FACULTY OF COMPUTER SCIENCE AND MANAGEMENT

SUBJECT CARD

Name in Polish: Teoria informacji i sygnałów

Name in English: Theory of information and signals

Main field of study (if applicable): Information technology

Specialization (if applicable): ……………………..

Level and form of studies: 1st level, full-time

Kind of subject: obligatory

Subject code INZ0255W, INZ0255C

Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	30			
Number of hours of total student workload (CNPS)	120	60			
Form of crediting	Examination	Crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	4	2			
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	2,4	1,2			

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Have a basic knowledge from linear algebra, analytic geometry and mathematical analysis necessary to solve simple engineering oriented calculation tasks in technical and nontechnical applications (K1INF_W01)

2. Have a basic knowledge from discrete mathematics, mathematical logic and mathematical statistics necessary to formulate and solve simple engineering problems (K1INF_W02)

3. Have a basic knowledge in area of mechanics and waves theory (K1INF_W03)

4. Can use indicated an analytical method and plan and carry out a simple experiment and computer simulation engineering, conduct a survey and analyze the results, particularly for the selected system components (K1INF_U09)

5. Understands and knows the need continuous training opportunities and improving their

social skills (K1INF_K01)

SUBJECT OBJECTIVES

C1. Ordered, underpinned by theoretical knowledge of information systems and processes, the use of statistical information theory, optimal coding of continuous and discrete channels and information without interference, methods and techniques to transmit signals using different modulation techniques supporting continuous and discrete signals, continuous and discrete signals and information prevention of errors arising in the results of interference in the transmission channels.

C2. Skills for determining the characteristics of analog and discrete signals (frequency spectrum, frequency, power distribution), the advantages and disadvantages of various methods of modulation signals, continuous and discrete signals and adjust transmission channels, modulation methods for comparing continuous and discrete signals, the range of applications of particular methods of modulation, basis of the hierarchy of analog and digital signals and selection methods to prevent errors in transmission systems.

C3. Skills for the selection of appropriate modulation methods of communication tasks in analog and digital systems.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:
K1INF_W11: Has a basic knowledge of IT systems and computer networks
K1INF_W16: Knows the basic methods and tools for collecting, processing and retrieval of information and knowledge extraction

Relating to skills:
K1INF_U05: Has the ability to self-education, including in order to improve the professional competence
K1INF_U15: Can using the right tools to build a simple model of the process (the object), to formulate a specific task analysis and decision making
K1INF_U16: Able to effectively use the methods and tools for the collection, processing and retrieval of information and knowledge extraction

Relating to social competences:
K1INF_K01: He understands and knows the need continuous training opportunities and improving their social skills and
K1INF_K03: Able to interact and work in a group, taking in the different roles

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	Information systems - basic concepts	2
Lec 2	Theories of information. Statistical information theory. Entropy as a measure of the amount of information in the statistical theory of	2

	information.	
Lec 3	Information processes and transmission of information. Transmission channel model.	2
Lec 4	Optimal encoding in discrete channel without interferences	2
Lec 5	Optimal encoding in discrete channel with interferences	2
Lec 6	Optimal encoding in continuous transmission channel without and with interferences	2
Lec 7	Representation of signals and systems - Fourier transform	2
Lec 8	Fourier transform - properties	2
Lec 9	Continuous amplitude modulation	2
Lec 10	Continuous angle modulation	2
Lec 11	Keying of amplitude, frequency and phase	2
Lec 12	Pulse code modulation	2
Lec 13	Transmission encoding	2
Lec 14	Preventing errors - correction codes	2
Lec 15	Preventing errors – automatic retransmission request	2
	Total hours	**30**

