(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: APPLIED DIGITAL SIGNAL PROCESSING	**2. Course code**
3. Validity of course description: 2012/2013	
4. Level of studies: BSc programme	
5. Mode of studies: intramural studies	
6. Field of study:CONTROL, ELECTRONIC AND INFORMATION ENGINEERING	(FACULTY SYMBOL) AEI
7. Profile of studies: academic	
8. Programme: Automatic Control	
9. Semester: 7	
10. Faculty teaching the course: Institute of Automatic Control, Rau1	
11. Course instructor: prof. dr hab. inż. Marek Pawełczyk	
12. Course classification: common object	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: Calculus and differential equations, Fundamentals of computer programming, Computer programming, Introduction to system dynamics, Numerical methods, Fundamentals of signal processing. It is assumed that students have basic knowledge on: differentiation, integration, Laplace transform, Z transform, Fourier transform, transfer function, dynamic system modeling, numerical algorithms, Matlab environment.	
16. Course objectives: The aim of this lecture is to present issues in modern signal processing techniques with focus on applications. It constitutes a pedagogical compilation of fundamentals, algorithm forms, behavioural insights, and application guidelines. The intertwining of theory and practice is demonstrated by numerous examples and verified during project exercises.	
17. Description of learning outcomes:	

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
W1	Knows fundamentals of signal sampling and reconstruction.	Written test	Classical lecture, Multimedia presentation	
W2	Understands time analysis and frequency analysis of signals.	Written test	Laboratory excercise, Multimedia presentation	
W3	Knows how to filter signals using optimal and adaptive filters.	Written test	Laboratory excercise, Multimedia presentation	
W4	Knows a number of applications of digital signal processing and rules for choosing appropriate algorithms for them.	Written test	Laboratory excercise, Multimedia presentation	
U1	Can process and analyse signals.	Written test, Laboratory excercise	Project	
U2	Can choose appropriate algorithm for a stated problem and correctly apply the algorithm.	Written test, Laboratory excercise	Project	
K1	Ma świadomość konsekwencji wynikających z odpowiedniej rejestracji, doboru metody analizy oraz algorytmu przetwarzania sygnału.	Laboratory excercise, Report preperation	Project	
K2	Potrafi zaprezentować zaproponowane rozwiązanie i uzasadnić jego słuszność oraz możliwości.	Laboratory excercise, Report presentation	Project	

18. Teaching modes and hours

Lecture: 30 / Project: 15

19. Syllabus description:

Semester : 7

In the era of rapid development of microprocessors, Digital Signal Processing (DSP) gains significant interest and finds applications in many fields of everyday life. DSP plays an increasingly central role in the development of telecommunications and information processing systems, and has a wide range of applications in multimedia technology, audio-visual systems, cellular mobile communications, adaptive network management, radar and ultrasonic systems, pattern analysis, medical signal processing, financial data forecasting, decision making, etc.

The lecture on *applied digital signal processing* touches the following subjects:

1. Sampling, analogue-to-digital and digital-to-analogue conversion, quantization
2. Correlation analysis
3. Fourier decomposition and Fourier transforms
4. Signal windowing and spectral analysis
5. Conversion of sampling frequency and multi-rate signal processing
6. Finite and Infinite impulse response filters
7. Wiener and Kalman filters
8. Adaptive filters
9. Signal decomposition and forecasting
10. Fundamentals of electroacoustics
11. Active suppression of noise and vibration
12. Echo generation and cancellation
13. Speech intelligibility enhancement
14. Speech recognition and speaker identification
15. Ultrasonic signal processing
16. Vibration and acoustic signals processing for condition monitoring of working machines

Project:
Different project topics related to digital signal processing are offered each year. Some of them are performed individually, and some of them in groups of a few students. Students may suggest topics by themselves.

Exemplary topics are:
- Speech intelligibility enhancement
- Condition monitoring with audio or vibration signals
- EKG signal processing
- Active noise control
- Active vibration control

20. Examination: semester …none

21. Primary sources:

1. B. S. Braun: Discover Signal Processing. An Interactive Guide for Engineers, Wiley, 2008
2. K. Shin, J.K. Hammond: Fundamentals of Signal Processing for Sound and Vibration Engineers, Wiley, 2008
3. V.K. Madisetti, D.B. Williams: The Digital Signal Processing Handbook, IEEE Press, 1998
4. S.K. Mitra, J.K. Kaiser: Handbook for Digital Signal Processing, J. Wiley & Sons, NY, 1993.
5. S.J. Elliott: Signal Processing for Active Control, Academic Press, 2001
6. J. Jan: Digital Signal Filtering, Analysis and Restoration, TJ Int. Ltd, 2000
7. J.S. Bendat, A.G. Piersol: Engineering Applications of Correlation and Spectral Analysis, Wiley, 1993.
8. S.W. Smith: The Scientist and Engineer's Guide to Digital Signal Processing, http://www.dspguide.com/.

22. Secondary sources:

1. T. P. Zieliński: Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań. WKiŁ, Warszawa 2005.
2. A.V. Oppenheim, R. Schafer, Cyfrowe przetwarzanie sygnałów, WNT, 1987.
3. R. Lyons, Wprowadzenie do cyfrowego przetwarzania sygnałów, WKiŁ, Warszawa, 1999 .
4. J. Szabatin, Podstawy teorii sygnałów, WKiŁ, Warszawa, 2002.
5. E. Bielińska: Metody prognozowania, Wyd. Śląsk, 2002.
6. A. Dąbrowski, Przetwarzanie sygnałów przy użyciu procesorów sygnałowych, WPP, Poznań, 1998.
7. A. Czyżewski: Dźwięk cyfrowy, Akademicka Oficyna Wydawnicza Exit, W-wa, 1998.
8. A. Niederliński, J. Kasprzyk, J. Figwer: EDIP – ekspert dla identyfikacji procesów., Wyd. Pol. Śl.,1993.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/5
2	Classes	0/0
3	Laboratory	0/0
4	Project	15/30
5	BA/ MA Seminar	0/0
6	Other	5/5
	Total number of hours	50/40

24. Total hours: 90

25. Number of ECTS credits: 3

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 2

26. Comments: none

Approved:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*