

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Obliczenia zwarcziowe**
 Name in English: **Fault Calculations**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Control in Electrical Power Engineering**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ELR032139**
 Group of courses: **NO**

| | Lecture | Classes | Laboratory | Project | Seminar |
|--|---------|---------|------------|----------------------|---------|
| Number of hours of organized classes in University (ZZU): | | | | 30 | |
| Number of hours of total student workload (CNPS): | | | | 60 | |
| Form of crediting: | | | | crediting with grade | |
| For group of courses mark (X) final course: | | | | | |
| Number of ECTS points: | | | | 2 | |
| including number of ECTS points for practical (P) classes : | | | | 2 | |
| including number of ECTS points for direct teacher-student contact (BK) classes: | | | | 1.40 | |

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has basic knowledge on power system operation.
2. Has basic knowledge on programming in Matlab.
3. Is able to state and verify simple calculation algorithms.
4. Is able to think and act in a creative way.
5. Is able to work in a team.

SUBJECT OBJECTIVES

- C1. Gaining knowledge on power system faults.
 C2. Familiarization with methods for analysis of fault signals and fault identification.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:**relating to skills:*

- PEK_U01 Is able to analyse fault signals obtained from computer simulation.
 PEK_U02 Is able to conduct fault identification and to determine its characteristic features.

relating to social competences:

- PEK_K01 Is able to act independently and cooperate within a group working on a complex engineering project.

| PROGRAMME CONTENT | | |
|---------------------------|---|------------------|
| Form of classes - project | | Number of hours: |
| Proj 1 | Presentation of health and safety rules and general regulations of the laboratory. Establishing conditions for passing and marking the project course. Introduction - aim and contents of the projects to be performed. | 2 |
| Proj 2 | Familiarization with loading the simulation data from ATP-EMTP simulation into the Matlab programme and visualisation of the signals. | 2 |
| Proj 3 | Digital filtering of fault signals from ATP-EMTP simulation. | 2 |
| Proj 4 | Digital algorithms for fault detection. | 2 |
| Proj 5 | Digital algorithm for fault direction discrimination. | 2 |
| Proj 6 | Digital algorithm for fault classification - part 1. | 2 |
| Proj 7 | Digital algorithm for fault classification - part 2. | 2 |
| Proj 8 | Distance protection - digital measurement of fault-loop impedance and reflection of MHO decision characteristic - part 1. | 2 |
| Proj 9 | Distance protection - digital measurement of fault-loop impedance and reflection of MHO decision characteristic - part 2. | 2 |
| Proj 10 | One-end fault location - the sample solution applied in modern protection terminal for power line - part 1. | 2 |
| Proj 11 | One-end fault location - the sample solution applied in modern protection terminal for power line - part 2. | 2 |
| Proj 12 | Fault location on power line with use of measurements of voltage and current from both line ends - part 1. | 2 |
| Proj 13 | Fault location on power line with use of measurements of voltage and current from both line ends - part 2. | 2 |
| Proj 14 | Calculation of fault currents in a given faulted network. | 2 |
| Proj 15 | Summary and description of the performer projects. | 2 |
| Total hours: | | 30 |

| TEACHING TOOLS USED |
|---|
| N1. Matlab software. N2. Report on performed project. N3. Student's own work. |

| EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT | | |
|---|-------------------------------|--|
| Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i> | Educational effect number | Way of evaluating educational effect achievement |
| F1(P) | PEK_U01 PEK_U02 PEK_K01 | Activity at the project classes |
| F1(P) | PEK_U01 PEK_U02 PEK_K01 | Marks from reports on the completed projects |
| P(P) | $P=0,3F1+0,7F2$ | |

| PRIMARY AND SECONDARY LITERATURE |
|--|
| PRIMARY LITERATURE: [1] Iżykowski J., Power system faults. PRINTPAP, 2011, p. 190. |
| SECONDARY LITERATURE: [1] Glover J. D., Sarma M., Power system analysis and design. PWS Publishing Company Boston, second edition, 1994. [2] Michalik M., Rosołowski E., Simulation and analysis of power system transients. PRINTPAP, 2011. [3] Saha M.M., Iżykowski J., Rosołowski E., Fault location on power networks. Springer-Verlag London, Series: Power Systems, 2010, 425 p. |

| SUBJECT SUPERVISOR |
|---|
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR032139 - Fault Calculations
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Control in Electrical Power Engineering**

| Subject educational effect | Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable) | Subject objectives | Programme content | Teaching tool number |
|----------------------------|---|--------------------|---|----------------------|
| PEK_U01 | K2ETK_U02 S2CPE_U15 | C.1 C.2 | Proj1 Proj2 Proj3 Proj4 Proj5 Proj6 Proj7 Proj15 | N.1 N.2 N.3 |
| PEK_U02 | K2ETK_U02 S2CPE_U15 | C.1 C.2 | Proj1 Proj2 Proj3 Proj8 Proj9 Proj10 Proj11 Proj12 Proj13 Proj14 Proj15 | N.1 N.2 N.3 |
| PEK_K01 | K2ETK_K02 | C.1 C.2 | Proj1 Proj2 Proj3 Proj4 Proj5 Proj6 Proj7 Proj8 Proj9 Proj10 Proj11 Proj12 Proj13 Proj14 Proj15 | N.1 N.2 N.3 |