COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computerization of design in electrical engineering [N1Eltech1>KPwE1]

Course

Field of study
Electrical Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

News in mathematics and physics at the matriculation level. Basic knowledge of computer science and programming. Ability to understand and interpret the transmitted messages and effective self-education in the field related to the chosen field of study.

Course objective

Understanding selected numerical methods in application to solve problems in the field of circuit theory and power engineering. Introduction to evolutionary algorithms and artificial neural networks. Discussion of the possibilities of using artificial intelligence techniques in electrical engineering.

Course-related learning outcomes

Knowledge:
Knows computer methods used for numerical calculations (integration, solving equations and systems of linear, nonlinear and differential equations, basic optimization methods). Knows basic structures of artificial neural networks, their classification, and learning algorithms.

Skills:

Is able to apply knowledge of numerical methods to solve selected issues in the field of electrical circuits and power engineering necessary to carry out project tasks.He can obtain information from literature and the Internet, work individually, solve tasks in the field of design computerization.

Social competences:
Is able to think and act in an entrepreneurial manner in the field of creating IT applications for design in the field of electrical engineering

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Knowledge acquired during the lecture is verified during an exam consisting of 5-10 (open) equally scored questions. Passing threshold: 50% of points. Additionaly, there will be quiz at the end of selected lectures. Gathered additional point will be added to score of the exam.

Programme content

Basic issues regarding the implementation and use of numerical methods in electrical engineering. Examples of methods for approximation and interpolation and their application in
technical issues (e.g. Lagrange interpolation, mean square approximation). Computer methods enabling the analysis of current flow in electric circuits in steady states containing linear (Jacobi, Gauss-Siedel, SOR) and nonlinear (Newton's method) elements. Basic issues related to artificial intelligence and its applications
in electrical engineering, e.g. prediction of energy yield in renewable energy sources. Local and global optimization methods and their application in electrical engineering.

Course topics

The lecture program includes the following issues:
1) representation of numerical values in digital systems
2) interpolation of functions of one variable: polynomial, Lagrange, Newton and trigonometric
3) mean square approximation
4) solving systems of linear equations using exact and iterative methods
5) solving systems of nonlinear equations
6) artificial neural networks: basic definitions, neuron models, network structures and learning methods
7) local optimization methods: gradient and nongradient
8) global optimization methods: simulated annealing, genetic algorithm and particle swarm optimization

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board, initiating discussions during the lecture. Additional materials are placed in the Moodle system.

Bibliography

Basic
[1] Johansson R, Kaminski F, Helion. Matematyczny Python: obliczenia naukowe i analiza danych z uzyciem NumPy, SciPy i Matplotlib. Gliwice: Helion; 2021.
[2] Rutkowski L. Metody i techniki sztucznej inteligencji. Warszawa: Wydawnictwo Naukowe PWN; 2012.
[3] Pańczyk B, Politechnika Lubelska. Metody numeryczne w przykładach. Lublin: Politechnika Lubelska; 2012.
Additional
[1] Sozański K. Digital Signal Processing in Power Electronics Control Circuits. Springer Science & Business Media; 2013. 280 p.
[2] Sesha Gopal S, BMS Institute of Technology and Management. Artificial Intelligence in the Field of Electrical Engineering. Int J Eng Res. 2020 Jul 10;V9(07):IJERTV9IS070115.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00