STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Selected issues of the theory of circuits**		Code **1010322321010324872**
Field of study **Electrical Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 2**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **15** Laboratory: **15** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Of the message in mathematics, physics and the theory of circumferences on the first degree level.
2	**Skills**	Ability of the deepened understanding and interpreting communicated messages and the effective self-education in the field associated with chosen subject.
3	**Social competencies**	Has an expanded awareness of the need to expand its competence, readiness to work individual and of cooperation in frames of the team.

Assumptions and objectives of the course:

Knowing the rules for applying Laplace and Fourier transforms in electrical circuit analysis. Expanding knowledge on the use of transfer function and spectral analysis of electrical circuits. Getting acquainted the rules of fusion the passive two-terminal and nonlinear electric circuits. Understanding the state variables methods of analysis on electrical circuits. Acquainted with the modeling capabilities different types of energy storage in electric circuits.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. to characterize, discreet electric circuits, real circumferences and signals, to describe and to explain laws of both the analysis method of dynamics and the stability of electric circuits, and their synthesis - [K_W02++, K_W04+, K_W06+++]

2. to recognize, and to select appropriate methods of deepened analysis of electric circuits - [K_W04+, K_W09++]

Skills:

1. to apply the knowledge in the scope of the deepened theory of electric circuits essential to determine real parameters (discreet and random) of electric circuits so as: rates of the stability, powers and their random indicators, transmitance - [K_U02++, K_U03+++, K_U07+]

2. to recruit specialist information from literature and the Internet, to work independently and collectively, independently and collectively to solve problems from the scope of the deepened theory of electric circuits - [K_U01++, K_U02++, K_U07+]

Social competencies:

1. is able to think and to operate in the enterprising way in the area of widened analysis of electric circuits - [K_K01++, K_K02+]

Assessment methods of study outcomes

Lecture:

? the evaluation of the knowledge and abilities of electric circuits demonstrated on a written exam from the theory.

Lecture exercises:

? assessing of the ability solving of arithmetic assignments on the scope of analysis electric circuits - checking the ability on every classes and test in the course of the semester.

Laboratory exercises:

? the test and awarding a bonus to the essential knowledge of problems for the accomplishment stated in the given area of laboratory tasks,

? evaluation of the knowledge and the abilities associated with the performance of a task exercise.

Getting additional points for the activity during classes, particularly too:

? proposing discussing of aspects of the issue,

? effectiveness of applying the acquired knowledge while solving a set problem,

? of the attention associated with improving teaching materials,

? aesthetic care of reports drawn up and tasks - in the framework of the own learning.

Course description

Transient analysis of RLC circuits using Laplace transform (operator model - electrical circuit elements, principles taking into account the initial conditions, fundamental rights and claims in the form of operators circuit theory). Synthesis of passive two-terminal networks (basic task of synthesis, physical ability to implement two-terminal, Cauer method, the method of Foster, energy function, schematics canonical LC circuits, RL and RC). Basics of synthesis of nonlinear electrical circuits. The method of state variables in the analysis of electrical circuits type of stationary and non-stationary (basics elementary, creating the state equation, output equation). Operational and spectral transmittance and its use in circuit analysis. Basics of sensitivity to electrical circuits.

Update 2016:

Modelling of energy storage systems - electrochemical, supercapacitors and kinetics. The use of modern methods of energy storage in redundant power systems of electrical circuits.

Update 2017:

Optimization of complex electrical systems.

Applied methods of education:

Lectures - Lecture with multimedia presentations (including: drawings, photos, animations, videos) supplemented by examples given on the board; having regard to (taking into account) the various aspects of the presented issues, including: economic, environmental, legal and social; presenting a new topic preceded by a reminder of related content, known to students from other subjects,

Exercises - solving sample tasks on the board, initiating discussion about solutions,

Laboratory - instructors detailed review of the reports and discussions about comments , demonstrations, work in teams.

Basic bibliography:

1. Bolkowski S.: "Teoria obwodów elektrycznych", WNT, Warszawa 1998.

2. Szabatin J., Śliwa E.: "Zbiór zadań z teorii obwodów. Część 1", Wydawnictwo Politechniki Warszawskiej, Warszawa 1997.

3. Mikołajuk K., Trzaska Z.: "Zbiór zadań z elektrotechniki teoretycznej", WNT, Warszawa 1978.

Additional bibliography:

1. Krakowski M.: "Elektrotechnika teoretyczna", PWN, Warszawa 1973.

2. Chua L. O., Desoer C. A., Kuh E. S.: "Linear and nonlinear circuits", McGraw-Hill Inc., New York 1987.

3. Jastrzębska G., Nawrowski R.: "Zbiór zadań z podstaw elektrotechniki", Wydawnictwo Politechniki Poznańskiej, Poznań 2000.

4. Frąckowiak J., Nawrowski R., Zielińska M.: "Podstawy elektrotechniki. Laboratorium", Wydawnictwo Politechniki Poznańskiej, Poznań 2011.

Result of average student's workload

Activity	Time (working hours)

1. participation in lectures	30
2. participation in laboratory classes	15
3. participation in exercise classes	15
4. participation in consulting (lectures)	8
5. participation in consulting (exercise)	8
6. participation in consulting (laboratory)	8
7. preparation to test/exam	20
8. test/exam	4
9. preparation for the laboratory and preparation of the report	12

Student's workload

Source of workload	hours	ECTS
Total workload	120	4
Contact hours	88	3
Practical activities	35	1