DESCRIPTION OF THE COURSES

- Course code: ELR1366
- Course title: Circuits and systems- selected problems
- Language of the lecturer: English

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*2*	*1*			
*Number of hours/semester**	*22*	*11*			
Form of the course completion	*Examination*	*Colloquium*			
ECTS credits	*4*	*2*			
Total Student's Workload	*120*	*60*			

- Level of the course (basic/advanced): advanced
- Prerequisites: Circuits theory 2.
- Name, first name and degree of the lecturer/supervisor: Tadeusz Łobos , prof. DSc., PhD.
- Names, first names and degrees of the team's members:
  1. Przemysław Janik PhD
  2. Paweł Kostyła PhD
  3. Zbigniew Leonowicz PhD
  4. Jerzy Piotrowicz PhD
  5. Piotr Ruczewski PhD
  6. Tomasz Sikorski PhD
  7. Bronisław Świstacz PhD
  8. Zbigniew Wacławek PhD
- Year:...I..... Semester:.... 1.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course): Knowledge about various digital systems. Ability of determination of the full response of the SLL systems using the methods in the domains of time and frequency. Skills of systems with the method flow graphs and block diagrams analysis. Solving of recurrent equations. Calculation of the characteristics of digital filters.
- Form of the teaching (traditional/e-learning): traditional.
- Course description:

SLL circuits in the transitory state. The classic method. Distributions. The Laplace transform. Bilateral Laplace transform. Fourier transform. Operational and spectral transmittance. The Hilbert transform. Stability of SLL systems. The synthesis of circuits. Method of the state variables. Digital signals. The description of digital systems. The processing of digital signals. Methods of the investigation of non-linear systems. The phase plane. Ferro-resonance. The generation of oscillations in non-linear systems.

- Lecture:

Particular lectures contents	*Number of*

	hours
1. Bilateral Laplace transforms - properties. The domain of the convergence. The inverse transform - Riemann-Mellin formula. The properties of the transform. The relationship of bilateral Laplace transform to Fourier bilateral transform. Operational transmittance and spectra of SLL systems. Relationships of Hilbert. Minimum-phase systems. Causality of the system.	2
2. Real positive functions. The reactance function. Immitance of two-terminal networks. Synthesis of passive CR and LR two-terminal networks. Canonical form of Foster and Cauer.	2
3. The impulse and digital signals. Relationships of the 'zet' transform to the Laplace transform and Fourier transform. The spectrum of the digital signal. The discrete convolution.	2
4. Flow graphs and block diagrams.	2
5. Elements and the equations of digital systems. Solving of difference equations. Recursive and non - recursive equations - transitory state and steady state and solutions of difference equations. Stability of the solution.	2
6. Methods based on the transformation into the frequency domain. Frequency characteristics of digital systems. Poles and zeroes of the transmittance.	2
7. The synthesis of digital circuits. Digital filters. Direct and indirect methods of the simulation of analogue filters.	2
8. Parameters and characteristics of non-linear two-terminal networks. Solving of non-linear circuits in steady state with dc excitations for the various kinds of nonlinearity.	2
9. The qualitative investigation of the non-linear circuits (equations) - the phase plane. Investigation of the stability of (equations) of non-linear systems. Self-excited circuits.	2
10. Elements with the ferro-magnetic core with ac and dc sources. Ferro-resonance of voltages and currents. The phenomenon of harmonic compensation in three-phase circuits - the tripling the frequency	2
11. Non-linear phenomena in the transformer. Distortions of the current waveforms. Method of the first harmonic. The influence of the secondary winding.	2

- Classes – the contents:

  Determination of the full response of the SLL systems using the methods in the domains of time and frequency. Operational and spectral transmittance. Immittance of SLL two-terminal networks. Synthesis of two-terminal networks from elements LC, LR and CR. Investigation of the stability of SLL systems. Solving of recurrent equations. Investigation of the properties of digital systems. Calculation of the characteristics of digital filters. Calculation of the transitory state of linear systems - analogue and digital - with the help of the method of the state variables.
- Seminars – the contents:
- Laboratory – the contents:
- Project – the contents:
- Basic literature:

1. J. Osiowski, J. Szabatin - ***Podstawy Teorii Obwodów*** – *t. III* - WNT 1992-1995;

2. Papoulis - ***Obwody i Układy -*** WKŁ 1988;
3. A.V. Oppenheim, R. W. Schafer - ***Cyfrowe Przetwarzanie Sygnałów*** - WKŁ 1979
4. Łuczycki, A. Skopec - ***Elektrotechnika Teoretyczna*** -A*naliza układów nieliniowych*
5. Skrypt P.Wr. Wrocław 1994;

- Additional literature:
  1. M. Uruski, W. Wolski - ***Teoria Obwodów*** *t. I, II, III* **-** Skrypt P.Wr
  2. J. Kudrewicz - ***Nieliniowe Obwody Elektryczne*** - WNT 1996
  3. Ś.I. Baskakow - ***Sygnały i Układy Radiotechniczne*** - PWN 1991
  4. K. Mikołajuk, Z. Trzaska - ***Elektrotechnika Teoretyczna*** - PWN 1984;
  5. S. Osowski, K. Siwek, M. Śmiałek – ***Teoria Obwodów***, Oficyna Wydawnicza Politechniki Warszawskiej, 2006

- Conditions of the course acceptance/credition: Passed examination, passed colloquium, reports and self-preparation work satisfactory evaluation

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