Assessment and subject description

Óbuda University Kandó Kálmán Faculty of Electrical Engineering			Institute of Microelectronics and Technology	
Subject name and code**: *Electrotechnics, KEXETBABNE*** **Credits: 5** **Full-time, Fall Semester**				
Course: Technical Manager, 3rd semester				
Responsible:	Csikósné Dr. Pap Andrea, PhD	Teaching staff:	*Dr. Balázs Kovács, PhD*	
Prerequisites:	Physics, KEXFI2ABNE			
Contact hours per week:	Lecture: 2	Class discussion: 2	Lab hours:	Tutorial:
Assessment and evaluation:	**exam**			

Subject description

Aims:
This course introduces the basic concepts and practices of the electrotechnics. It makes the attendees to be familiar with the basic electronic components and the basic circuit's theory. The relation with the management practice will be demonstrated through practical examples.

Topics to be covered:

Topics	Week	Lessons
The structure of the matter. Atom, electron, proton. The electric charge, electric force, electrostatic field: electrostatic field strength, displacement, potential, voltage. The structure of the atoms, electron shells, energy levels. Quantum numbers, Pauli's theorem, excitation of electrons, absorption and emission. Chemical bonds. Solid state, energy levels and energy level splitting, band structure: metals, semiconductors, insulators.	1	2
The electric current, current density, specific conductance and specific resistance. Direct and alternating current. The resistance. Ohm's Law. Electric power, work, energy, dissipation. Voltage sources. Schematics. DC circuits, serial and parallel circuits. Current and voltage distributions, total resistance and conductance. Open and short circuit. Voltage divider. Kirchoff's Laws.	2	2
The type of conductors, resistance, temperature and frequency dependence, skin effect. The different type of resistors. Potentiometers and rheostats. Standard values' set, tolerances. Design of resistors and conductors.	3	2
DC Resistor's network. Y to Δ conversion. Superposition theorem. Thevenin's and Norton's theorem. Voltage and current source. Wheatstone bridge. The maximum output powers. Alternating voltage's and current's parameters: cycle time, frequency, propagation speed, wavelength. Phase relationship, phasors. Power, effective values.	4	2

Electrical parameters of insulators (dielectrics). Relative dielectric constant, breakdown field. Power density. Dielectrics of the practice. The capacitor and its parameters: charge, voltage, capacitance, current. Energy storage. Phase relationship, phasors. Capacitive reactance and susceptance. Serial and parallel circuits. Application of complex numbers to describe the phase relationships. Losses of capacitors and their physics reasons. The figure of merit and the loss factor. Equivalent circuits. Type of capacitors, construction's and working parameters. Nominal values and tolerances. Adjustable capacitors, characteristic curves, construction. Value calculations.	5	4
The nature of magnetism. Para-, dia-, ferro- and ferri-magnetism. The parameters of magnetic field: field strength, induction. Energy density, magnetic force. Magnetic material, magnetization curves, hysteresis, permeability.	6	2
Soft and hard magnets, their applications. Permanent magnets. Simple magnetic circuits. The analogy of electric and magnetic circuits.	7	0
Electromagnetic induction. Coils: self-induction, induction, energy storage. Air- and iron-core coils. Phase relationship, phasors. Inductive reactance and susceptance. Losses and their physics reasons. The figure of merit and the loss factor.	8	2
Mutual inductance. Transformers, voltage, current, impedance transformation. Parameters of ideal and real transformers. Parallelly and serially connected coils. Summary of electric and magnetic units. The free electron. Movement in electric and magnetic field. The wave behavior of electrons.	9	2
DC energy sources, primary and secondary cells, photo-electric, thermos-electric systems, DC generators	10	2
AC generators, energy supply systems, power losses, reactive power. Phase corrections.	11	2
DC and AC motors, electro-mechanical actuators	12	2
Grounding, life-safety systems, electrostatic discharge and ESD precautions	13	2
Summary	14	2
Class discussion		
Calculation with rounded values. SI measures. Scientific notation. Forces and movement of charged particles, potential and kinetic energy. Electron and atom density of materials.	1	2
Specific conductivity, specific resistance, current density. Resistor in series, in parallel. Current and voltage, total resistivity and conductivity. Voltage divider. Kirchoff's laws.	2	2
Resistivity of conductors. Thermal and frequency dependence. Penetration depth, limit frequency, high frequency resistivity. Design of conductors and resistors.	3	2
DC resistor networks. Y to Δ conversion, Δ to Y conversion. Superposition theorem. Thevenin's and Norton's theorem. Voltage and current source. Wheatstone bridge. The maximum output powers. Alternating voltage's and current's parameters: cycle time, frequency, propagation speed, wavelength.	4	2

Calculus with complex numbers. Phase relationship, phasors. Power, effective values in AC systems. Charge, voltage, capacity, current, electric field and displacement, energy storage in capacitors. Simple RC circuits: admittance and impedance. Voltage and current, power in RC circuits.	5	2
Test 1	6	2
National Holiday	7	0
Electrical design of capacitors. Calculation of thermal dependencies and losses. Application of parallel and serial replacement circuits. Figure of merit.	8	2
Calculation of simple magnetic circuits. Calculation of magnetic field and its force.	9	2
Inductivity of coils. Losses. Application of parallel and serial replacement circuits. Energy, induction, flux.	10	2
Admittance and inductance of simple RL and RLC circuits. Current and voltage calculation. Power. Resonant circuits. Time constant and transient signal.	11	2
Transformation of voltage, current and impedance in the case of ideal and real transformers. Summary of electric and magnetic units.	12	2
Test 2	13	2
Repeat test	14	2

Assessment and evaluation

Requirements of the signature:

- To attend the lectures is obligatory. Max 30% of the lecture could be passed.
- To pass both tests – the student should overcome 50% of obtainable points of each test.
- To do the repeat test for free one occasion for each test will be provided.

Type of exam:

- Written, covering the all topics of the course. To pass the exam at least 50% of the obtainable points should be reached.

Suggested material

M. Gussow: Schaum's Outline of Basic Electricity, Second Edition, 2007, The McGraw-Hill Companies, Inc.

Comment: