



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

High Frequency Techniques

### Course

Field of study

Technical Physics

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

dr inż. Adam Buczek, prof. PP

Responsible for the course/lecturer:

adam.buczek@put.poznan.pl

### Prerequisites

1. Basic knowledge concerning physics, electrotechnics, electronics and mathematics.
2. Ability to work with computer and basic laboratory devices and apparatus. Capability to acquire information from given sources.
3. Understanding of necessity of own competence broadening, responsibility for created technical solutions.

### Course objective

1. Hand over knowledge concerning theoretical basics and practical solutions applied in techniques of high electromagnetic frequencies.
2. Develop students abilities to choose elements and devices useful in techniques of high frequencies.
3. Mold students responsibility for created systems.



### Course-related learning outcomes

#### Knowledge

W01. Knowledge about crucial parameters of materials and basic electronic elements (passive and active) applied in high frequency techniques [K2\_W04].

W02. Knowledge within parameters and constructions of chosen devices used for generation, transformation and transmission of high frequency signals [K2\_W12].

W03. Knowledge about working of devices and measurement apparatus in high frequencies range, based on physics and electronics principles [K2\_W06, K2\_W07].

W04. Knowledge within applications of high frequency techniques in science and modern technology [K2\_W02].

#### Skills

U01. Using (with understanding) recommended engineering knowledge sources (basic bibliography), and current literature (e.g. books, professional magazines, documentations of producers e.t.c.) [K2\_U02, K2\_U04].

U02. Planning of choosing a proper materials, elements, modules and apparatus for high frequency systems [K2\_U13, K2\_U18].

U03. Operating of chosen devices working in high frequency range [K2\_U17].

#### Social competences

K01. Aware of threats for users of high frequency systems and necessity of using of security mechanisms and methods facilitating exploitation of made constructions [K2\_K05, K2\_K06].

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Effect:	Evaluation form:	Evaluation criteria:
W01, W02, W03, W04	Oral / written exam	50.1%-70.0% (3) 70.1%-90.0% (4) from 90.1% (5)

U01, U02, U03, K01      Evaluation of work and activity on laboratory classes:

Student works strongly supported by teacher, with understanding of acquired knowledge. Is able to solve assigned tasks only in common way. Is not capable to analyze more problems than covered by basic scope of teaching. Demonstrate limited engagement during lessons. (3)

Student works independently, occasionally supported by teacher, with understanding of acquired knowledge. Is able to solve assigned tasks in proper way. Sometimes is capable to analyze more problems than covered by basic scope of teaching. Demonstrate engagement during lessons. (4)



Student works fully independently with deep understanding of acquired knowledge. Is able to solve assigned tasks in ingenious and unconventional way. Is capable to analyze more problems than covered by basic scope of teaching. Demonstrate great engagement during lessons. (5)

### Programme content

1. Sources of knowledge in scope of high frequency techniques (e.g. books, professional magazines, documentations of producers e.t.c.),
2. Properties of devices and signals in high frequency range. Decibel calculations,
3. Description of alternating signals using of complex numbers,
4. Passive elements of high frequency devices:
  - Resistor (model and real parameters in high frequency range),
  - Coil (model and real parameters in high frequency range),
  - Capacitor (model and real parameters in high frequency range),
  - Serial and parallel connections of elements (impedance, admittance, quality),
5. Energy distribution in high frequency systems:
  - RLC resonance,
  - Coupling of resonator with system
  - Impedance transformation and matching,
6. Distributed circuits:
  - Equations and parameters of transmission lines,
  - The Smith Chart,
7. Matrix analysis of high frequency circuits,
8. Electromagnetic fields and waves,
9. Chosen components for high frequency range:
  - Transmission lines and waveguides,
  - Filters, couplers, dividers, resonators, mixers,
  - Components with ferrimagnetic elements,
  - Semiconductor and tube elements,
10. Chosen devices for high frequency range:
  - Amplifiers,
  - Generators,
  - RLC meters,
  - Power meters,
  - Spectrum analyzers,
11. Applications of high frequency techniques in modern science and technology,



12. Ergonomic and safety in building and exploitation of high frequency devices.

### Teaching methods

Lecture: multimedial presentation.

Laboratory classes: practical exercises, experiments, measurements, discussion, teamwork.

### Bibliography

Basic

1. Joseph F. White, High Frequency Techniques : An Introduction to RF and Microwave Engineering, Wiley, Hoboken New Jersey 2004,
2. J.Szóstka, Mikrofałe – układy i systemy, WKŁ, Warszawa 2006,
3. J.Szóstka, Fałe i anteny, WKŁ Warszawa 2006

Additional

1. D.M.Pozar, Microwave Engineering, Wiley, Hoboken New Jersey 2012,
2. Czasopismo "Świat Radio", ISSN 1425-1701,
3. Czasopismo „Elektronik”, ISSN 1248-4000,
4. Czasopismo „Elektronika dla Wszystkich”, ISSN 1425-1608,
5. Czasopismo "Elektronika Praktyczna", ISSN 1230-3526.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	100	3,0
Classes requiring direct contact with the teacher	64	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) <sup>1</sup>	36	1,0

<sup>1</sup> delete or add other activities as appropriate