COURSE DESCRIPTION CARD - SYLLABUS

Course name
Waves and antennas [S1EiT1>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
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Piotr Górniak
piotr.gorniak@put.poznan.pl

Lecturers

Prerequisites

A student should have a basic knowledge of algebra, probability theory, mathematical analysis, physics, circuit theory, and electric metrology. He should also be able to perform calculations of simple DC and AC circuits, to acquire information from suggested literature sources, and should be ready for teamwork.

Course objective

Learning and understanding of mathematical description of EM fields radiated by linear sources in the near and far fields, learning and understandingnumerical and asymptotical analysis methods of transmission lines, antennas and propagation channels, learning and understanding of antenna parameters and the basic antenna types leading to optimal choice of an antenna for a given radio communication system, learning and understanding of feeder and antenna measurements as well as free space propagation and propagationn in the Earth"s atmosphere for various frequency ranges.

Course-related learning outcomes

Knowledge:
After completing the course a student has:
1. mathematically supported and systematic detailed knowledge of radio wave propagation, antenna

construction and properties
2. knowledge in the area of radio communication (wireless) metrology (measurement methods of basic parameters of feeders and antennas)
3. basic knowledge necessary to understand the non-technical aspects of engineer"s activities, he knows occupational health and safety guidelines
4. knowledge of the latest antenna development trends.

Skills:
After completing the course a student:
1. is able to extract information from literature, databases and other sources, is able to synthesize gathered information, draw conclusions, and justify opinions
2.can design simple antennas based on a given economical and technical assumptions; can design a feeder and a radio link, can use application notes and is able to compare various solutions basing on technical and economic criteria, knows basic terms related to propagation projects
3. can choose optimal measurement methods and make the measurements of basic feeder and antenna parameters obeying occupational safety rules
4. can notice the non-technical (environmental, economic, legal, etc.) aspects of design of feeders, antennas, and radio communication systems
5. is capable of studying autonomously and can be a member of a working group.

Social competences:
After completing the course a student:
1. is aware of the limitations of his/her current knowledge and professional, personal and social skills; is committed to further self-study
2. demonstrates responsibility and professionalism in solving technical problems, is aware of potential threats coming from improper use of designed systems and can assess the potential risk,
3. is aware of professional aethics and behaviour.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
4th term
- lecture material is verified during written or/and oral test (90 minuts, 4-6 problem/numerical questions, threshold 50%, the list of test problems is available as an e-mail)
- lab skills is verified by preparation of measurement reports according to the rules presented during introductory classes; the grade comprises the formal agreement of the report with the template and presented rules, preparation of the results and answers to the questions from excersise manuals.
5th term
-lecture knowledge is verified during the finalwritten and/or oral exam (90 minuts, 3-5 problems, 50% threshold, the problem list is available as an e-mail)
- lab skills is verified by preparation of measurement reports according to the rules presented during introductory classes; the grade comprises the formal agreement of the report with the template and presented rules, preparation of the results and answers to the questions from excersise manuals.

Programme content

4th term
Herzian dipole, antenna near and far field, linear antenna array analysis, FDTD method for analysis of transmission lines and antennas, geometrical optics, uniform theory of diffraction
5th term
sources of em. radiation, basic antenna parameters, reciprocity theorem, simple radiating structures, halfwave dipole, short dipole, small loop, antennas above the ground, broadband antennas, aperture antennas, microstrip antennas, antennas for various radio communication systems, antenna installation and maintenance, influence of em. radiation on human health, occupational safety, basic propagation formulae, free space propagation, Fresnel zones, Rayleigh criterion, two antennas above the perfect ground, properties of throposphere and ionosphere, propagation of long, medium, short waves and microwaves, design of radio communication problems, propagation models, electromagnetic compatibility, measurement of antenna feeders, reflectometry, measurement of antenna gain and radiation pattern, propagation measurements.

Laboratory excersises - 4th term
1. Measurement of transmission line loss
2. Measurement of characteristic impedance and velocity of propagation of a transmission line
3. Measurement of Gunn generator
4. Investigation of the halfwave dipole properties
Laboratory excersises 5th term
1. Radiation pattern measurement of selected antennas
2. Doppler effect
3. RL/VSWR measurement of a feeder loaded with an antenna
4. Computer simulation of selected antennas
5. Isolator and circulator measurements
6. Wave propagation in waveguides
7. Free space propagation

Teaching methods

4th term
1. Lecture with multimedia presentations and board examples
2. Lab exercises (2-3 people in a group) based on written manuals.
5th term
1. Lecture with multimedia presentations, board examples and movies
2. Lab exercises (2-3 people in a group) based on written manuals.

Bibliography

Basic
1. Szóstka J., Fale i anteny (wyd. III), Wyd. Komunikacji i Łączności, Warszawa, 2006.
2. Bandurski W., Górniak P., Wardzińska A., Woźniak A., Metody analizy pól i propagacji fal elektromagnetycznych w elektronice i telekomunikacji, Wydawnictwo Politechniki Poznańskiej, 2012
Additional
1. Szóstka J., Mikrofale. Układy i systemy, Wyd. Komunikacji i Łączności, Warszawa, 2006.
2. Szóstka J., Horyzontowe linie radiowe, Wyd. Politechniki Poznańskiej, Poznań 2011.

Breakdown of average student's workload

	Hours	ECTS
Total workload	175	7,00
Classes requiring direct contact with the teacher	101	5,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	74	2,00