FACULTY OF ELECTRICAL ENGINEERING, COMPUTER SCIENCE AND TELECOMMUNICATIONS

ERASMUS PROGRAMME

GENERAL DESCRIPTION AND ECTS SCORING FOR COURSES TAUGHT IN ENGLISH

FIELDS OF STUDY:

ELECTRICAL ENGINEERING

UNDERGRADUATE PROGRAMME

Collected and prepared for printing by
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FUNDAMENTALS OF ELECTRICAL POWER ENGINEERING

Course code: 06.2-WE-E-PE-PK28_S1S

Type of course: compulsory

Entry requirements: -

Language of instruction: Polish, English

Director of studies: dr hab. inż. Grzegorz Benysek, prof. UZ

Name of lecturer: dr hab. inż. Grzegorz Benysek, prof. UZ

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					5
Lecture	30	2	III	exam	
Class					
Laboratory	15	1		grade	
Seminar					
Workshop					
Project					
Part-time studies					
Lecture	18	2	IV	exam	
Class					
Laboratory	9	1		grade	
Seminar					
Workshop					
Project	9	1		grade	

COURSE CONTENTS:

Energy significance in present times. Energetic raw materials and energy carriers. Energetic characteristics, economy energy-consumption, energy balances.

Electrical energy production. Operation principles and types of the conventional power stations, as well as nuclear. Distributed energy production. Unconventional energy sources – wind energy.

Power networks. Construction and types of the energy networks: industry networks, transmission networks, distribution networks. Overhead and cable networks. Influence of the distributed generation on power system behavior.

Power stations: connection types, construction solutions. Distribution and measurement devices: types, principle of operation, destination. Operation of the star-point in energy networks.

LEARNING OUTCOMES:

Skills and competences in: understanding problems related to electrical energy production in power stations; electrical energy market functions; requirements to the power system users.

ASSESSMENT CRITERIA:

Lecture – the main condition to get a pass are sufficient marks in written or oral exam.

Laboratory – the main condition to get a pass is acquiring sufficient marks for all laboratory exercises as scheduled.

Project – the main condition to get a pass is acquiring sufficient marks for all project tasks as scheduled.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
45	Class participation	1.5
105	Self-study	3.5
150	**Total**	**5**

RECOMMENDED READING:

1. Mielczarski W., Electrical energy market – selected technical and economical aspects, ARE & EP-C, Warszawa, 2000 (in Polish)
2. Arrillaga J., Watson N., Power system harmonics, John Wiley & Sons, 2003
3. Machowski J. et all., Power system dynamics and stability, John Wiley & Sons, 1997

OPTIONAL READING:

1. Polskie Sieci Elektroenergetyczne, Balance market regulations, Warszawa, 2001 (In Polish)

REMARKS:

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WIRELESS SENSOR NETWORKS

Course code: *06.5-WE-E-BSS-PSW_H48_SPE_S1S*

Type of course: compulsory

Entry requirements: Microprocessor systems, Intelligent measurement transducers

Language of instruction: Polish/English

Director of studies: dr inż. Emil Michta

Name of lecturer: dr inż. Emil Michta

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					4
Lecture	30	2	VI	1. grade	
Laboratory	30	2		2. grade	

COURSE CONTENTS:

Introduction to sensor networks. Evolution of WPAN wireless networks. Wireless networks IEEE 802.15.x. Processors for wireless network nodes. Supply issues of wireless sensor networks. Application areas of sensor networks.

Sensor networks. Sensor networks topology. Physical layer and data layer of wireless sensor networks – IEEE 802.15.4. Network layer and application layer – ZigBee standard.

ZigBee. Architecture of ZigBee protocol. ZigBee network functioning. Kinds and functioning of ZigBee nodes. Central managing and routing. Domens, clusters and profiles in ZigBee networks. Configuration of ZigBee networks. Implementation of security solution on MAC layer, network layer and application layer. Addressing and binding of variables. Application areas and application profiles.

Bluetooth. Architecture of Bluetooth protocol. Functioning of Bluetooth networks. Implementation of measurement – control functions.

Nodes of WPAN. Types and functions of ZigBee and Bluetooth network nodes. Design of ZigBee and Bluetooth network nodes.

Design and analysis of communication features in sensor networks. Choose of designed network topology. Coordinator and network configuration. Calculation of communication parameters for designed network. ZigBee sensor network simulation. Examples of applications.

