

## Foundations of Electrical Signals of Hardware – Course Syllabus

Course Code: IVB286ANMI

Semester: 2018/2019.1 (Autumn)

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### GENERAL INFORMATION

Name of Course	Foundations of Electrical Signals of Hardware ( <i>Principles of Electrical Circuits in Hardware</i> )
Course Code	IVB286ANMI
Semester	2018/2019 1. (Autumn)
Number of Credits	5
Allotment of Hours per Week	2 lectures and 2 practical lessons per week
Evaluation	Signature with grade
Prerequisites	-
Instructors	Dr. István Gyurcsek, Email: <a href="mailto:gyurcsek.istvan@mik.pte.hu">gyurcsek.istvan@mik.pte.hu</a> Office: 7624 Pécs Boszorkány u. 2. Room: B232, Office phone extension: 23852

### INTRODUCTION AND LEARNING OUTCOMES

Electric circuit theory and electromagnetic theory are the fundamental principles upon, which many branches of engineering are built. Therefore, the basic electric circuit theory is not only the one of the most important course for students learning information technology, electrical engineering but always an excellent starting point for the beginnings in all kind of engineering education.

Circuit theory is also valuable for students specializing in other branches of the physical sciences because circuits are good model for the study of energy systems in general, and because the applied mathematics, physics, and topology involved.

In different branches of engineering, we are often interested in communicating or transferring energy from one point to another. To do this an interconnection of electrical devices is required. The interconnection is referred as an electric circuit and each component of the circuit is known as an element.

This course is the short collection of the fundamental principles is given helping to understand the basics of practical electricity i.e. the basics of electric circuits.

### GENERAL COURSE DESCRIPTION AND MAIN CONTENT

This subject covers the fundamental principles of the electricity that is required to the study of students attending the B.Sc. program. It aims to increase students' knowledge and expertise and determine whether they satisfy the requirements of the course.

The aim of the subject is to convey fundamental knowledge on the governing relations of electrical and magnetic fields as well as characteristics, laws and computation methods of linear, time-invariant electrical circuits. Modeling of electrical networks with concentrated parameters, fundamentals of dipole theory and network topology. Computation procedures and methods of network analysis for linear, time-invariant dipole networks. The aim of the subject is also to convey knowledge on methods of alternating current network analysis. Mathematical representation of sinusoidal quantities and AC power analysis.

### METHODOLOGY

The course is based on the lectures and practices giving examples and calculation exercises to help understanding the subject of the study.

### SCHEDULE

The semester is divided into three principle periods and attendant exercises. The rough outline of the schedule is as the followings:

#### **Week 1-3 ELECTROMAGNETIC FIELDS**

- Electric field (characteristics of static electric field, Gauss' law, energy of the electric field, interaction with matter, characteristics of stationary electric field, theoretical background of Ohm's law and Kirchhoff's laws) (examples)
- Magnetic field (Energy in static and stationary magnetic field, interaction with matter, induction, self and mutual inductance, Ampere's excitation law, Faraday's induction law, Time varying electric and magnetic fields, Maxwell equations)

### **Week 4-9 STATIC CIRCUIT ANALYSIS**

- Concepts and definitions (charge and current, voltage, power and energy, circuit elements) (examples)
- Basic laws (Ohm's Law, nodes, branches, and loops, Kirchhoff's laws, series resistors and voltage division, parallel resistor and current division, wye-delta transformations) (examples)
- Methods of analysis (nodal analysis, mesh analysis, applications: DC transistor circuits) (examples)
- Circuit theorems (linearity property, superposition, source transformation, Thevenin's theorem, Norton's theorem, maximum power transfer) (examples)
- Operational amplifiers (ideal op amp, inverting amplifier, noninverting amplifier, summing amplifier, difference amplifier, cascaded op amp circuits) (examples)

### **Week 10-15 OVERVIEW OF DYNAMIC CIRCUITS**

- Capacitors and inductors (capacitors, series and parallel capacitors, inductors, series and parallel inductors, applications) (examples)
- Sinusoids and phasors (sinusoids, phasors, phasor relationships for circuit elements, impedance and admittance, Kirchhoff's laws in the frequency domain, impedance combinations) (examples)
- AC power analysis (instantaneous and average power, maximum average power transfer, effective or RMS value, apparent power and power factor, complex power, conservation of AC power, power factor correction) (examples)
- Three-phase circuits (balanced three-phase voltages, balanced wye-wye, wye-delta, delta-delta, delta-wye connections, power in a balanced system, unbalanced three-phase systems, applications) (examples)

### **ATTENDANCE**

Attending is required all classes and will impact the grade. Unexcused absences will adversely affect the grade and in case of absence from more than 30% of the total number of lessons will be grounds for failing the class. To be in the class at the beginning time and stay until the scheduled end of the lesson is required. Tardiness of more than 20 minutes will be counted as an absence. In the case of an illness or family emergency the student must present a valid excuse, such as a doctor's note.

The highest possible grade on the late performance (in two weeks) is '2'.

### **REQUIRED PERFORMANCE, EVALUATING, GRADING**

The requirement is two approved classroom studies, scheduled during the semester and the written examination scheduled for the exam terminus. The grade of the examination will be based on the following guidelines:

5. Outstanding work. Execution of work is thoroughly complete and demonstrates a superior level of achievement overall with a clear attention to details. The student is able to synthesize the course material with new concepts and ideas in a thoughtful manner and is able to express those ideas in clear way.
4. High quality work. Student work demonstrates a high level of knowledge with consistency. The student demonstrates a level of thoughtfulness in addressing concepts and ideas. Work demonstrates excellence but less consistency than a '5' student.
3. Satisfactory work. Student work addresses all of the task and assignment objectives with few minor or major problems.
2. Less than satisfactory work. Work is incomplete in significant ways and lacks attention to details.
1. Unsatisfactory work. Work exhibits several major and minor problems with basic conceptual premise, lacking both intention and resolution. Results are severely lacking and are weak in clarity and completeness.

Grading Scale:

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Numeric Grade	5	4	3	2	1
Evaluation interval	90-100%	76-89%	63-75 %	51-62 %	0-50 %

**STUDENTS WITH SPECIAL NEEDS**

Students with disability and needs to request special accommodations, please notify the Deans Office. Proper documentation of disability will be required. All attempts to provide an equal learning environment for all will be made.

**RECOMMENDED READING AND REFERENCE MATERIALS**

- Dr. Gyurcsek – Dr. Elmer: Theories in Electric Circuits, GlobeEdit, 2016  
ISBN:978-3-330-71341-3
- Ch. Alexander, M. Sadiku: Fundamentals of Electric Circuits, 6th Ed., McGraw Hill NY 2016  
ISBN: 978-0078028229
- <http://gyurcsekportal.hu/mik.html> (Principles of Electrical Circuits in Hardware)