University POLITEHNICA of Bucharest

Electrical Engineering Faculty

Electrical Engineering Department

STUDY DOMAIN: Mechanical Engineering, Chemical Engineering

STUDY PROGRAM: Bachelor

DISCIPLINE'S SHEET

Electrical Engineering I

(for Faculty of Engineering in Foreign Languages in English)

Discipline's status: ■ **Compulsory** □ **Optional** □ **Free choice**
Level of Study: ■ **Bachelor** □ **Master** □ **PhD**
Year of study: **2**
Semester: 1

Discipline's titular: lecturer PhD eng. Marilena STĂNCULESCU

No. of hrs./Type of Examination/Credit Points					
Course	**Seminar**	**Laboratory**	**Project**	**Type of Examination**	**Credit Points**
2	**1**	**0**	**0**	**Verification**	**2**

A. DISCIPLINE'S OBJECTIVES

- is an applicative approach of the electromagnetic field theory as a fundamental part of the vast domain of electrical;
- to develop the student's skills to understand the field hypothesis of electrical circuits theory and the electromagnetic field phenomena;
- the acquirement and deeply understanding of the methods for computing some simple electromagnetic field and electric circuits applications.

B. PRECONDITIONS

To attend and/or pass the following disciplines: Physics I, Mechanics I and Calculus.

C. SPECIFIC COMPETENCES

This course develops the student's abilities in applying the basic knowledge of electromagnetic field theory and circuit theory to understand, model and analyze the field and circuit problems, to understand the limits of the used models.
Understanding the main phenomena of electromagnetism.

Correct identification and formulation of macroscopic laws of electromagnetism.
Identify important consequences resulting from the system laws of electromagnetism macroscopic theory.
Correct identification of the electric circuit state associated to a certain type of application;
Correct writing of Kirchhoff equations and powers for a given circuit.

D. SYLLABUS

COURSE

Chapter	Syllabus	No. of hours
I. Electromagnetism		
I.1 Introduction	Overview of the subject. The coherent construction of a scientific theory. Physical model, physical quantities and attached mathematical relationships.	**2 hrs**
I.2 Electromagnetic quantities	Primary electromagnetic quantities Derived electromagnetic quantities	**2 hrs**
I.3 Laws and theorems of electromagnetic phenomena	Electric flux law (Gauss law). Magnetic flux law. The magnetic field constitutive law. Temporary magnetization law. The electric field constitutive law. The law of temporary electric polarization. Electromagnetic induction law (Faraday Law). The magnetic circuit law (Ampère law). The electric charge conservation law. The constitutive law of electric conduction. The law of energy conversion associated to e The law of energy conversion associated to electric conduction The electrolysis law.	**10 hrs**
II. Electric circuits		
II.1 Introduction and overview	Limits of circuits' models. The main quantities of electrical engineering Kirchhoff's theorems.	**2 hrs.**
II.2 Direct current (D.C.) circuits	Elements of direct current circuits. Branch characteristics. Fundamental theorems for direct current circuits Kirchhoff equations method. Loop current method Node potential method.	**6 hrs.**

II.3. Alternating current (A.C.) circuits	Circuit equations. Basic circuit elements. Complex form of equations for A.C. circuit Power in A.C. circuits (active, reactive, apparent). Power factor. Matrix form of circuit equations. Power conservation. RLC series circuit. RLC parallel circuit. Combined circuits: series/parallel branches. Inductive coupling. Coupling removal.	**6 hrs**
	Total no. of hrs.	**28 hrs**

SEMINAR

Chapter	Syllabus	No. of hours
1. Electromagnetism	Charge distributions: linear, surface and volume distributions. Coulomb Force. Applications of Electromagnetic induction law Applications of Magnetic circuit law Applications of Biot-Savart-Laplace's theorem	**8 hrs**
2. Direct current (D.C.) circuits	Kirchhoff equations method. Loop current method Nodal Analysis Method.	**4 hrs**
3. Alternating current (A.C.) circuits	Kirchhoff equations method. Loop current method Nodal Analysis Method.	**4 hrs**
	Total no. of hrs.	**14 hrs**

E. EVALUATION

- activity during seminar, homework during the whole semester 30%
- half-term verification 50%.
- final verification 20%

Minimum performance standards:

- knowledge of the correct terminology from electrical engineering domain;
- knowledge of the primitive and derived quantities of macroscopic electromagnetic theory;
- correct identification and formulation macroscopic laws of electromagnetism;
- identify important consequences resulting from the system laws of electromagnetism macroscopic theory;
- correct identification of the electric circuit state associated to a certain type of application;
- correct writing of Kirchhoff equations and powers for a given circuit.

F. METHODOLOGICAL REFERENCE POINTS

- Course lectures presentation will take place in amphitheatre, optionally, at student's request: at the blackboard, with multimedia facilities or combined. The lectures will include free discussions and interactive presentations.
- The seminars are designed in order to allow the active participation of the students and they include individual and team homework.
- The homework implies also the use of internet accessible applets. In this way, many medium difficulty circuits can be interactive solved. Homework is evaluated using tests.
- The instructors (the discipline's titular and his assistants) and the students will act together to establish a consultation program.

G. BIBLIOGRAPHY

On-line resources: course

- T.R. Kuphaldt, *Lessons in Electric Circuits A free series of textbooks on the subjects of electricity and electronics*, Volume I – DC, Volume II – AC

On-line resources: applications

- J.A. Svoboda, *Electric Circuit Study Applets*
- J.A. Svoboda, *Interactive Examples & Exercises*
- M.D. Filipovic, *Understanding Electronics Components*
- Amanogawa & Semchip, *Circuit Applets* (Power components for sinusoidal signal. Parallel and series resonant circuits)
- The Nuffield Foundation, *Electric Circuits & Fields*

On-line resources: terminology, units

- CEI, *The International System of Units and the IEC*
- (USA) National Institute of Standards and Technology – NIST, *Constants, Units & Uncertainty* – CUU

Text books, set of problems

- L. Ochiana, G. Ochiana**, M. Stanculescu**, *Electromagnetic Field Theory*, Ed. Pritech, Bucharest, 2012.
- M. Vasiliu, I.F. Hănţilă, *Electromagnetics*, Editura Electra, Bucureşti, 2006
- E. Cazacu, I. Nemoianu, M. Maricaru, F. Enache, **M. Stănculescu**, A. Stănciulescu, A. Anghel, *Chestiuni speciale de teoria circuitelor electrice – elemente de teorie şi aplicaţii*, Editura Matrix-ROM, Bucureşti, 2005
- E. Cazacu, **Marilena Stănculescu**, *Bazele electrotehnicii – seminar*, Editura Matrix Rom, Bucureşti, 2004.

Data approved by the department:

HEAD OF DEPARTMENT,	**DISCIPLINE'S TITULAR,**
Prof. PhD. eng. **Valentin IONIȚĂ**	lecturer PhD. eng. **Marilena STĂNCULESCU**