COURSE DESCRIPTION CARD - SYLLABUS

Course name
Waves and antennas [N1EiT1>FiA]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/4

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
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

7,00

Coordinators

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Lecturers

dr inż. Jarosław Szóstka
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Prerequisites

Students starting this course should have basic knowledge of physics, circuit theory, and electrical metrology. They should also be able to calculate simple DC and AC electrical circuits, obtain information from given sources, and be ready to work in a team.

Course objective

Learning and understanding the parameters describing transmission lines and antennas, learning and understanding the operation of the most commonly used types of antennas, enabling the correct selection of an antenna for a specific radio communication system; learning and understanding the principles of measuring antennas and antenna paths, learning and understanding the propagation of radio waves in free space and the Earth's atmosphere for different frequency ranges.

Course-related learning outcomes

none

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. The knowledge acquired during lectures is verified during the final written and/or oral exam (the written part lasts 60-90 minutes; descriptive answers to 3-5 questions, pass mark
50% of points (grade 3.0), list of exam topics is sent to students by email/available on the e-Kursy platform)
2. knowledge and skills acquired during laboratory classes are verified on the basis of the
final test (2-3 questions, duration 45-90 minutes, pass threshold 50% of points -
sufficient grade); the list of topics is sent to students by e-mail.

Programme content

none

Course topics

Properties of electric and magnetic fields, Maxwell's solution for plane waves, skin effect, penetration depth, waves at the boundary between two media, boundary conditions, reflection and refraction, standing waves - qualitative and quantitative description (reflection coefficient, WFS, RL), transmission line parameters, structure and properties of the most popular transmission lines, impedance matching, sources of electromagnetic radiation, the role of the antenna in the radio path, basic antenna parameters, the principle of reciprocity, the simplest antennas - short dipole, half-wave dipole, loop dipole, antennas above ground
ideal and real antennas, unipoles, straight antennas, symmetrization, antenna arrays, broadband antennas, aperture, reflector and microstrip antennas, antennas in radio communication systems, antenna installation and maintenance, current trends in antenna technology, the impact of electromagnetic fields on the human body, health and safety and environmental protection regulations concerning work in an electromagnetic field, basic propagation relationships, wave propagation in free space, Fresnel zones, the case of two elevated antennas, properties of the troposphere and ionosphere, propagation of long, medium, short, ultra-short and microwave waves, design of radio communication systems, electromagnetic compatibility of radio communication systems, antenna path measurements, radiation and energy gain characteristics, propagation measurements.

Laboratory
1. Transmission line attenuation measurement
2. Characteristic impedance and transmission line shortening factor measurement
3. Radiation pattern measurements of selected antennas
4. SWR/RL measurement of an antenna-loaded antenna path
5. Wave propagation in free space
6. EMF measurements for environmental protection purposes

Teaching methods

1. Traditional (informative) lecture: multimedia presentation supplemented with examples given on the board, educational films.
2. Laboratory exercises: performing practical exercises in groups (2-4 people) based on written instructions, experimental demonstrations, educational films.

Bibliography

Main
1. Szóstka J., Fale i anteny (wyd. III), Wyd. Komunikacji i Łączności, Warszawa, 2006.
Additional
1. Szóstka J., Miernictwo radiokomunikacyjne, Wyd. PP, Poznań 2021.
2. Szóstka J., Mikrofale. Układy i systemy, Wyd. Komunikacji i Łączności, Warszawa, 2006.
3 Szóstka J., Horyzontowe linie radiowe, Wyd. Politechniki Poznańskiej, Poznań 2011.
4. W. Stutzman, G. Thiele, Antenna Theory and Design, John Wiley & Sons, 2011.
5. A. Balanis, Antenna Theory and Design, John Wiley & Sons, 2011.

Breakdown of average student's workload

	Hours	ECTS
Total workload	130	7,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	75	5,00