EEE.8-1.4 **ELECTROTECHNICAL APPLICATIONS**

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
DEPARTMENT	DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDER GRADUATE		
COURSE CODE	EEE.8-1.4	SEMESTER	8
COURSE TITLE	ELECTROTECHNICAL APPLICATIONS		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		WEEKLY TEACHING HOURS	CREDITS
	Lectures	4	5
	Total	4	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization Course		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (official)- English (optional)		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/EEE212/		

(2) LEARNING OUTCOMES

Learning outcomes
The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described. *Consult Appendix A* • *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area* • *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B* • *Guidelines for writing Learning Outcomes*
Upon completion of the course, students will have acquired: 1. Ability to select and design heating resistors for commercial and industrial applications. 2. Ability to select and design magnetic components. 3. Ability to select heat accumulators based on their characteristics and the thermal needs of a room. 4. Knowledge of the operating principles of cooling systems and heat pumps. 5. Knowledge of the principles of operation of arc welding machines and their operating

characteristics.

6. Ability to select type and function of arc welding machines for industrial applications.
7. Knowledge of the operating principles of the heating, induction and dielectric heating systems.
8. Ability to select heat treatment systems according to application.

More specifically, they will:

1. Be able to prescribe, select and design heating resistors for commercial and industrial applications.
2. Be able to select and design magnetic components according to the specific operating requirements.
3. Be able to choose refrigeration systems, heat pumps and heat accumulators in cooling and space heating applications.
4. Be able to choose the type and characteristics of arc welding machines for industrial applications
5. Be able to understand how ohmic, inductive and dielectric heating devices work and choose thermal processing systems depending on the application.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

The course aims at fostering the following capabilities:

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision making
- Individual project
- Generating free creative and inductive thinking

(3) **COURSE CONTENT**

The course consists of the following modules:

Module 1: Heating Element Design: Heat Transfer - Electrical Heating Energy Requirements - Heat Treatment, Conduction and Radiation Heating - Power Requirements - Power Rating - Heat Resistors - Operating Temperature of Electrothermal Devices - Temperature Sensors.

Module 2: Design of Magnetic Components: Magnetic Materials and Cores - Coil Design, Low and High Frequency Transformer.

Module 3: Compression Cycle Devices: Introduction to Cooling - Basic Cooling System - Cooling Cycle - Refrigerants - Introduction to Heat Pumps - Heat Pump Distinction - Heat Sources - Applying Heat Pump to Water Heating.

Module 4: Electrical Heat Accumulators: Introduction - Operating Principle - Heat Accumulator Parts - Heat Accumulator Power Calculation.

Module 5: Metal Arc Welding: Welding Arc Types - Arc Welding Power Sources - Rotary Arc Welding Machines - Arc Welding Machines with Transformer - Rectifier Arc Welding Machines - Inverter Type Arc Welding Machines - Welding Machines Selection / Specifications.

Module 6: Conduction Heating: Basic electrical & electrothermal equations - Alternating current in conductors - AC current in semi-stepped plate - AC current in rectangular cross section conductors - AC current in circular cross-section conductors - AC current in tubular ducts.

Module 7: Induction Heating: Resonant Circuits - Current Source Inverter for Induction Heating - Voltage Source Inverter for Induction Heating - Resonant Inverters for Induction Heating - Induction Heating of Semi-infinite Plate - Induction heating of rectangular thin slab - Induction heating of Compact Cylinder - Induction heating of Pipe.

Module 8: Dielectric Heating: Generalized Approach - Equivalent material circuit - Dielectric material loosening losses, Duplex loss mechanism, Bipolar relaxation interpretation, Thermal leakage, Equivalent circuits of dielectric materials - Devices for dielectric heating application (RF and microwave application devices).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, laboratories , distance learning methods
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Teaching using ICT, Laboratory Education using ICT, Communication and Electronic Submission
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	*Activity* / *Semester workload* Lectures: 40 Exercises: 12 Educational visit - Optional individual work- Self study - Preparation for examinations: 98 **Course total: 150**
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Evaluation Language : Greek 1. Written final exam including: •questions of theoretical content and judgment questions •Multiple choice questions •Solving computer problems 2. Optional individual work (project)

	The final grade of the course is based on the following relationship: Without the optional individual work Degree of written examination of theory With optional individual work 0.8 x written test theory + 0.2 x grade of work (project)

(5) ATTACHED BIBLIOGRAPHY

1. Μαχιάς ΑΒ (1984), "Ηλεκτρομηχανολογικές Εγκαταστάσεις", Αθήνα.
2. Μπούρκας ΠΔ (1991), Εφαρμογές κτιριακών-βιομηχανικών μελετών και εγκαταστάσεων, Εκδόσεις Συμεών, Αθήνα.
3. Χαλικιά ΣΝ (1992), "Θέρμανση-Ψύξη-Αερισμός", ΟΕΔΒ, Αθήνα.
4. Κουρεμένου Δ, Χατζηδάκη Σ (1994), "Σημειώσεις ψύξεως", Εκδόσεις Ε.Μ.Π, Αθήνα.
5. Chapman SJ (2003), "Ηλεκτρικές Μηχανές AC-DC", Εκδόσεις Τζιόλα, Θεσσαλονίκη.
6. Mohan N., Undeland T., Robbins W. (2006), "Power Electronics", John Wiley & Sons.
7. Μανιάς ΣΝ (2000), "Ηλεκτρονικά Ισχύος", Εκδόσεις Συμεών, Αθήνα.
8. Μανιάς Σ, Καλετσάνος Α (2001), "Βιομηχανικά Ηλεκτρονικά", Εκδόσεις Συμεών, Αθήνα.
9. Watlow Educational Series Book (1995), "Heat Transfer" (www.watlow.com).
10. Metaxas AC (1996), "Foundations of Electroheat, A Unified Approach", John Wiley & Sons.
11. Davies EJ (1979), "Induction Heating Handbook", McGraw-Hill Book Company Ltd, London.
12. H.B.Cary (1998), "Modern Welding Technology", Prentice Hal.