LEARNING OUTCOMES:

Skills and competence within: design and configuration ZigBee wireless sensor networks. Writing of application programs in C or Java for ZigBee nodes. Creating of application profiles for ZigBee. Use of security solutions for data transmission protection in ZigBee networks.

ASSESSMENT CRITERIA:

Lecture – in order to get a credit it is necessary to pass all tests (oral or written) carried on at last once per semester

Laboratory – in order to get a credit it is necessary to earn positive grades for all laboratory works defined by tutor.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
60	Class participation	2
60	Self-study	2
120	**Total**	**4**

RECOMMENDED READING:

1. Miller A.B., Bisdikian Ch.: Bluetooth. Helion. Gliwice, 2004.
2. Raghavendra C.S., Sivalingam K.M., Znati T.: Wireless Sensor Networks. Kluver Academic Publisher, 2005.
3. Zieliński B.: Wireless Computer Networks. Helion, Gliwice, 2003.
4. ZigBee ZigBee Alliance. ZigBee Specification v.1.1 2007.

OPTIONAL READING:

1. Zhao F., Gibas L.: Wireless Sensor Networks. An Information Processing Approach. Elsevier, 2004.

REMARKS:

DIGITAL MEASUREMENT SYSTEMS

Course code: 06.5-WE_E_CSP_H48_SPE_S1S

Type of course: compulsory

Entry requirements: -

Language of instruction: Polish, English

Director of studies: dr inż. Leszek Furmankiewicz

Name of lecturer: dr inż. Leszek Furmankiewicz

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					4
Lecture	30	2	II	exam	
Class					
Laboratory	30	2		grade	
Seminar					
Workshop					
Project					
Part-time studies					
Lecture	18	2	II	exam	
Class					
Laboratory	18	2		grade	
Seminar					
Workshop					
Project	9	1		grade	

COURSE CONTENTS:

Measuring systems - introduction. Definition, classification, basic tasks, basic configurations, kinds of transmission, methods of transmission coordination, functional blocks of measuring and control systems. Data acquisition systems. Destination of data acquisition systems, configurations, basic functional blocks: conditioning system, multiplexer, measuring amplifier, isolating amplifier, filters. Data acquisition cards, basic functional blocks of the cards. Programming of data acquisition cards . Interfaces of measuring systems: Definition of interface, classification of interfaces, interfaces used in measuring systems. Serial interfaces: RS -232, RS -422, RS -485, serial interfaces programming. Parallel interface IEEE 488: principal tags of IEEE 488 standard, bus of the interface, types of devices, word of status, serial control of devices, parallel control of devices. Widening of IEEE -488 standard: enlargement of speed, enlargement of range, enlargement of number of devices. IEEE 488.2 standard. Requirement relating to controller requirements relating to devices, word of status, synchronization of devices. Controller and devices software. VXI standard. Principal tags of VXI, card chassis, bus of VXI. SCPI standard. SCPI device model, structure of commands, trigger system, status system. Profile of commands for example devices. Digital industrial nets. Net: MODBUS, PROFIBUS, PROFInet, CAN, LONWORKS, INTERBUS - S. Internet technologies in measuring systems. Embedded WWW servers. Profiles of hardware structure and software of embedded WWW servers. Wireless measuring systems. GSM technology in measuring systems. Radiomodems. BlueTooth and ZigBee standards. Virtual measurement instruments. Definition, structure and basic tags of virtual instruments. Programming of virtual instruments. Metrological and computer characteristics of virtual instruments. Measuring systems programming. Programming of measuring systems using software development environments. Characteristics of integrated environments: LabWindows, LabView, Agillent Vee. Software of interfaces and chosen DSP software. VISA library. Software drivers for measuring instruments. IVI drivers. Visualization systems. Structure of company computer system, functions of SCADA, measuring and control instruments in SCADA, design of visualization systems. Examples of SCADA applications. Programmable Automation Controllers (PAC). PAC in measuring and control systems as an example of B&R systems. Hardware and software architecture of PAC. Automation Studio - integrated software development environment. Process visualization in PAC. Design and starting of measuring systems. General principles of design. Task analysis, consolidation of requirements, stages of design. Starting of hardware and starting of software. Failure of measuring systems.

LEARNING OUTCOMES:

Skills and competences in the range of the: understanding of functioning of measuring and control systems, using laboratory and industrial measuring systems with wired and wireless communication technique, design hardware of measuring and control systems, creating application software for measuring system and control systems.

