E L E C T R I C I T Y & M A G N E T I S M – I

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Discipline	**Electricity and Magnetism I**		Course ID	**Ob.106F**	
Year of Study	**I**	Semester	**II**	Assessment and Evaluation	**E**
Formative category: **FDS-Fundamental Discipline of Scientific Type**					
Type of discipline: **Ob.- Mandatory**				Number of ECTC	**6**
Total number of instructional hours	**70**	Total number of hours allocated to individual study	**80**	Total number of hours per semester	**150**

Faculty	**PHYSICS**	Total number of hours in curriculum/semester				
Department	**Electricity and Biophysics**	**70=14 weeks x 2 hours course +14 weeks x 3 lab hours**				
Main Domain Science, arts, culture	**Science**					
Bachelor Study Program	**Physics**	**Total****	**C**	**R**	**L**	**P**
Branch of Study	**F, FI, BF, FM**		28		42	

** **C**-Course, **R**-Recitation, **L**-Lab work, **P**-Project, or Practical work

Prerequisite Disciplines	Required	Geometry, Algebra, Mathematical Analysis, Classical Mechanics, Analytical Mechanics, Molecular Physics, Equations of Mathematical Physics, Classical Statistics, Atomic Physics
	Recommended	Vectorial Analysis, Numerical Methods and Processing of Physical Data

SYLLABUS	**Lectures Outline** *The formalism of electrostatic field in vacuum.* Electric charges. Charge conservation and quantization. Electric force between two point charges at rest. Coulomb's Law. The electrostatic field. Electrostatic potential. Charge distributions and charge densities. Gauss's Law. Integral and local forms of Gauss's Law. Laplace's and Poisson's equations. The electric dipole. The field and the potential of an electric dipole. *The electrostatic field in matter* Systems of charged conductors at electrostatic equilibrium. The electric capacitance. Dielectrics. Electric polarization of matter. The electric polarization vector. The microscopic approach to polarization. Electrostatic field energy. *Steady state electrical currents(DC currents)* Electrokinetic steady-state. The intensity of electrical current. Current densities. Conduction, convection and drift currents. The continuity equation. Integral and local forms of Ohm's and Joule-Lenz's laws for homogeneous

	and non-homogeneous conducting media. Faraday laws of electrolysis. Electrical conductivity of electrolytes. Electrical conduction in ionized gases. Electrical conduction of free electrons in vacuum. **Lab Works** - Electrifying various bodies by friction, influence, and contact. Principle of electroscope operation. - Electrostatic interaction of point charges. Coulomb's Law. - Millikan experiment and charge quantization. - Conductors at electrostatic equilibrium. Charge vs potential. - The electrostatic capacitance of parallel plate capacitors. - Dielectrics. Measurement of static dielectric constant. - Using voltmeters and ammeters in various configutations. Upstream and downstream methods for measuring electrical resistances. - Measuring electrical resistances using Wheatstone Bridge method. - Measurement of electric resistivity for various metals. - The efect of temperature on electrical resistivity of metals and semiconductors. - Potentiometric measurements. Measurement of electromotive forces. - Thermoelectric effects (Peltier and Seebeck effects). Applications. - The narrow electron beam tube. Principle of oscilloscope operation. - Current-Voltage characteristics of vacuum diode. - Current-Voltage characteristics of semiconductor diodes.
Equipment List	Experimental setups for hands-on direct learning, available in our Laboratory of Electricity and Magnetism.

The final evaluation will include:	**Percent in %** **{Total=100%}**
- Examination (final evaluation).	**50%**
- Hands-on Lab test & quiz.	**20%**
- Final answers to mid-term examination (written).	**20%**
- Homework, written tests and quizzes during recitation class.	**10%**
Final evaluation methods, E/V. {ex: Written test, Oral examination on topics covered by lectures, Individual Colloquium, or Group Project, etc.}. **Written test & Oral examination**	

Minimal requirements for mark 5 **(10 point scale)**	**Requirements for mark 10** **(10 point scale)**
- **Mandatory attending**: 50% lectures and all lab activities. **- At least mark 5** in each stage of final exam.	- **Mandatory attending**: most lectures, all lab activities, and most recitation classes. - **Mark 10** in each stage of final exam.

