COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	8.004	**SEMESTER**	8th
COURSE TITLE	High Voltage Engineering I		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures)	3	3
Tutorial/Exercises	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/ECE178/

(2) LEARNING OUTCOMES

Learning Outcomes

A) Upon successful completion of the course, the student will:

(a) know the basic principles of electric field distribution in devices
(b) be able to estimate the applied dielectric stress
(c) be able to apply techniques to control the applied dielectric stress
(d) be familiar with the basic principles governing the dielectric behaviour and electrical breakdown of gaseous, liquid and solid dielectrics and vacuum
(e) be familiar with the basic characteristics describing the dielectric quality of materials and techniques for their measurement and evaluation

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

a) understanding of the relationship between electric field, device geometry and electric stress,
b) understanding the influence of the material properties
c) understanding the dielectric breakdown concept in materials and further in equipment.
d) understanding of fundamental dielectric material properties and
e) writing a project based on literature review from papers in Greek and English, that includes Introduction, Main Body, Conclusions, and References.
f) utilization of a computer in writing and presenting a project.

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

a) the explanation and prediction of electrical stress experienced in typical dielectric geometries found in high voltage equipment.
b) the identification of the appropriate methodology to evaluate electric stress and quality testing in materials and high voltage equipment.
c) 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 develop the ability to understand the operation of devices and materials under the influence of strong electric fields, familiarisation with the basic concepts concerning the dielectric behaviour of systems and materials as well as loss phenomena. To achieve this objective the structure is as follows:

1. Electric field - stress control
   Basic principles of calculation of electric fields in simple geometric devices
   Electric field calculation techniques in complex structures
   Dielectric stress control techniques
2. Dielectric behaviour of gases - vacuum
   Ionization in gaseous dielectrics, Townsend and Streamer mechanisms, decay in dielectric gases, Paschen's law, gas mixtures, fundamental gaps, SF6, electrical vacuum decomposition.
3. Electric discharges and arc
   Categories of electrical discharges, glow discharges, basic characteristics
   Electrical arcs, initiation and energy balance, static and dynamic behaviour, magnetic effects, the electric arc in an electric circuit.
4. Dielectric behaviour of liquid and solid materials
   Mechanisms of decomposition in solid and liquid dielectrics.
5. Tests and measurements to evaluate dielectrics
   Dynamic properties of dielectrics, dielectric losses and capacitance measurements, partial discharges, dielectric measurements on equipment (tand, FRA, DGA analysis, etc.)

(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	45
Project (journal/paper reading and theoretical study)	10
Projects	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 (80 %) • Problem solving. • Targeted multiple-choice questions (B) Written individual work (20%)

(5) RECOMMENDED BIBLIOGRAPHY

-Recommended Bibliography:

1. *High voltages, E. Kuffel, W. S. Zaengl, J. Kuffel, Tziola Publications, 2010, (in Greek)*
2. *Elements of High Voltage Technology, Michael Danikas, Sbilias Publications, 2005 (in Greek)*
3. *High Voltages, Ioannis A. Stathopoulos, Simeon Publications, 1991, (in Greek)*
4. *High Voltages, Oikonomou Lambros, Fotis Giorgos, Christodoulou Christos, Tziola Publications, (in Greek)*
5. *Introduction to the protection of electrical installations, Konstantinos N. Kritsotakis, Tziola Publications, 2012 (in Greek)*
6. *Electric Fields in Composite Dielectrics and their Applications, Takuma, Tadasu, Techaumnat, Boonchai, Springer, 2010*
7. *High Voltage Engineering, Farouk A.M. Rizk, Giao N. Trinh, CRC Press, 2014*
8. *High Voltage Engineering, M S Naidu, V Kamaraju, Tata McGraw Hill, 2013*
9. *High Voltage and Electrical Insulation Engineering, Ravindra Arora, Wolfgang Mosch, Mohamed E. E Hawary, Wiley-IEEE Press,2011*
10. *High voltage engineering, C.L. Wadhwa, New Age International Pvt Ltd Publishers, 2006*
11. *High-voltage engineering: theory and practice, Mazen Abdel-Salam, Electrical and computer engineering, M. Dekker, 2000*
12. *Insulation of High Voltage Equipment, V.Y. Ushakov, Springer, 2010*

Relevant Scientific Journals:

1. *IEEE DEIS Society Transactions*
2. *IEEE Electrical Insulation Magazine*
3. *IET High Voltage*