Załącznik do Uchwały nr 4

Senatu UwB

z dnia … … 2012 roku

SYLLABUS OF COURSE

Elementy składowe sylabusu	**Opis**
Nazwa jednostki prowadzącej kierunek	*Faculty of Physics*
Nazwa kierunku / specjalności studiów	*Physics; Medical Physics*
Poziom kształcenia	*undergraduate study*
Forma studiów	*regular studies*
Profil studiów	*practical*
Kod przedmiotu	*0900-FM1-2ELE*
Język przedmiotu	*English language*
Rodzaj przedmiotu	*obligatory*
Rok studiów /semestr	*year II, semester 4*
Wymagania wstępne (tzw. sekwencyjny system zajęć i egzaminów)	*Zaliczone kursy : Elektryczność i magnetyzm, Optyka, Budowa materii.*
Założenia i cele przedmiotu	***Aim of Lecture:*** Understand the basic electrical engineering principles and abstractions on which the design of electronic systems is based. These include lumped circuit models, digital circuits, and operational amplifiers, as well as the physical bases of solid state electronics; ***Laboratory:*** Appreciate the practical significance of the systems developed in the course. Build circuits and take measurements of circuit variables using tools such as oscilloscopes, multimeters, and signal generators. Compare the measurements with the behavior predicted by mathematic models and explain the discrepancies;
Treści merytoryczne przedmiotu	**Basic Principles of Electronics**. Analog signal, Digital signal. DC and AC voltage; Ohm Law, Kirchhoff's Laws: KCL, KVL; Gain (Transmittance) of circuits. Passive electronics elements: resistors, capacitors, inductors; parameters. **RC and LR circuits** (filters) Low-pass filter; High-pass filter; Band- pass filters; Resonance circuits. Frequency response of simple RC circuits. Amplification of step voltages and pulses. **Semiconductor materials**, crystal structures, basic of quantum theory and band theory. Introduction to **p-n junction** theory: electrostatics; ideal p-n diode equation. Non-ideal diode description. DC voltage-current characteristics, temperature effects. Reverse bias

transition capacitance.
Charge storage and transient behavior. Real diode small- and large- signal models. Junction breakdown;
The Zener, Capacitance, LED, Photodiode and other special types of diodes.
Metal-semiconductor junctions: Schottky diodes, non-rectifying contacts, tunneling.
Bipolar Junction Transistors (BJT); principles of operation; derivation of voltage-current and current gain expressions. DC and AC models and equivalent circuits. Frequency response.
Large and small-signal models of BJT. Relationship between collector current and small signal parameters. Impedance seen from base, collector and emitter. Robust BJT biasing in discrete and integrated technology. BJT amplifiers configurations – OE OC and emitter follower. Benchmark parameters for different configurations.
Theory of Junction **Field Effect Transistor** (JFET); dc characteristics and ac performance.
Two-terminal MOS structure, MOS capacitors, flat-band and threshold voltages.
Static MOS transistor (MOSFET), its equivalent circuit, body effect.
Small signal parameters, equivalent circuit and frequency limitations of MOSFETs.
MOSFET biasing and amplifier configurations – CS, CG and CD.
Basic classes of amplifiers. Input and output impedance. **OpAmp** as a Black Box. Negative voltage feedback Analysis of linear applications with OpAmps – inverting and non-inverting, voltage follower, adder and subtracter.
Behavioral description of open loop OpAmp's gain. Gain-bandwidth exchange in OpAmp circuits. Other OpAmp non-idealities and their impact on application performance.
Analysis of linear applications: OpAmp Integrator, OpAmp Differentiators for integration and differentiation configuration, converter current- voltage
OpAmp RC Active filters. Types of filters. Approximation, implementation and filter synthesis.
Comparators, principle, parameters. Real comparators, with hysteresis loop, without hysteresis loop; Circuits with positive feedback; The RC oscillator

Power supplies
Basic rectifying circuits, - full wave rectifying circuits.
Smoothing circuits: $\pi -$ sections filters
Other forms of power supply
Electronic regulation of power supplies

Digital Logic Elements
Boolean Logic, Basic Logic function and selected complex functions.
The Basic of Digital circuits:

- Logic gates
- Decoders, Converter
- Multiplexers, Demultiplaxers
- Flip-flops type: D, RS, T, JK;
- Counters - using Flip-flops (binary and BCD counters)