E L E C T R I C I T Y & M A G N E T I S M – II

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Name of Discipline	**Electricity and Magnetism II**			Course ID	**Ob.206F**		
Year of Study	**II**	Semester	**I**	Assessment and Evaluation			**E**
The formative category of discipline: **FDS – Fundamental Discipline on Scientific Type**							
Type of discipline: **Ob.- Mandatory**						Number of ECTC	**5**
Total number of instructional hours	**56**	Total number of hours allocated to individual study		**69**		Total number of hours per semester	**125**

Faculty	**PHYSICS**		Total number of hours in curriculum per semester **70=14 weeks X 2 hours course +14 weeks X 2 hours laboratory**				
Department	**Electricity and Biophysics**						
Main Domain Science, arts, culture	**Science**						
Bachelor Study Program	**Physics**		**Total****	**C**	**R**	**L**	**P**
Direction of study	**F, FI, BF, FM**			**28**		**28**	

** **C**-Course, **R**-Recitation, **L**-Lab work, **P**-Project, or Practical work

Prerequisite Disciplines	Required	Geometry, Algebra, Mathematical Analysis, Classical Mechanics, Analytical Mechanics, Molecular Physics, Equations of Mathematical Physics, Classical Statistics, Atomic Physics
	Recommended	Vectorial Analysis, Numerical Methods and Processing of Physical Data

SYLABUS	**Lectures Outline** *The magnetic field of steady-state currents.* The Biot-Savart-Laplace's law. Flux density. Applications. Integral and local forms of Ampere's law (magnetic circuital law). Local and integral forms of the magnetic flux law. The vector potential. Magnetic forces. The Lorentz force. The magnetic properties of matter. Magnetic moments. Diamagnetism. Paramagnetism. Ferromagnetism. *Electromagnetic induction.* Integral and local forms of Faraday's electromagnetic induction law. Self-induction. Mutual induction. Neumann's formula. Applications. *The alternating current (AC).* Generation of alternating current. Mean values and RMS values. RLC circuits (series and parallel connections) in alternating currents. Resonance phenomena and Thomson formula. The electrical power in alternating current. *Electromagnetic waves.* The Maxwell equations. The electromagnetic wave equation. The wave

	impedance. The theorem of electromagnetic energy. The power density flux (Poynting's vector). **Lab Works** - Biot-Savart-Laplace's Law. Measuring the magnetic flux of circular coils and solenoids. - Measurement of Earth's Magnetic Field. - Magnetic forces. - Specific charge of the electron. - Magnetic moment in the magnetic field. - Ferromagnetic hysteresis - The Hall Effect - The Faraday's electromagnetic induction law. - The transient regime in RLC cicuits. Damped oscillations. - Resonance phenomena in series and parallel AC circuits. - Coupled Oscillating Circuits. - The Ohm's laws for AC circuits. - Kirchhoff's laws for AC circuits. - Measurements with AC Wheatstone Bridge. - Power measurements in DC and AC circuits. - The power characteristics of a single phase transformer.
Equipment List	Experimental setups for hands-on direct learning, available in our Laboratory of Electricity and Magnetism.

The final evaluation will include:	**Percent in % {Total=100%}**
- Examination (final evaluation).	**50%**
- Hands-on Lab test & quiz.	**20%**
- Final answers to mid-term examination (written).	**20%**
- Homework, written tests and quizzes during recitation class.	**10%**

Final evaluation methods, E/V. { ex: Written test, Oral examination on topics covered by lectures, Individual Colloquium, or Group Project, etc.}.

Written test & Oral examination

Minimal requirements for mark 5 (10 point scale)	**Requirements for mark 10 (10 point scale)**
- Mandatory attending: 50% lectures and all lab activities. **- At least mark 5** in each stage of final exam.	**- Mandatory attending**: most lectures, all lab activities, and most recitation classes. **- Mark 10** in each stage of final exam.