STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
High Voltage Engineering		**1010311451010315641**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**(brak)**	**3 / 5**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours					No. of credits
Lecture: **30**	Classes: **-**	Laboratory: **30**	Project/seminars: **-**		**5**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)

Responsible for subject / lecturer:

dr hab. inż. Zbigniew Nadolny, prof. nadzw.
email: zbigniew.nadolny@put.poznan.pl
tel. 61-665-2298
Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	He/she has knowledge in frame of electric engineering material science, and knows fundamental principles of theory of electrical circuits.
2	**Skills**	He/she can build simple electrical system.
3	**Social competencies**	He/she can work and cooperate in group.

Assumptions and objectives of the course:

To know simple tasks connected to high voltage engineering. To know sources of test Voltage. To know methods of measurements of typical properties for high voltage engineering. To know fundamental definitions regarding to Overvoltage protection.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. He/she has knowledge in frame of physics, necessary to understand fundamental phenomena occurring in high voltage insulating systems used in electric power. - [K_W02++]
2. He/she has fundamental knowledge in frame of materials passing constructive and loading needs of high voltage insulation systems used in electric power. - [K_W05++]
3. He/she has knowledge in frame of fundamentals of high voltage insulating systems used in electric power. - [K_W11+]
4. He/she knows and understands methods of measurements of fundamelntal properties describing high voltage insulation systems. - [K_W19++]
5. He/she has elementary knowledge about life cycle of high voltage insulating systems used in electric power devices. - [K_W24+]

Skills:

1. He/she can collect information from literature, data base, and other sources; can integrate collected information, can explain, and can make conclusions and opinions about high voltage engineering. - [K_U01++]
2. He/she can use proper methods and devices to measurements of high voltage properties. - [K_U10+++]
3. He/she can plan, simulate and measurements properties describing high voltage engineering. - [K_U11++]

Social competencies:

1. He/she understands role of their own work, work in team, and responsibility of team tasks in frame of high voltage engineering. - [K_K04++]

Assessment methods of study outcomes

Lectures

? Assessment of knowledge and skills proved on tests,

Laboratories:

? Tests and preemie of knowledge which is necessary to realize fundamental tasks in some fields of laboratory,

? Continuous assessment on each laboratory ? preemie of knowledge increase,

? Assessment of knowledge and skills connected to realization of laboratory tasks, assessment of report.

Course description

Sources of DC test voltage, AC (high voltage transformer) and pulse (Marx generator). Method of measurements of electrical properties, describing high voltage engineering, such as electrical strength (plate spark gap, spherical spark gap, cylindrical spark gap, sharp spark gar), resistance (Schering bridge), surfacial resistance, capacity (Schering bridge), partial discharge, dielectric losses factor (Schering bridge). Overvoltage protection (overvoltage factor, source of overvoltage, spares, attenuation of overvoltage waveform, overvoltage installations, touch voltage).

In frame of laboratory, following subjects are realized: measurements of electrical strength of plate spark gap, spherical spark gap, cylindrical spark gap, sharp spark gap; relationship between electrical strength of air and pressure; influence of space charge on electrical strength of air; surfacial breakdown; distribution on voltage on insulator; methods of measurements of high voltage; development of conductive bridge in oil; analysis of transformer oil.

Basic bibliography:

1. 1. Flisowski Z., High Voltage Engineering, WNT, Warszawa, 1988.

2. 2. Kosztaluk R. i inni, Techniques of high voltage investigations, tom I i II, WNT, Warszawa, 1985.

3. 3. Florkowska B., Electrical strength of gas high voltage insulation systems, Uczelniane Wydawnictwo Naukowo ? Dydaktyczne AGH, Kraków, 2003.

4. 4. Florkowska B., High Voltage Techniques, Wydawnictwo AGH, Kraków, 1988.

5. 5. Gacek Z., High Voltage Techniques, Wydawnictwo Politechniki Śląskiej, Gliwice, 1999.

6. 6. Laboratories in frame of material science and techniques of high voltage, pod redakcją H. Mościckiej ? Grzesiak, skrypt, Wydawnictwo Politechniki Poznańskiej, Poznań, 2002.

Additional bibliography:

1. 1. Florkowska B. i inni, Mechanizms, measurements and Analysis of partia discharges in Diagnostic of high voltage insulation systems, Uczelniane Wydawnictwo Naukowo ? Dydaktyczne AGH, Kraków, 2001.

2. 2. Gacek Z., Construction of high voltage insulating systems used in electric power, Wydawnictwo Politechniki Śląskiej, Gliwice, 2002.

3. 3. Gacek Z., High Voltage Techniques, Wydawnictwo Politechniki Śląskiej, Gliwice, 2006.

4. 4. Szpor S., Electrical strength and insulation techniques, PWN, Warszawa, 1959.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in laboratory	30
3. Participation in exam	1
4. Preparation to exam	20
5. Consultation	10
6. Preparation to laboratory	20
7. Preparation of reports to laboratory	15

Student's workload

Source of workload	hours	ECTS
Total workload	126	5
Contact hours	71	3
Practical activities	65	3