ASSESSMENT CRITERIA:

Lecture – obtaining a positive grade in written or oral exam.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Project – the main condition to get a pass are sufficient marks for all project tasks conducted during the semester.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
60	Class participation	1.3
120	Self-study	1.7
180	**Total**	**4**

RECOMMENDED READING:

[1] Winiecki W.: *The Organization of Computer Measuring Systems*. Warsaw University of Technology Press, Warsaw, 1997 (in Polish).

[2] Mielczarek W.: *Measuring Instruments and Systems with SCPI Compatibility*, Helion, Gliwice 1999 (in Polish).

[3] Lesiak P., Świsulski D.: *Computer Measuring Technique in Examples*, PAK, Warsaw, 2002 (in Polish).

[4] Nawrocki W.: *Computer Measuring Systems*, WKiŁ, Warsaw, 2002 (in Polish).

[5] Rak R., J.: *Virtual Measuring Instrument - Real Tool of Present Metrology,* Warsaw University of Technology Press, Warsaw, 2003 (in Polish).

[6] Nawrocki W.: *Distributed Measuring Systems*, WKŁ, Warsaw 2006 (in Polish).

[7] Pietrusiewicz K., Dworak P.: *Programmable Automation Controllers* PAC. Nakom, Poznań, 2007.

[8] Bentley J. P.: *Principles of Measurement Systems*, Pearson Education Limited, Harlow, England, 2005.

[9] Caristi A., J.: *IEEE-488 General Purpose Instrumentation Bus Manual,* Academic Press, INC., San Diego, California, 1992.

OPTIONAL READING:

2. Lesiak P., Świsulski D.: *Computer Measuring Technique in Examples*, PAK, Warsaw, 2002 (in Polish).
3. Johnson G.W., Jennings R.: *LabView Graphical Programming*, MacGraw-Hill, New York, 2006.

REMARKS:

COMPUTER-AIDED DESIGN

Course code: 06.2-WE-E-KWP-PSW_B42_SPE_S1S

Type of course: Optional

Entry requirements: -

Language of instruction: Polish, English

Director of studies: dr inż. Janusz Kaczmarek

Name of lecturer: dr.inż. Janusz Kaczmarek

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	V	grade	
Class					
Laboratory	30	2		grade	
Seminar					
Workshop					
Project	15	1		grade	
Part-time studies					
Lecture	18	2	VI	grade	
Class					
Laboratory	18	2		grade	
Seminar					
Workshop					
Project					

COURSE CONTENTS:

Basic knowledge of the virtual instruments. Basic definitions. Characteristic of integrated software environments to designing the software for virtual instruments and measurement systems.

Introduction to programming in LabWindows. LabWindows overview. Basics of creating the Graphical User Interface. Generating the source code. Methods of designing programs: callback functions and event loops. Properties and programming control of GUI objects. Characteristic of library functions for analysis and processing of measurement signals. Debugging techniques. Creating and distributing executable program.

Advanced programming techniques in LabWindows. Multithreading programming techniques. Using ActiveX automation: server and controller applications. Using internet programming technology. Methods of creating reports from measurements.

Methodology of designing an electronic circuit using EDA system. Basic concepts on capturing a circuit as a schematic diagram: netlist, wires and buses. Component library structure: part, symbol, package and padstack. Printed Circuit Board designing using layout editor. Methods of placing components and routing traces. Designing one, two and multilayer PCB. Automatic routing of PCB traces with an autorouter tool. Design rule check in EDA systems.

Computer simulation of electronic circuits. SPICE simulation fundamentals. Types of simulation analysis: nonlinear dc, small signal ac, transient, sensitivity and distortion. Models of electronic devices. Analysis of simulation results.

Producing design documentation and CAM files in EDA systems.

LEARNING OUTCOMES:

Skills and competences in the field of designing and creating the software for measurement systems with the use of specialized integrated software environment the LabWindows/CVI. Skills and competences in the field of applying Electronic Design Automation software supporting the process of designing electronic circuits.

ASSESSMENT CRITERIA:

Lecture – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once a semester.

Laboratory – the main condition to get a pass is acquiring sufficient marks for all laboratory exercises as scheduled.