PROGRAMME CONTENT		
Form of classes - class		**Number of hours**
Cl 1	Fourier transform and Fourier series expansion	2
Cl 2	Orthogonality - collections of orthogonal signals. Even and odd functions.	2
Cl 3	The Fourier transform of periodic and aperiodic signals. Even and odd harmonics. Convergence of Fourier series.	2
Cl 4	Fourier series - amplitude, trigonometric and exponential forms	2
Cl 5	Calculation of Fourier series coefficients in amplitude, trigonometric and exponential forms.	2
Cl 6	Fourier series - linear, timeline stretching and shift of signals in the time domain	2
Cl 7	Fourier series - a shift of signals in the frequency domain.	2
Cl 8	Fourier series - differentiation and integration of signals in the time domain.	2
Cl 9	Fourier series - coupled functions, multiplication in the time domain and time-domain convolution. Discrete frequency spectra.	2
Cl 10	Rayleigh energy theorem. The multiplication and Parseval's theorems. Power spectrum.	2
Cl 11	The inverse proportionality of the time and frequency - the interchangeability of the products of bandwidth and time	2
Cl 12	The Dirac delta function, step function and sampling function	2

Cl 13	Applications of Dirac delta and step functions	2
Cl 14	Transmission of signals through linear systems	2
Cl 15	Fast Fourier Transform algorithms	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Traditional lecture. Multimedia presentations.

N2. Student's own works – solving calculation tasks.

N3. N4. Student's own works – literature studies.

N5. Collective works during classes.

N5. Student's own works – oral presentations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1 (lecture)	K1INF_W11 K1INF_W16 K1INF_U05 K1INF_U15 K1INF_U16 K1INF_K01 K1INF_K03	Observation of student's activity. Solving exercises. Preparation and presentation delivery.
F1 – F15 (class)	K1INF_W11 K1INF_W16 K1INF_U05 K1INF_U15 K1INF_U16 K1INF_K03	Checking the preparation of the student. Checking the presence of the student. Observation of student activity. Observation and evaluation of student independence. Analysis of reports of exercise.
P (lecture)	K1INF_W11 K1INF_W16 K1INF_U05 K1INF_U15 K1INF_U16 K1INF_K01 K1INF_K03	Examination taking into account results of forming evaluation F1 (lecture)
P (class)	K1INF_W11 K1INF_W16 K1INF_U05 K1INF_U15	Weighted sum of forming evaluations F1 – F15 (classes).

	K1INF_U16	
	K1INF_K03	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] G. Pujolle, D. Seret, D. Dromard, E. Horlait, „Integrated Digital Communication Networks", J. Wiley & Sons

[2] S. Haykin, „Communication systems", J. Wiley & Sons

[3] M. Roden, „Analog and digital communication systems", Prentice Hall

SECONDARY LITERATURE:

[1] MIT open cources:http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

[2] http://www.freebookcentre.net/Networking/Free-Computer-Networking-Books-Download.html

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Information and signals theory

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY ………………………..
AND SPECIALIZATION …………………………..

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Program content***	Teaching tool number***
PEK_W01 (knowledge)	K1INF_W11	C1, C2, C3	Lec 1 – Lec 15	N1, N2, N3
PEK_W02	K1INF_W16	C1, C2, C3	Lec 1 – Lec 15	N1, N2, N3
PEK_U01 (skills)	K1INF_U05	C2, C3	Lec 1 – Lec 15 Cl 1 – Cl 15	N1, N2, N4
PEK_U02	K1INF_U15	C2, C3	Lec 1 – Lec Cl 1 – Cl 15	N1, N2, N4, N5
PEK_U03	K1INF_U16	C2, C3	Lec 1 – Lec Cl 1 – Cl 15	N1, N2, N3, N4
PEK_K01 (competences)	K1INF_K01	C1, C2, C3	Cl 1 – Cl 15	N4, N5
PEK_K02	K1INF_K03	C1, C2, C3	Lec 1 – Lec Cl 1 – Cl 15	N1, N2, N3, N4

** - enter symbols for main-field-of-study/specialization educational effects
*** - from table above