POWER ELECTRONICS

COURSE OUTLINE

1. GENERAL			
SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Electronic Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	0806.8.009.0	**SEMESTER**	255th
COURSE TITLE	Power Electronics		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	**WEEKLY TEACHING HOURS**	**CREDITS**
	2	4
Total	**2**	**4**

COURSE TYPE general background, special background, specialised general knowledge, skills development	Scientific Area, Skills Development
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	https://eclass.hmu.gr/courses/EE111/

2. LEARNING OUTCOMES

Learning outcomes

The power electronics course focuses the attention of students, who already know most of the possibilities of electronics, on the elimination of losses, introducing switching methods suitable to replace linear operation. The electronic components that they already know are now examined, along with new ones, from another perspective, that of operating as switches. Attention is focused on any disadvantages of switching methods and how to deal with them. Upon successful completion of the course, the student will be able to:

- Know how to design to minimize losses.
- Have knowledge of the effect of the characteristics of the components on the switching function.
- Know how to implement a power electronics device in order for it to operate effectively.

General Competences

Searching, analyzing and synthesizing data and information, using the necessary technologies Decision-making Autonomous work, Exercising criticism and self-criticism, Promoting free, creative and inductive thinking

3. SYLLABUS

Definition of the concept of "Power Electronics", Power semiconductors (Diode, Thyristor, GTO, MCT, TRIAC, Power BJT, Power MOSFETs, SJ MOSFET, IGBT, HEMT, TRIAC), Circuits with switches and diodes (with RC, RL, RLC load), semiconductor protection, oscillation damping - snubbers, MOVs, di/dt limiting coils, fuses, current sensors - protection through driving. Rectifiers, polyphase rectifiers, thyristor controlled rectifiers. RL and LC low-pass filters, Fourier analysis, use of harmonic spectrum in power electronics, ripple factor (K), total harmonic distortion factor (THD), harmonic factors (HF), power factor (PF). DC/DC conversion, Buck converter, DC and AC coil operation, Boost converter, DC and AC coil operation, Polarity reversal converter. Definition of Duty Cycle and control using a reference voltage and using a triangular or sawtooth pulse (PWM). Switching power supplies, power factor correction (PFC), the pulse transformer, forward converter, half-bridge, bridge, Push-Pull, coupled coils, Flyback converter. Inverters: Half-bridge, Bridge, PWM technique, MPWM technique, PDM technique, Modulation Factor (Mf), SPWM technique, Normalized carrier frequency (Fnc), HF-Link, three-phase inverters, Inverters and motors., Class-D amplifiers, Class-E. Integrated Circuits and Power Electronics, switching regulators, DC/DC converters, PFC controllers, power semiconductor driving, PWM units, Microcontrollers and DSP for power electronics. Feedback control and correction techniques. Cycloconverters, and other applications of Power electronics.

4. TEACHING and LEARNING METHODS - EVALUATION	
DELIVERY Face-to-face, Distance learning, etc.	Face to face theoretical teaching.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of PowerPoint presentations. Electronic communication with students
TEACHING METHODS The manner and methods of teaching are described in detail.	**Activity** / **Semester workload** Lectures: 26 Personal study: 92 Exam: 2 **Course total**: **120**
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	I. Written final exam - Problem solving/calculations - Comparative evaluation of theory elements The evaluation criteria are accessible to students from the course website and are announced in the first lesson.

5. ATTACHED BIBLIOGRAPHY

Suggested Bibliography:

- "Power Electronics", Lander C.
- "Power Electronics", Brandley B.
- "Power Electronics", Williams B.
- "Power Electronics", Rashid M.