# 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 Electronic Engineering</td><td>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>Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Protection against interference</td><td>Course code</td><td>IS-FEE-10016W</td></tr>
<tr><td>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>winter</td></tr>
<tr><td>30</td><td></td><td>30</td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">Knowledge on basic phenomena related to generation, propagation, basic methods of measurement and study of disturbing electromagnetic signals, their influence on electronic and electrical equipment and systems. Knowledge on on functioning of elements and devices or methods of protection of electronic and electric equipment and systems against various types of disturbing electromagnetic signals. Skills of selection and application of basic protection measures against main types of disturbances. Skills of planning and performing measurements of disturbing signals, their propagation and coupling effects and basic characteristics and parameters of protective elements and devices. Skills of using measurement equipment. Skills of elaboration, illustration, analysis and interpretation of measurement results.</td></tr>
<tr><td>Course content</td><td colspan="9">Lectur:e Basic terms and definitions. Sources of disturbing electromagnetic signals and their characteristics. Characteristics of disturbing signals in electrical installations and signal transmission lines. Ways of disturbing effects of various electromagnetic signals, electromagnetic couplings, travelling waves. Elements and devices for protection against interference in electrical installations and signal transmission lines. Equipotentialization, cable routing, screening techniques. Zone concept of complex protection against interference.<br>Laboratory class: Introduction. Electrostatic discharge (ESD) - method of ESD testing and measurements of characteristics of ESD impulse currents. Investigation of travelling wave phenomena in electrically long lines and wires. Measurements of electromagnetic coupling effects between various cables. Estimation of threat connected with voltages and currents induced due to impulse electromagnetic field in various cables and antennas. Measurements and testing of protective electrical characteristics and parameters of basic types of protective elements and devices, e.g. power mains filters,gas discharge tubes,varistors and other elements and devices used for surge protection in electrical installation and signal transmission lines.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture and laboratory class</td></tr>
</table>

| Assessment method | lecture: written or oral exam; laboratory class: evaluation of reports, verification of preparation for classes. | |
|---|---|---|
| Symbol of learning outcome | Learning outcomes | Reference to the learning outcomes for the field of study |
| LO1 | characterizes main sources of disturbances and rates levels of threat which they provide; plans and performs studies and measuremets of basic characteristics and effects of various types of disturbances; | |
| LO2 | has detailed knowledge on rules of functioning, basic characteristics and parameters of typical elements and devices used for protection against different type disturbances; plans measurements of basic electrical characteristics and parameters of protective devices; | |
| LO3 | can use catalogue cards for selection of proper devices or systems to provide appropriate protection against interference; | |
| LO4 | plans and prepares protocols that document the measurements and studies; | |
| LO5 | elaborates, analyses and illustrates of the results of performed studies and measurements; | |
| LO6 | interprets, compares and rates the performed measurement results; | |
| LO7 | applies rules of safety and hygiene of work. | |
| LO8 | | |
| Symbol of learning outcome | Methods of assessing the learning outcomes | Type of tuition during which the outcome is assessed |
| LO1 | exam on lecture content,evaluation of student's reports and performance at classes | L, LC |
| LO2 | exam on lecture content,evaluation of student's reports and performance at classes | L, LC |
| LO3 | exam on lecture content, presentation of selected topic or problem | L |
| LO4 | evaluation of student's reports and performance at classes | L, LC |
| LO5 | evaluation of student's reports and performance at classes | LC |
| LO6 | evaluation of student's reports | LC |
| LO7 | evaluation of student's reports and performance at classes | LC |
| LO8 | | |
| Student workload (in hours) | | No. of hours |
| *Calculation* | lecture attendance | 30 |
| | participation in laboraatory classes | 30 |
| | participation for laboraatory classes | 20 |
| | work in reports from laboratory classes | 24 |
| | participation in student-teacher sessions related to the lecture | 5 |

| | | | |
|---|---|---|---|
| | participation in student-teacher sessions related to laboratory classes | 5 | |
| | preparation and performance of presentation on selected topic | 14 | |
| | preparation for and participation in exam | 24 | |
| | TOTAL: | 152 | |
| Quantitative indicators | | HOURS | No. of ECTS credits |
| Student workload – activities that require direct teacher participation | | 74 | 2,5 |
| Student workload – practical activities | | 79 | 3 |
| Basic references | 1. Ott H. W.: Electromagnetic compatibility engineering. Wiley, 2009.<br>2. Williams T.: EMC for systems and installations. Newnes, 2000.<br>3. Hasse P.: Overvoltage protection of low voltage systems. IEEE Press, 2004.<br>4. Latturo F.: Electromagnetic compatibility in power systems. Elsevier, 2007.<br>5. Joffe E. B., Lock K. S.: Grounds for grounding. A circuit-to-system handbook. IEEE Press, 2010. | | |
| Supplementary references | 1. Wiliams T., Amstrong K.: Installations cabling and earthing technique for EMC. 2002. 2. Sengupta D. L.: Applied electromagnetics and electromagnetic compatibility. Wiley, 2006. 3. Hasse P., Wiesinger J.: Blitzschutz der elektronik. Risikoanalyse, planen und ausfuhren nach neuen normen der reihe DIN VDE 0185. VDE Verlag, 1999. 4. Raab V.: Überspannungsschutz in verbrauscheranlagen. Auswahl, errichtung, prüsfung. Verlag Technik 1998. 5. Kaiser K.L.: Electromagnetic compatibility handbook. CRS Press 2005. | | |
| Organisational unit conducting the course | Department of Photonics, Electronics and Light Technique | Date of issuing the programme | |
| Author of the programme | Renata Markowska, PhD. DSc. Eng | 07.02.2020 | |

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