COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	4.001	**SEMESTER**	4th
COURSE TITLE	Electromagnetic Field I		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures) and Exercises	4	6
TOTAL	**4**	**6**

COURSE UNIT TYPE	General knowledge
PREREQUISITES	None
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	No
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE153/

(2) LEARNING OUTCOMES

Learning Outcomes

The aim of the course is to familiarize the student with the relevant mathematical background that covers the electrostatic and magnetostatic fields, to understand the physical quantities and properties of the electrostatic and magnetostatic fields as well as the flow field of constant currents. In particular, the student will be able to

- define basic concepts of electromagnetism,
- formulate the relevant laws,
- describe the sources that create electrostatic fields,
- describe the sources that create magnetostatic fields,
- understand the differences between pointed and extended load distributions,
- apply the laws relating to electrostatic fields and solve related problems

General Skills

The course aims to allow the student to acquaint the following general skills:

- Retrieve, analyse and synthesise data and information, with the use of necessary technologies
- Autonomous work
- Cross disciplinary collaboration
- Develop new research ideas
- Promoting liberal, creative and inductive/deductive thinking

(3) SYLLABUS

The structure of the course is as follows:

Vector element analysis: Vector algebra, Differential calculus, Integral calculus, Delta function, spherical, cylindrical coordinates.
Electrostatics: Loads and their distributions. Coulomb Law, electric field intensity, scalar electric potential, dielectric displacement, electrical flow. Fundamental laws of the electrostatic field. Poisson and Laplace equations.
Energy and forces: Electrostatic field energy. Forces in conductors. Motion of charged particles in an electrostatic field.

Perfect conductors: Conductive bodies Cavities in conductive bodies. Green's reciprocity theorem. Capacitors, capacitance, partial capacitance.
Analytical methods: Uniqueness theorem. Mirroring method (electric images). Variable separation method. Other methods.
Dielectric means: Electric bipolar. Dielectric Polarization. Polarized loads. Forces in dielectrics. Gauss' law in the presence of dielectrics.
Direct current electric field: Intensity and density of electric current. Continuity equation. Boundary conditions. Electromotive force. Resistance. Ohm's law. Kirchhoff's laws. Variable cross-section conductor resistance. Capacitors with losses. Energy. Joule's law.
Magnetostatics: Magnetic induction and flux. Biot-Savart Law.
Magnetic field intensity. Ampere's law. Scalar and vector magnetic potential. Poisson vector equation. Magnetic flux. Solenoids. Induction. Forces in conductors. Torque.

(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	72
Exercises	33
Self-study	75
Total Contact Hours	**180**

ASSESSMENT METHODS	**Assessment Language: Greek** All announcements for the course regulations and complementary reading material are posted in the course web page. The course grade incorporates the following evaluation procedures: **Description** ➢ Written test (70%) a. Problem solving b. Multiple choice question ➢ Intermediate exam (30%)

(5) RECOMMENDED BIBLIOGRAPHY

Recommended Bibliography:

- *Introduction to Electrodynamics, David J. Griffiths, Cambridge University Pres, ISBN 978-1108420419*
- *Electromagnetics with Applications, John Daniel Kraus & Daniel A. Fleisch, William C Brown Pub, ISBN 978-0072899696*

Relevant scientific journals:

(1) *Journal of Electromagnetic Waves and Applications*
(2) *Journal of Electromagnetic Analysis and Applications*
(3) *International Journal of Magnetics and Electromagnetism*
(4) *Journal of Applied Electromagnetism*