Project – the main condition to get a pass is acquiring sufficient marks for all project tasks as scheduled.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
75	Class participation	3
75	Self-study	**3**
150	**Total**	**6**

RECOMMENDED READING:

4. Williams T., The Circuit Designer's Companion, Newnes, 2005.
5. Khalid S.F., LabWindows/CVI Programming for Beginners. Prentice Hall PTR, 2000.
6. Rymarski Z., *Materials technology and construction of electronic circuits. Designing and production of electronic circuits*, Wydawnictwo Politechniki Śląskiej, Gliwice, 2000 (in Polish).

7. Dobrowolski A., *Under the mask of SPICE*, BTC, Warszawa, 2004 (in Polish).

OPTIONAL READING:

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REMARKS:

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ELECTRIC MACHINES AND DRIVES I

Course code: 06.2-WE-E-MNE1-PK32_S1S

Type of course: compulsory

Entry requirements: -

Language of instruction: Polish

Director of studies: Dr hab. inż. Grzegorz Benysek, prof. UZ, Dr hab. inż. Robert Smoleński

Name of lecturer: dr hab. inż. Robert Smoleński, dr inż. Sławomir Piontek, dr inż. Jacek Rusiński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2		Grade	
Class					
Laboratory	30	2		Grade	
Seminar					
Workshop					
Project					
Part-time studies					
Lecture					
Class					
Laboratory					
Seminar					
Workshop					
Project					

COURSE CONTENTS:

Basic electrodynamics' laws in electric machines theory. Induced voltage. Conditions of electromagnetic torque formation. Electromagnetic torque asynchronous, synchronous (excited and reluctance) and electromagnetic torque of commutator motors.

Construction elements of electric machines.

Transformers. One-phase-transformer, three-phase-transformer, winding connections, transformer ratio, voltage, hour indication of vector group, parallel work of three-phase-transformers. Power balance, efficiency.

Induction motors (asynchronous). Mathematical model of three-phase induction motor. Steady state of induction motor. Equivalent circuit. No load and short-circuit condition, power balance, currents and torque in steady state. Mechanical characteristic, Kloss formula, electrodynamics and electromagnetic transients of induction motors. Typical waveforms of currents, speed and torque. Two-phase induction motors. Power balance, efficiency.

Synchronous motors. Construction, basis of work of three-phase synchronous motor. Mathematical model of three-phase synchronous motor. Synchronization, field forcing, field suppression. Synchronous motor start-up, steady state of synchronous motor. Equivalent circuit, vector diagram for motor and generator state. Load, no-load and shorting condition. Electric grid and single generator work. Reluctance motors. Permanent magnet motors. Synchronous motor fed-by current source inverter. Power balance, efficiency.

Direct current motors. Mathematical model of DC motor. Separately excited DC motor, series connected DC motor. Start-up, speed control, braking of DC motors. Printed circuit DC motors, brushless DC motors. Power balance, efficiency.

LEARNING OUTCOMES:

Skills and competences in: understanding of the matters of electromechanical energy conversion; application of the basic electric motors and transformers as elements of energy and drive systems.

ASSESSMENT CRITERIA:

Lecture – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once per semester.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
60	Class participation	1.2
240	Self-study	4.8
300	**Total**	**6**

RECOMMENDED READING:

1. Boldea I., Nasar S. A, Electric Drives, CRC Press, 1999
2. Sen P.C., Principles of Electrical Machines and Power Electronics, John Willey and Sons, Inc., New York, USA. 1997
3. Kaźmierkowski M. P., Tunia H., Automatic Control of Converter-Fed Drives, Warsaw - Amsterdam - New York - Tokyo: PWN-ELSEVIER SCIENCE PUBLISHERS, 1994
4. Kaźmierkowski M. P., Blaabjerg F., Krishnan R., Control in Power Electronics, Selected Problems, Elsevier, 2002
5. Kaźmierkowski M. P. and Orłowska-Kowalska T., Neural Network estimation and neuro-fuzzy control in converter-fed induction motor drives, Chapter in Soft Computing in Industrial Electronics, Springer-Verlag, Heidelberg, 2002
6. Leonhard W., Control of Electrical Drives, Springer, Berlin, New York, 2001
7. Miller T. J. E., Brushless Permanent-Magnet and Reluctance Motor Drives, Oxford University Press, Oxford, England, 1989

OPTIONAL READING:

REMARKS:

PRINCIPLES OF ELECTRONICS AND POWER ELECTRONICS II

Course code: 06.2-WE-E-PEE2-PD37_S1S

Type of course: compulsory

Entry requirements: -

Language of instruction: Polish

Director of studies: dr hab. inż. Zbigniew Fedyczak, prof. UZ

Name of lecturer: dr hab. inż. Zbigniew Fedyczak, prof. UZ

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					3
Lecture	30	2	II	exam	
Class					
Laboratory	30	1		grade	
Seminar					
Workshop					
Project					
Part-time studies					
Lecture	18	2	II	exam	
Class					
Laboratory	9	1		grade	
Seminar					
Workshop					
Project	9	1		grade	

COURSE CONTENTS:

Basic power electronics circuits (general description). Power electronics historical outline. Application area. Types of power electronic converters (PEC), their classification and basic functions. A semiconductor device as a power electronics switch and its thermal model.

Basic parameters and conversion quality evaluation of the PEC. Coefficients or factors: efficiency, total harmonics distortion, power, deformations, displacement, non-symmetry at non-sinusoidal current circumstances.

Non-controlled and controlled rectifiers (AC/DC converters). Topologies and properties of single-, two and six-pulsed non-controlled rectifiers. Single- and three-phase thyristor rectifiers with phase control. Influence of the rectifiers on supplying source. Examples of applications.

DC/DC PWM voltage and current stabilizators (DC/DC converters). Topologies and properties of the impulse DC stabilizators types buck, boost, buck-boost and H-bridge with PWM control. Examples of applications.

Single-phase AC choppers (AC/AC converters, $f_1 = f_2$). Solid state relay and thyristor choppers. Phase angle and integral control. Operation and static characteristics at R and RL load, power factor. Examples of applications.

Inverters (DC/AC converters). Single-phase voltage source inverters. Functioning and properties of the transistorized inverters at different load. The PWM control strategy in the inverters. Output voltage and frequency control. Operation general description of three-phase voltage source inverter with square wave modulation and sinus PWM. Examples of applications.

Problems and development trends of the PEC. Intelligent power module, multilevel converters, resonance converters. Future trends.

LEARNING OUTCOMES:

Skills and competence in the frame: operation understanding of basic power electronic semiconductor devices and circuits, knowledge deals with their properties and application fields.

ASSESSMENT CRITERIA:

Lecture – obtaining a positive grade in written or oral exam.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
60	Class participation	1.2
90	Self-study	1.8
150	**Total**	**3**

RECOMMENDED READING:

[1] Pirog S., *Power electronics*, AGH Publishing House, Cracow, 2006 (in Polish)
[2] Mohan N., *Power Electronics: Converters, Application and Design*, John Wiley & Sons, 1998
[3] Trzynadlowski A., *Introduction to modern power electronics*, John Wiley & Sons, 1998
[4] Erickson R., W., Maksimović D.: *Fundamentals of power electronics.* Kluver Academic Publishers, 1999.

OPTIONAL READING:

[1] Mikołajuk K., *Fundamentals of power electronic circuits analysis*, PWN, Warsaw, 1998 (in Polish)
[2] Holms D., G., Lipo T., A.: *Pulse width modulation for power converters. Principles and practice.* John Wiley & Sons Inc., 2003.

REMARKS:

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DIGITAL SIGNAL PROCESSING USING DIGITAL SIGNAL PROCESSOR

Course code: 06.0-WE-E-PSZP-PSW_B42_S1S

Type of course: optional

Entry requirements: Circuit Theory, Microprocessor Systems, Computer Science

Language of instruction: Polish

Director of studies: dr inż. Krzysztof Sozański

Name of lecturer: dr inż. Krzysztof Sozański

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2		Exam	
Class					
Laboratory	30	2		Grade	
Seminar					
Workshop					
Project	15	1		Grade	
Part-time studies					
Lecture	18			Exam	
Class					
Laboratory	18			Grade	
Seminar					
Workshop					
Project					

COURSE CONTENTS:

Analog and digital signal processing. Properties of signals. Analog (continuous-time) signals, discrete time signals. Signal parameters.

Analog signal processing. Analog circuits, linear two-port network. Continuous-time filters. Filter parameters. Introduction to analog filter design.

Signal discretization. Uniform and non uniform signal sampling. Analog-to-digital (A/D) and digital-to-analog (D/A) signal conversion. A/D and D/A signal converters. Examples of multimedia and measurements data signal conversions.

Linear time-invariant (LTI) circuit. Discrete Fourier transform (DFT). Leakage effects. Widows. Properties of DFT. Fast Fourier transform (FFT). Z transform. Properties of Z transform.