Logic gates; Parameters of logic gate design: e.g. TTL, ECL, CMOS

	Analysis of selected logic gate design. **Converters D\A and A\D** Principles of working of selected converters; parameters.
Punkty ECTS	*5*
Liczba godzin zajęć dydaktycznych oraz forma prowadzenia zajęć	*lecture – 30 h, laboratory-45 h*
Metody dydaktyczne oraz formy i warunki zaliczania przedmiotu	*Weekly consultation.* *To gets assessment of laboratory necessary is to execute all of labs, to prepare reports and oral presentation of results. The absence of 50% of the laboratory makes it impossible to obtain credit from the laboratory.* *The assessment of labs is necessary condition to exams.* *Evaluation of student work:* • *assessment of labs ;* • *oral exams*

Bilans nakładu pracy studenta	***Np.:***	***Liczba godzin***	
	Udział w wykładach.	*15 x 2h*	*30h*
	Udział w zajęciach (laboratoriach)	*14 x 3h + 3h(instruktażu)*	*45h*
	Przygotowanie do zajęć (laboratoriów)	*7 x 1h*	*7h*
	Opracowanie (w domu) sprawozdań z zajęć (laboratoriów)	*7 x 3h*	*21h*
	Udział w konsultacjach związanych z zajęciami (laboratoriami).	*5 x 1h*	*5h*
	Przygotowanie do egzaminu / zaliczenia i obecności na nim.	*12h + 3h*	*15h*
		Razem:	*123h (odpowiada 5 pkt ECTS)*
Wskaźniki ilościowe		***Liczba godzin***	***Punkty ECTS***
	Nakład pracy studenta związany z zajęciami wymagającymi bezpośredniego udziału nauczyciela;	*30 +45 + 5+3h = 83h*	*odpowiada 3pkt. ECTS*
	Nakład pracy studenta związany z zajęciami o charakterze praktycznym.	*45 + 7 + 21 +5h = 78h*	*odpowiada 2pkt. ECTS*

Efekty kształcenia *Opis zakładanych efektów kształcenia w zakresie wiedzy, umiejętności i kompetencji społecznych, czyli tego, co student powinien po zakończeniu zajęć wiedzieć, rozumieć i być zdolny wykonać. Uwzględnia się tylko efekty możliwe do sprawdzenia (mierzalne / weryfikowalne)*	***Odniesienie do kierunkowych efektów kształcenia***	***Sposoby weryfikacji zakładanych efektów kształcenia***
After successfully studying course of Electronics (KOD USOS **0900)** students will be able to: 1. Understand the basic electrical engineering principles and abstractions on which the design of electronic systems is based. These include lumped circuit models, digital circuits, and operational amplifiers; 2. Understand the physical bases of solid state electronics; 3. Build circuits and take measurements of circuit variables using tools such as oscilloscopes, multimeters, and signal generators. Compare the measurements with the behavior predicted by mathematic models and explain the discrepancies; 4. Analyze problems in the field of basic electronics and find their solutions, analyze and formulate conclusions; 5. Use literature and Internet resources to understanding and solving the problems of electronics; 6. Use teamwork skills laboratory, assuming the role of the leader or the coordinator of the experiment; 7. Organize a work and take responsibility for results of his work; 8. Appreciate the practical significance of the systems developed in the course.		• Test/ talk before each lab, • Oral presentation results of each labs

Literature	1. Agarwal, Anant, and Jeffrey H. Lang. *Foundations of Analog and Digital Electronic Circuits*. San Mateo, CA: Morgan Kaufmann Publishers, Elsevier, July 2005. ISBN: 9781558607354. 2. Yang E.S. – Microelectronic devices – McGraw Hill 1988 3. Neamen D.A. – Semiconductor Physic and Devices 3rd ed. – Mc Graw Hill 2002 4. Sze S.M. – Semiconductor Devices: physics and technology, 2nd Edition – Wiley 2002 5. B. Razavi Fundamentals of Microelectronics, Willey, 2008 6. A. Sedra, K.C. Smith, Microelectronic Circuits, Oxford UP 2010 7. R. Jaeger, T. Blalock, Microelectronic Circuit Design,McGraw Hill 2003
Lecturer	*dr Krystyna Perzyńska*

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podpis osoby składającej sylabus