovládat základy matematické analýzy

orientovat se v lineálních systémech

algoritmizovat

Skills - students are expected to possess the following skills before the course commences to finish it successfully:

dekomponovat úlohu na subúlohy

pracovat s lineárními časově invariantními systémy

aplikovat znalosti z matematické analýzy

Competences - students are expected to possess the following competences before the course commences to finish it successfully:

N/A

teaching methods

Knowledge - the following training methods are used to achieve the required knowledge:

Lecture with visual aids

Lecture supplemented with a discussion

One-to-One tutorial

Skills - the following training methods are used to achieve the required skills:

Practicum

Individual study

Competences - the following training methods are used to achieve the required competences:

Lecture supplemented with a discussion

Task-based study method

learning outcomes

Knowledge - knowledge resulting from the course:

vysvětlit zpracování signálů spojitých a disktrétních v čase

formulovat úlohu převodu signálu do spektra a zpět

vysvětlit principy filtrace signálu

interpretovat časo-frekvenční analýzu signálu

vysvětlit úplné spektrum a řádovou analýzu

Skills - skills resulting from the course:

převést navzorkovaný signál do spektra

navrhnout a realizovat FIR a IIR filtry

provádět kepstrální analýzu

realizovat časo-frekvenční analýzu

odhadnout úplné spektrum a identifikovat precesi

Competences - competences resulting from the course:

N/A

Course is included in study programmes:

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Applied Sciences and Computer Engineering	Postgraduate Master	Full-time	Cybernetics and Control Engineering	1	2020	2023	Povinné předměty	A	1	LS
Informatika	Bachelor	Full-time	Výpočetní technika	1	2023	2023	Povinné předměty	A	2	LS
Kybernetika a řídicí technika	Postgraduate Master	Full-time	Automatické řízení a robotika	1	2022 akr	2023	Povinné předměty - společná část	A	1	LS
Kybernetika a řídicí technika	Postgraduate Master	Full-time	Umělá inteligence a automatizace	1	2022 akr	2023	Povinné předměty - společná část	A	1	LS
Certificate Programmes	Postgraduate Master	Full-time	Technologie pro bezpilotní létání	1	2017	2023	Povinně volitelné předměty	B	1	LS
Certificate Programmes	Postgraduate Master	Full-time	Technologie pro bezpilotní létání	1	2022	2023	Povinně volitelné předměty	B	1	LS
Certificate Programmes	Postgraduate Master	Full-time	Technologie pro bezpilotní létání	1	2022	2023	Povinně volitelné předměty	B	2	LS
Certificate Programmes	Postgraduate Master	Full-time	Technologie pro bezpilotní létání	1	2017	2023	Povinně volitelné předměty	B	2	LS
Geomatics	Postgraduate Master	Full-time	Globální geodézie	1	2023 akr	2023	Povinně volitelné předměty (typ B)	B	1	LS