

DESCRIPTION OF THE COURSES

- Course code: **ELR3312**
- Course title: **Electromagnetic Compatibility**
- Language of the lecturer: english

<i>Course form</i>	<i>Lecture</i>	<i>Classes</i>	<i>Laboratory</i>	<i>Project</i>	<i>Seminar</i>
<i>Number of hours/week*</i>	<i>2</i>	<i>0</i>	<i>1</i>	<i>0</i>	<i>1</i>
<i>Number of hours/semester*</i>	<i>30</i>	<i>0</i>	<i>15</i>	<i>0</i>	<i>15</i>
<i>Form of the course completion</i>	<i>pass</i>		<i>reports</i>		<i>seminar</i>
ECTS credits	<i>2</i>		<i>1</i>		<i>1</i>
Total Student's Workload	<i>45</i>		<i>25</i>		<i>20</i>

- Level of the course (basic/advanced):
- Prerequisites: Passed course: Mathematics, Circuit Theory, High voltage engineering
- Name, first name and degree of the lecturer/supervisor: Jerzy Leszczyński, Ph.D.
- Names, first names and degrees of the team's members: Przemysław Janik, Ph. D.
Grzegorz Kosobudzki, Ph. D.
- Year:..... Semester:.....
- Type of the course (obligatory/optional):
- Aims of the course (effects of the course): The main aim of course is acquainted with practical aspects of EMC in power delivery system (power quality)
- Form of the teaching (traditional/e-learning):
- Course description: The course contains the basic problems and practical aspects of electromagnetic compatibility EMC. Following problems are presented: electromagnetic disturbances caused by lightning strikes and electrostatic discharges; EMC phenomena generated by converter fed drives; methods of electrical and electronic equipment protection from overvoltages and overcurrents; aspects of electromagnetic shielding; power quality parameters, requirements, standards; influence of power quality phenomena on equipment; non-linear devices influence on power quality; disturbances mitigation techniques; harmonics reduction; measurements
- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
1. Introduction to electromagnetic compatibility (EMC). Basic problems and requirements of EMC.	2h
2. Two ways of electromagnetic interferences propagation – radiation and conduction	2h
3. Sources and parameters of external electromagnetic interferences. Lightning discharges as source of electromagnetic stress, System and its elements for lightning stress protection, principles of surge arrester installation in buildings	2h
4. Electrostatic discharges: characteristics, parameters, remedial measures	2h
5. Electromagnetic compatibility aspects of drive systems	2h
6. Power electronic converters as sources of electromagnetic interferences	2h
7. Electrical equipment and system protection against overvoltages, nonlinear protection elements: gas spark gaps, varistors, diodes, thyristors	2h
8. Techniques and construction rules for hybrid protection systems, signal systems and save feeding.	2h
9. Filtering and compensation methods	2h
10. Electromagnetic shielding, effectiveness of shielding from electric and magnetic interference sources in near and far field, low frequency magnetic field shielding, materials for shielding systems, shielding effectiveness	2h

11. Voltage quality indices and parameters, disturbances influence on power supply system	2h
12. power quality (PQ) parameters definition and measurement with respect to standards	2h
13. Disturbances influence on power supply network and equipment, definitions of electrical power in case of disturbed voltage and current signals, computational example	2h
14. PQ disturbances mitigation techniques, examples, voltage fluctuation and flicker	2h
15. Practical aspects of PQ indices and parameters measurements, measurements results from Wroclaw area with according interpretation, power losses due to PQ disturbances	2h

- Classes – the contents:
- Seminars – the contents:
 1. Filters for power quality disturbances mitigation
 2. Spectral analysis of distorted waveforms
 3. Static characteristics of elements and systems for overvoltage protection
 4. Dynamic characteristics of elements and systems for overvoltage protection
 5. Effectiveness of electromagnetic shielding
 6. High voltage phenomena – examples
- Laboratory – the contents:
 1. Studies on voltage quality – designating voltage deviations, asymmetry, dips, breaks, signal voltages, harmonic and interharmonic – system MEMOBOX 686
 2. Analysis of current and voltage courses – designating harmonic and interharmonic values – system MEMOBOX 604.
 3. Studies of the influence of non-linear receivers on the distortion of courses.
 4. Register and analysis of electroenergetic courses (indirect method)
 5. Studies of the resistance of electric energy receivers on dips and short breaks of supply voltages.
 6. Power analysis in distorted circuits. – Topas system 1000.
- Project – the contents:
- Basic literature:
 - [1] Hasse P.: *Overvoltage protection of low voltage systems*, TJ International, Padstown, 2000
 - [2] Pradas Kodali V.: *Engineering Electromagnetic Compatibility Principles, Measurements and Technology*, IEEE Press, New York, 1996
 - [3] Dugan R. C., McGranaghan M. F., Beaty H. W.: *Electrical Power Systems Quality*, McGraw-Hill, New York, USA, 1986.
- Additional literature:
 - [1] Standler R. B.: *Protection of electronic circuits from overvoltages* John Wiley & Sons, New York, 1989
 - [2] Clayton R. P.: *Introduction to electromagnetic compatibility* John Wiley & Sons, New York, 1992
 - [3] Arrillaga J. Watson N. R.: *Power System Quality Assessment*, John Wiley & Sons, New York, 2000
- Conditions of the course acceptance/creditation:

* - depending on a system of studies