COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	9.003	**SEMESTER**	9th
COURSE TITLE	High Voltage Engineering II		
COURSEWORK BREAKDOWN		**TEACHING WEEKLY HOURS**	**ECTS Credits**
	Theory (Lectures)	2	2
	Tutorial/Exercises	1	1
	Laboratory	1	1
	TOTAL	**4**	**4**
COURSE UNIT TYPE	Specialized knowledge/Skills development		
PREREQUISITES			
LANGUAGE OF INSTRUCTION/EXAMS	Greek		
COURSE DELIVERED TO ERASMUS STUDENTS	No		
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE181/		

(2) LEARNING OUTCOMES

Learning Outcomes

Upon successful completion of the course, the student will be:

- familiar with the structure and operation of high voltage networks and systems,
- Able to identify typical equipment elements utilized in high voltage networks and installations,
- able to assess the applied dielectric stress and evaluate critical performance parameters,
- familiar with typical switching technologies
- able to interpret switching phenomena in various breaker technologies,
- familiar with the concept of overvoltage phenomena experienced in high voltage networks,
- familiar with the technology of high voltage laboratories and equipment tests

The **skills**, which the students will obtain upon successful completion of the course are:

- understanding the operation of fundamental high voltage equipment design, operation, and performance,
- understanding fundamental switching phenomena in high voltage/power circuit breakers,
- understanding fundamental transient phenomena in high voltage networks.
- writing a project based on literature review from papers in Greek and English, that includes Introduction, Main Body, Conclusions, and References.
- utilization of a computer in writing and presenting a project.

The **abilities**, which the students will get upon the successful completion of the course are:

a) understanding fundamental concepts of high voltage equipment design, operation, maintenance and failure.
b) the cooperation with other people, as part of a team, in writing project.

General Skills

- Search, analysis and synthesis of data and information, using the necessary technologies.
- Autonomous work
- Working in an international environment
- Working in an interdisciplinary environment
- Exercising critical and self-critical thinking
- Respect for the natural environment

(3) SYLLABUS

The aim of the course is to understand the operation of high voltage networks, the equipment used, the operating conditions and familiarisation with the basic principles governing the sizing of the equipment.

(A) Lectures

1. Structure of HT networks
   Principles of high-voltage networks, structure and operation, substations and systems.
   The structure, structure and operation of high-voltage networks, transmission systems, transmission systems, the Greek high-voltage and extra-high-voltage transmission system.
2. Equipment in HV transmission networks
   Technology of basic equipment components:
   - high voltage transmission lines and cables
   - Power transformers and inductors
   - Special purpose transformers
   - Insulators and transit insulators
   - Power switch technology
   - Surge arresters
3. Power switches and switching effects
   Types of power switches and historical development, switching phenomena, basic structure.
   Switching elements, oil, SF6 and vacuum circuit breakers, controlled switchgear, switchgear design, switchgear design, switchgear design, switchgear design, switchgear design, switchgear design, switchgear design, switchgear design, controlled operation, HVDC switches.
4. Internal and external overvoltages
   Surge generation mechanisms and categories, travelling waves and estimation
   stress assessment, insulation rating principles, insulation grading principles.
5. High Voltage Laboratory Technology
   Safety and operation of HT laboratory, production and measurement of standard forms
   High Voltage Laboratory, destructive and non-destructive testing.

(B) Laboratory

- Safety regulations - working in high-voltage installations.
- Fundamental high voltage generation devices in the laboratory
- Fundamental high voltage measurement devices in the laboratory
- Dielectric stress tests in basic air gaps

(4) TEACHING METHODS - ASSESSMENT

MODE OF DELIVERY	In-Class Face-to-Face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	▪ Use of ICTs in lecturing ▪ Use of ICTs for the communication with students via the e-class platform
TEACHING ORGANIZATION	**Method description/Activity** | **Semester Workload**

	Lectures	30
	Problem solving	15
	Project (journal/paper reading and theoretical study)	10
	Laboratory work	15
	Non-guided personal study	50
	Total Contact Hours	**120**
ASSESSMENT METHODS	All announcements for the course regulations and complementary reading material are permanently posted in the course web page. The course grade incorporates the following evaluation procedures: (A) Final Written examination (70 %) • Problem solving. • Targeted multiple-choice questions (B) Written individual work (15%) (C) Laboratory practice (15%)	

(5) RECOMMENDED BIBLIOGRAPHY

<u>*Recommended Bibliography:*</u>

1. *Advances in High Voltage Engineering, A. Haddad, Doug Warne, The Institution of Engineering and Technology, 2009*
2. *Extra High Voltage A.C. Transmission Engineering, R.D. Begamudre, New Age Publications (Academic), 2009*
3. *Condition Assessment of High Voltage Insulation in Power System Equipment, R. James, Q. Su, The Institution of Engineering and Technology, 2007*
4. *Overhead Lines, Konstantin O. Papailiou, CIGRE Green Books, Springer International Publishing, 2017*
5. *Substations, Terry Krieg, John Finn, CIGRE Green Books, Springer International Publishing, 2019*
6. *Switching Equipment, Hiroki Ito, CIGRE Green Books, Springer International Publishing, 2019*
7. *Transients in Electrical Systems: Analysis, Recognition, and Mitigation, J.C. Das, Springer International Publishing, 2010*
8. *Power System Grounding and Transients: An Introduction, R. R. Sakis Meliopoulos, Marcel Dekker, 1988*
9. *High-Voltage Test and Measuring Techniques, Wolfgang Hauschild, Eberhard Lemke, Springer International Publishing, 2019*
10. *Mikropoulos Pantelis, "Laboratory exercises in High Voltage Technology", Aristotle University of Thessaloniki, Thessaloniki, 2008.*
11. *Dieter Kind, Kurt Feser, High Voltage Test Techniques 2nd Edition, Newnes, 2001 Insulation of High Voltage Equipment, V.Y. Ushakov, Springer, 2010*

<u>*Relevant Scientific Journals:*</u>

1. *IEEE DEIS Society Transactions*
2. *IEEE Electrical Insulation Magazine*
3. *IEEE Transactions on Power Delivery*

4. *IET High Voltage*
5. *IEEE Transactions on Industry Applications*
6. *IET Electric Power Applications*
7. *IET Generation, Transmission & Distribution*
8. *International Journal of Electrical Power & Energy Systems*
9. *Electric Power Systems Research*
10. *IET Science, Measurement & Technology*
11. *Electric Power Components and Systems*
12. *Journal of Physics D: Applied Physics*
13. *INMR*
14. *Transmission and Distribution World*

Standards and Technical Guides:

1. *IEC Standards*
2. *IEEE Standards*
3. *Cigre*
4. *ANSI*
5. *EPRI*