Multirate digital signal processing. Decimation and interpolation. Implementation of multirate digital signal processing algorithms. Applications of multirate signal processing: noise shaping technique in delta sigma modulator (DSM) used in A/D and D/A converters.

Digital modulations: pulse width modulation (PWM), pulse density modulation PDM, pulse code modulation PCM, differential pulse code modulation.

Digital filters: linear and nonlinear filters, multirate filters, filter banks, multidimensional filters. Properties of digital filters: finite impulse response filter (FIR), infinite response filter (IIR). Design of digital filters.

Round off effects in digital filters. Implementation of digital filters using digital signal processors.

Switched Capacitor (SC) filters.

Signal processing of random processes. Adaptive systems.

Subband coding. Design of filter banks. Wavelet transform.

LEARNING OUTCOMES:

Basic knowledge of: designing of digital signal processing, applied: in power electronics, multimedia, control technique, measurements. Implementation of digital signal processing methods and digital control algorithms using DSPs and microcontrollers.

ASSESSMENT CRITERIA:

Lecture – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
75	Class participation	2.5
105	Self-study	3.5
180	**Total**	**6**

RECOMMENDED READING:

1. Proakis J. G., Manolakis D. M., *Digital Signal processing, Principles, Algorithms, and Applications*, Third Edition, Prentice Hall Inc., Engelwood Cliffs, New Jersey 1996.
2. Lyons R., *Understanding digital signal processing*, Prentice Hall, 2004.
3. Oppenheim A. V., Schafer R. W., *Discrete-time signal processing*, Prentice Hall, New Jersey, 1999.
4. Stallings W., *Computer Organization and Architecture*, Prentice Hall Inc., 1996.
5. Vaidyanathan P. P., *Multirate Systems and Filter Banks*, Prentice Hall Inc., Engelwood Cliffs, New Jersey 1992.
6. Wanhammar L., *Digital Filters*, Linkoping University, 1996.
7. Embree P. M., Kimble B., *C Language Algorithms for Digital Signal Processing*, Prentice Hall, 1991.

OPTIONAL READING:

1. Chassaing R., *Digital Signal Processing with C and the TMS320C30*, John Wiley & Sons, 1992.
2. McFarland G., *Microprocessor Design (Professional Engineering)*, McGraw-Hill Professional, 2006.

REMARKS:

POWER ELECTRONIC CIRCUITS

Course code: 06.2-WE-E-UE-PSW_D44_SPE_S1S
Type of course: compulsory
Entry requirements: -
Language of instruction: Polish, English
Director of studies: dr hab. inż. Zbigniew Fedyczak, prof. UZ
Name of lecturer: dr hab. inż. Zbigniew Fedyczak, prof. UZ

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					3
Lecture	30	2	II	exam	
Class					
Laboratory	30	1		grade	
Seminar					
Workshop					
Project	15			grade	
Part-time studies					
Lecture	18	2	II	grade	
Class					
Laboratory	9	1		grade	
Seminar					
Workshop					
Project	9	1		grade	

COURSE CONTENTS:

Introduction. General description (outline) of the preceded course deals with Fundamentals of power electronics (basic power electronics semiconductor devices, basic power electronic converters, standards and conversion quality evaluation, basic control techniques, application field).

AC/DC and AC/AC with phase-angle control. Topologies review, operation description and properties of non-controlled and controlled (thyristorized) six- and multipulse rectifiers, three-phase AC choppers. Application examples of such converters. Conversion quality of the AC/DC and AC/AC converters using phase-angle control. Influence of such converters on a voltage supplying source (displacement factor, deformation factor and power factor).

PWM DC/DC converters II. Operation descriptions and properties of the DC/DC converters with ideal switch circuit models: non-isolated higher level (types Chuck, ZETA), isolated (types flyback and forward). Application examples of such converters.

PWM DC/AC converters II. Topologies, operation descriptions and properties of single- and three-phase voltage source and current source inverters (VSI, CSI) with sinus PWM (SPWM) control. PWM control techniques review. Properties of the VSI with space vector PWM (SVPWM) control.

PWM AC/DC converters. Topologies, operation description and properties of single- and three-phase rectifiers with sinusoidal input current as well as buck and boost type. Suppliers with power factor correction (PFC). The impulse stabilizators control techniques in the suppliers with unity power factor. Integrated monolithic control circuit in the impulse stabilizators.

