# COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Electrical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Electrical and Electronics Engineering</td><td colspan="2">Degree level and programme type</td><td>bachelor's degree, full time programme</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td colspan="2">Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">High Frequency Techniques 1</td><td colspan="2">Course code</td><td>IS-FEE-10033S</td></tr>
<tr><td colspan="2">Course type</td><td>elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>summer</td></tr>
<tr><td>30</td><td>15</td><td></td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>5</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Mathematics, Physics, Circuits and Signals, Electromagnetic Field Theory</td></tr>
<tr><td>Course objectives</td><td colspan="9">The aim of the course is to acquaint the students with basic topics of high frequency techniques: components, instruments, measurements, applications. Training skills of calculation of voltages and currents in transmission lines and solving simple problems of impedance matching.</td></tr>
<tr><td>Course content</td><td colspan="9">Examples of applications of high frequency devices and systems. Electromagnetic waves in transmission lines (coaxial lines, striplines, microstrips) and in waveguides. Wave types (TEM, TE and TM) and wave modes. Definitions of current, voltage, characteristic impedance. Impedance matching (narrowband and broadband). The Smith chart. Multiport circuits. The scattering matrix. Passive microwave elements: reactance irises, matched loads, stub tuners, attenuators, phase shifters, power dividers, hybrid junctions, directional couplers. Resonators. Ferrite devices. Semiconductor devices. MEMS. Basics of high frequency measurements. Network analyzers.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, class.</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture: discussion on homework reports; class: two tests.</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="8">Learning outcomes</td><td>Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="8">has detailed knowledge on the principles of operation of electronic high frequency components;</td><td></td></tr>
<tr><td>LO2</td><td colspan="8">has elementary knowledge on materials used in the high frequency technology;</td><td></td></tr>
<tr><td>LO3</td><td colspan="8">has ordered, theoretical knowledge on guiding of high frequency waves;</td><td></td></tr>
<tr><td>LO4</td><td colspan="8">knows and understands basic methods of measurements of parameters of high frequency devices;</td><td></td></tr>
<tr><td>LO5</td><td colspan="8">can get information from the literature and other sources,</td><td></td></tr>
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| | **also in a foreign language;** | |
| **LO6** | **can use the known mathematical description for solving basic problems concerning transmission lines;** | |
| **LO7** | **can apply the Smith chart for analysis of simple impedance matching problems.** | |
| **Symbol of learning outcome** | **Methods of assessing the learning outcomes** | **Type of tuition during which the outcome is assessed** |
| **LO1** | evaluating the student's homework, and discussion on it | **L** |
| **LO2** | evaluating the student's homework, and discussion on it | **L** |
| **LO3** | evaluating the student's homework, and discussion on it | **L** |
| **LO4** | evaluating the student's homework, and discussion on it | **L** |
| **LO5** | evaluating the student's homework, and discussion on it | **L, C** |
| **LO6** | tests on classes content | **C** |
| **LO7** | tests on classes content | **C** |
| **Student workload (in hours)** | | **No. of hours** |
| **Calculation** | Lecture attendance | **28** |
| | discussion on homework reports | **2** |
| | participation in classes | **13** |
| | tests related to the classes | **2** |
| | preparation for classes | **5** |
| | homework reports | **30** |
| | participation in student-teacher sessions related to the class | **15** |
| | preparation for exams/tests | **40** |
| | **TOTAL:** | **135** |

| **Quantitative indicators** | **HOURS** | **No. of ECTS credits** |
|---|---|---|
| **Student workload – activities that require direct teacher participation** | **60** | **2** |
| **Student workload – practical activities** | **75** | **3** |

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|---|---|
| **Basic references** | **1. Collin R. E.: Foundations for microwave engineering. IEEE Press, 2001.**<br>**2. White J. F.: High frequency techniques - an introduction to RF and microwave engineering. Wiley, 2004.**<br>**3. Elliott R. S.: An introduction to guided waves and microwave circuits. Prentice-Hall, 1998.** |
| **Supplementary references** | **1. Hickman I.: Practical radio frequency handbook. Newnes, 2002.**<br>**2. Bowick C.: RF circuit design. Newnes, 1982.**<br>**3. IEEE Microwave Magazine. 4. Aniserowicz K.: lecture notes** |

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| **Organisational unit conducting the course** | **Department of Photonics, Electronics and Lighting Technology** | **Date of issuing the programme** |
| **Author of the programme** | **Prof. Karol Aniserowicz** | **12.02.2020** |

**L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar**