(*faculty stamp*)

| Z1-PU7 | WYDANIE N1 | Strona 1 z 3 |
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**COURSE DESCRIPTION**

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| **1. Course title: TRANSFER OF ELECTRICAL ENERGY** | **2. Course code** |
| **3. Validity of course description: 2012/2013** | |
| **4. Level of studies: 1st CYCLE OF HIGHER EDUCATION** | |
| **5. Mode of studies: INTRAMURAL STUDIES** | |
| **6. Field of study: POWER ENGINEERING** | (FACULTY SYMBOL) |
| **7. Profile of studies: GENERAL ACADEMIC** | |
| **8. Programme: SUSTAINABLE ENERGY ENGINEERING** | |
| **9. Semester: 4** | |
| **10. Faculty teaching the course: ELECTRICAL FACULTY** | |
| **11. Course instructor: PROF. PAWEŁ SOWA** | |
| **12. Course classification: COMMON OBJECTS** | |
| **13. Course status: COMPULSORY** | |
| **14. Language of instruction: ENGLISH** | |
| **15. Pre-requisite qualifications: STUDENT BEGINS CLASSES SHOULD UNDERSTAND THE BASIC PHYSICAL PHENOMENA IN ELECTRICAL ENGINEERING, BE ABLE TO SET CURRENTS, VOLTAGES AND POWERS IN SIMPLE ELECTRIC CIRCUITS, KNOW THE BASIC PRINCIPLES OF OPERATION OF THE POWER SYSTEM. STUDENT SHOULD KNOW THE RULES FOR SAFE HANDLING OF ELECTRICAL CIRCUITS AND UNDERSTAND THE NEED TO PROVIDE ELECTRICITY TO CUSTOMERS.** | |
| **16. Course objectives: THE AIM OF THE COURSE IS TO ACQUIRE ADEQUATE COMPETENCE IN THE OPERATION OF THE POWER SYSTEM, THE COMPONENTS OF THE SYSTEM, VOLTAGE REGULATION AND REACTIVE POWER, FREQUENCY CONTROL AND ACTIVE POWER (PRIMARY, SECONDARY, AND TERTIARY CONTROL OF FREQUENCY), SYSTEMS OF: AUTOMATIC FREQUENCY CONTROL AND ACTIVE POWER, REACTIVE POWER GENERATION AND ITS PROPAGATION AND VOLTAGE REGULATION IN THE NODES OF THE SYSTEM. STUDENT RECOGNIZE THE CHARACTERISTICS OF A FLEXIBLE SYSTEM OF ELECTRICITY TRANSMISSION, CONTROL ALGORITHMS, AND SUPPORT FOR SYSTEM DISPATCHER ON THE LEVELS AND AREAS OF DISTRIBUTION NETWORKS IN A VARIETY OF OPERATING CONDITIONS, THE STRATEGY OF DEFENSE AND RESTORATION OF THE POWER SYSTEM, THE SOFTWARE FEATURES FOR THE ENERGY MANAGEMENT SYSTEMS FOR POLISH POWER SYSTEM CONTROL.** | |

**17. Description of learning outcomes:**

| Nr | Learning outcomes description | Method of assessment | Teaching methods | Learning outcomes reference code |
|---|---|---|---|---|
| 1. | **STUDENT UNDERSTANDS THE PRINCIPLE OF OPERATION OF THE POWER SYSTEM AND KNOWS THE BASIC COMPONENTS OF THE SYSTEM** | **WRITTEN EXAMINATION (THEORETICAL PART - QUESTIONS OF CONCERN)** | **LECTURE** | **K_W12++ K_W14+** |
| 2. | **STUDENT UNDERSTANDS THE GENERAL ISSUES RELATED TO THE REGULATION OF VOLTAGE AND REACTIVE POWER, FREQUENCY AND ACTIVE POWER** | **WRITTEN EXAMINATION (THEORETICAL PART - QUESTIONS OF CONCERN)** | **LECTURE** | **K_W08+ K_W12++** |
| 3. | **STUDENT KNOWS THE CONTROL ALGORITHMS AND SUPPORTING SYSTEM ON LEVEL DISPATCHERS, THE LEVELS AND AREAS OF DISTRIBUTION NETWORKS IN DIFFERENT STATES OF OPERATION** | **WRITTEN EXAMINATION (THEORETICAL PART - QUESTIONS OF CONCERN)** | **LECTURE** | **K_W04+ K_W12++ K_W15+** |
| 4. | **STUDENT UNDERSTANDS THE CHARACTERISTICS OF A FLEXIBLE SYSTEM OF ELECTRICITY TRANSMISSION** | **PARTLY TO TEST, THROUGH THE FUTURE OF ENGINEERING** | **LECTURE** | **K_W08+ K_W12++** |
| 5. | **STUDENT KNOWS THE BASICS OF ISSUES RELATED TO THE STRATEGY OF DEFENSE AND RESTORATION OF THE POWER SYSTEM** | **WRITTEN EXAMINATION (THEORETICAL PART - QUESTIONS OF CONCERN)** | **LECTURE** | **K_W12++ K_W08+** |

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| 6. | **STUDENT KNOWS AND UNDERSTANDS THE CONSTRUCTION OF THE FUNCTIONS PERFORMED BY THE SELECTED POWER SYSTEM COMPONENTS, SOFTWARE FEATURES EMS FOR THE POLISH POWER SYSTEM CONTROL.** | **WRITTEN EXAMINATION (THEORETICAL PART - QUESTIONS OF CONCERN)** | **LECTURE + CLASS** | **K_W04+ K_W08++** |
| 7. | **STUDENTS CAN PREPARE AND PRESENT A SHORT PRESENTATION ON THE RESULTS OF AN ENGINEERING TASK** | **QUESTIONS VIEWING AND THE DEVELOPMENT OF THE PRESENTATION** | **CLASS** | **K_U04++ K_U16+** |

**18. Teaching modes and hours**

**Lecture 30**

**Class 15**

**19. Syllabus description:**

**THE STRUCTURE AND ORGANIZATION OF THE POWER SYSTEM. POLISH INTERCONNECTIONS (UCTE). ENERGY TRANSIT ISSUES. TRANSMISSION AND DISTRIBUTION OF ELECTRICITY. POWER LOSSES AND VOLTAGE DROPS IN THE NETWORK. POWER GENERATION TECHNOLOGY IN A VARIETY OF TYPES OF PLANTS. THERMAL POWER PLANTS. NUCLEAR POWER - THE DESIRABILITY AND PROSPECTS IN POLAND. RENEWABLE SOURCES OF ENERGY. QUALITY OF ELECTRICITY. CONTINUITY OF SUPPLY INDICATORS USED IN EUROPEAN COUNTRIES. FREQUENCY AND ACTIVE POWER. VOLTAGE REGULATION AND REACTIVE POWER. STABILITY OF THE POWER SYSTEM AND ITS COMPONENTS. IMPROVING THE POWER FACTOR. NATIONAL ELECTRICITY BALANCE. CALCULATION OF LOSSES IN TRANSMISSION AND DISTRIBUTION NETWORKS. ENERGY-SAVING METHODS. THE CHARACTERISTICS OF A FLEXIBLE SYSTEM OF ELECTRICITY TRANSMISSION (FACTS). APPLICATION OF FACTS TECHNOLOGY TO CONTROL THE IMPEDANCE OF THE TRANSMISSION LINE. REGULATORS AND UNIFIED POWER FLOW CONTROLLERS. ANALYSIS OF THE POSSIBILITIES AND DESIRABILITY OF FACTS SYSTEMS INSTALLED IN THE POLISH POWER SYSTEM. REVIEW OF BASIC METHODS & ANALYTICAL TOOLS FOR POWER SYSTEM VARIATION INVESTIGATIONS. POWER SYSTEM FAILURE CLASSIFICATION. SEARCH OF OPTIMUM EQUIVALENT REPRESENTATION FOR TRANSIENTS INVESTIGATIONS. FREQUENCY DOMAIN METHODS. THE TIME DOMAIN SOLUTION FOR TRANSIENT CALCULATIONS. ARTIFICIAL NEURAL NETWORK-BASED DYNAMIC EQUIVALENTS. POWER SYSTEM ELEMENTS REPRESENTATION. POWER SYSTEM TRANSIENTS. OVERCURRENT. OVERVOLTAGES. FUNDAMENTAL NOTIONS ABOUT ELECTRICAL TRANSIENTS. CAPACITOR SWITCHING TRANSIENT EVALUATIONS. TRANSFORMER MAGNETIZING INRUSH CURRENT. FERRORESONANCE. CHAOTIC BEHAVIOR IN FERRORESONANCE.**

**20. Examination: YES**

**21. Primary sources:**


1. **NASSER TLEIS: POWER SYSTEMS MODELLING AND FAULT ANALYSIS, PUBLISHED: NOV-2007, ISBN 10: 0-7506-8074-1**
2. **GREENWOOD A.: ELECTRICAL TRANSIENTS IN POWER SYSTEMS, 2ND ED. WILEY, NEW YORK 1991**
3. **MACHOWSKI J., BIALEK J.W., BUMBY J.R.: POWER SYSTEM DYNAMICS. STABILITY AND CONTROL. JOHN WILEY & SONS, CHICHESTER, NEW YORK, 2008, 2009**
4. **GLOVER D.J., SARMA M.S., OVERBAYE T.J.: POWER SYSTEM ANALYSIS AND DESIGN (SI EDITION). CENGAGE LEARNING, STAMFORD 2010.**


**22. Secondary sources:**


1. **DOMMEL H.W.: ELECTROMAGNETIC TRANSIENTS PROGRAM MANUAL (EMTP THEORY BOOK), SECOND EDITION, VANCOUVER BC, 1996**
2. **RUHLE O.: DYNAMIC NETWORK REDUCTION, PSS®NETOMAC EXAMPLES, ERLANGEN, 2009.**
3. **SOWA P.: DYNAMICZNE UKŁADY ZASTĘPCZE W ANALIZIE ELEKTROMAGNETYCZNYCH STANÓW PRZEJŚCIOWYCH, WYDAWNICTWO POLITECHNIKI ŚLĄSKIEJ, GLIWICE 2011**


**23. Total workload required to achieve learning outcomes**

| Lp. | Teaching mode : | Contact hours / Student workload hours |
|---|---|---|
| 1 | Lecture | **30 H / 30H - INCLUDING A LITERATURE REVIEW AND SUPPLEMENT THE MATERIAL PRESENTED IN CLASS (15H), PREPARATION FOR LECTURES AND TESTS (15H)** |
| 2 | Classes | **15H / 15H - INCLUDING PREPARATION FOR EXERCISE (7 H) AND ANALYSIS OF TASKS PERFORMED IN ACCOUNTING AND PREPARATION CLASSES AND CREDIT COLLOQUIUM (8H)** |
| 3 | Laboratory | / |
| 4 | Project | / |
| 5 | BA/ MA Seminar | / |
| 6 | Other | / |
| | Total number of hours | **45/ 45** |

**24. Total hours: 90**

**25. Number of ECTS credits:** 3

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| **26. Number of ECTS credits allocated for contact hours: 1** |
| **27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 0** |
| **26. Comments:** |

Approved:

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*(date, Instructor's signature)* (*date , the Director of the Faculty Unit signature)*