Indirect PWM AC/AC converters. Topologies, operation description and properties of PWM AC/DC/AC converters (frequency converters). Output and input current shaping methods in PWM AC/DC/AC converters. Application examples of the AC/AC frequency converters.

Conversion quality of the circuits with PWM AC/DC and AC/AC converters. Influence of such converters on supplying source (displacement factor, deformation factor and power factor).

Future trends of the power electronic circuits (general description). A new semiconductor power electronic switches and intelligent power modul. Conversion quality improvement as well as new application areas of the power electronic converters.

LEARNING OUTCOMES:

Skills and competence in the frame: operation understanding and design of basic power electronic converters, knowledge deals with their properties and application fields.

ASSESSMENT CRITERIA:

Lecture – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester and pass of the final exam.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
45	Class participation	1.5
45	Self-study	1.5
90	**Total**	**3**

RECOMMENDED READING:

[1] Pirog S., *Power electronics*, AGH Publishing House, Cracow, 2006 (in Polish)
[2] Mohan N., *Power Electronics: Converters, Application and Design*, John Wiley & Sons, 1998
[3] Trzynadlowski A., *Introduction to modern power electronics*, John Wiley & Sons, 1998
[4] Erickson R., W., Maksimowić D.: *Fundamentals of power electronics.* Kluver Academic Publishers, 1999.
[5] Mikołajuk K., *Fundamentals of power electronic circuits analysis*, PWN, Warsaw, 1998 (in Polish)
[6] Holms D., G., Lipo T., A.: *Pulse width modulation for power converters. Principles and practice.* John Wiley & Sons Inc., 2003.

OPTIONAL READING:

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REMARKS:

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HIGH VOLTAGE ENGINEERING

Course code: 06.2-WE-E-TWN-PK33_S1S
Type of course: compulsory
Entry requirements: -
Language of instruction: Polish
Director of studies: dr hab. inż. Adam Kempski, prof. UZ
Name of lecturer: dr hab. inż. Adam Kempski, prof. UZ

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	V	exam	
Class					
Laboratory	30	2		grade	
Seminar					
Workshop					
Project					
Part-time studies					
Lecture	18	2	V	exam	
Class					
Laboratory	18	2		grade	
Seminar					
Workshop					
Project					

COURSE CONTENTS:

Introduction. Subject and range of discipline. Electric field distributions. Electric field non-uniformity coefficient. Ionization and deionization processes.

Electric breakdown strength of materials and composite insulation. Electrical breakdown in gases. Townsend's mechanism. Paschen's law. Streamer mechanism of spark breakdown. Breakdown under impulse voltage. Insulating properties of high-pressure gas. Processes of electrical breakdown in liquids. Effect of oil contamination on the electrical strength. Breakdown processes in solid dielectrics. Partial discharges. Dielectric aging. Breakdown in composite insulation. Forms of surface discharge.

Overvoltages. Types of overvoltages. External and internal overvoltages. Wave phenomena in electrical power transmission power lines. Travelling waves in real conditions.

Lightning protection and transit overvoltage protection. Lightning overvoltages. Lightning protection. Overvoltage protection. Coordination of overvoltage protection.

Electrical insulation systems. Principles of insulation coordination. Outdoor and indoor high voltage insulators. Electrical insulation of rotating machines, transformers and cables.

High voltage testing techniques. High voltage measurements. High voltage measurements safety.

:LEARNING OUTCOMES:

Skills and competences in : understanding high voltage phenomena; designing and exploitation of high voltage systems; designing and exploitation of lightning and transit overvoltage protection.

ASSESSMENT CRITERIA:

Lecture – obtaining a positive grade in written or oral exam.

Laboratory – the main condition to get a pass is acquiring sufficient marks for all laboratory exercises as scheduled.

STUDENT WORKLOAD

No. of hours	Type of workload	ECTS
60	Class participation	2
120	Self-study	4
180	**Total**	**6**

RECOMMENDED READING:

[1] Flisowski Z.: *High voltage technique*, WNT W-wa, 2005 (in Polish)
[2] Naidu M.S., Karamaju V. *High voltage engineering*, McGraw-Hill, 1995
[3] Gacek Z.: *High voltage insulation technique*, Wydawnictwo Politechniki Śląskiej, 1996 (In Polish)
[4] Kufel J., Kufel E., Zaengl W.S.: *High voltage engineering Fundamentals*, Elsevier 2000

OPTIONAL READING:

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