CERTIFICATE IN PHOTONICS & LASERS TECHNICAL SPECIALIST

OPSC 110 ELECTRONICS FOR OPTICS AND PHOTONICS I

Contact hours: Forty-five (45) lecture hours & sixty (60) laboratory hours – 5 Credit

Prepared by: **Dr. Andrés Díaz – 2014**
Revised by: Dr. Jonathan Friedman, Dr. Andrés Díaz
María C. Ortiz, Dean School of Environmental Affairs - 2015

Course Description: Electronics for Optics and Photonics I is the first of two courses that provide basic coverage of electricity and electronics fundamentals. This first part provides the student with an understanding of the basics of DC circuit theory and laboratory practice, including basic electrical concepts, electronic components, basic laws, and the use of measuring devices. It also introduces the student to the industry-standard Multisim simulation environment and the LabVIEW development environment. Requirements OPSC 100.

Competences / Objectives:

At the end of the course, the student will develop and apply the skills to:

1. Understand basic electrical concepts of voltage, resistance, current, and power in DC circuits.
2. Understand DC circuits by using schematic diagrams and be able to perform tests and measurements.
3. Safely work with electronic components and be aware of the risks involved and how to minimize them.
4. Use industry-standard simulation and development environments such as Multisim and LabVIEW.
5. Recognize the importance of electronics and its use in different industries to address the needs of society.
6. Access information sources related to electronics and photonics effectively and use this information ethically and legally.

Course Content:

a. Survey of Electronics and Electricity
   - The System Concept and Basic System Functions
   - Electronic System Example
   - Structure of Matter
   - Electrostatic Charges
   - Static Electricity
   - Electric Current

b. Resistors and Ohm's Law
   - Volts, Ohms, and Amperes
   - Components, Symbols, and Diagrams
   - Resistor Color Codes
   - Electrical Force (Voltage)

Measuring Voltage, Current, and Resistance
Ohm's Law
Examples

c. Series and Parallel Circuits
Characteristics of Series Circuits
Examples of Series Circuits
Equivalent Resistance in Series Circuits
Characteristics of Parallel Circuits
Examples of Parallel Circuits
Equivalent Resistance in Parallel Circuits
Example of Combination Circuits
Voltage Dividers
Current Dividers
Procedure for Solving Series-Parallel Circuits

d. Network Theorems
Kirchoff's Laws
Examples and Problems
Thevenin Equivalent Circuits
Norton Equivalent Circuits

e. Conductors, Insulators, and Semiconductors

f. Batteries

g. Magnetism
Permanent Magnets
Magnetic Field Around Conductors
Magnetic Field Around a Coil
Electromagnets
Ohm's Law for Magnetic Circuits

h. Analog and Digital Multimeters
Measuring Voltage, Current, and Resistance
Analog Multimeters
Digital Multimeters

i. DC Troubleshooting

j. Capacitors and Inductors
Capacitance
Series and Parallel Capacitors
Inductance
Series and Parallel Inductors
RC Circuits and RC Time Constant
RL Circuits and L/R Time Constant
RLC Circuits and Resonance

LABORATORY - ELECTRONICS FOR OPTICS AND PHOTONICS I

The Electronics for Optics and Photonics courses prepare the student to understand the basics of DC and AC circuits and systems, and to apply these concepts to the area of Photonics. This first course focuses on DC Circuits and also introduces the student to industry-standard tools such as Multisim and LabVIEW, which he is likely to encounter in a research or industrial environment. At the end of the first course, the student will understand and will have the skills to safely operate electronic equipment (DC Circuits).

Laboratory Content

a. Introduction to Multisim and LabVIEW Environments

b. Ohm's Law

c. Voltage Divider and Resistance Bridge

d. Kirchoff's Laws

e. Thevenin and Norton Equivalent Circuits

f. Series and Parallel Capacitors

g. Capacitance and RC Circuits

h. Inductance and RL Circuits

i. RLC Circuits

Grading Policy:

30%	Two (2) partial exams
20%	Homework and class presentations
30%	Laboratory logbook
20%	One (1) comprehensive final exam

The learning assessment policy and related tools may be accessed at: http://www.suagm.edu/umet/vicerrectoria_opai_papara.asp

Textbook: Frenzel, L. (2013). *Contemporary Electronics: Fundamentals, Devices, Circuits, and Systems*. (1st ed., p. 848). USA: WCB/McGraw-Hill.

References:

a. Printed Resources

Chen, W. (2005). *The Electrical Engineering Handbook*. Boston: Elsevier Academic Press.

Karris, S. T. (2012). *Electronic Devices and Amplifier Circuits: With MATLAB*. Fremont, California, USA: Orchard Publications.

National Instruments, Carballo, L., Ulloa, D. & Garro, F. (n.d.). *Laboratory Exercises for Analog and Digital Courses using NI ELVIS II and NI Multisim.* (p. 150). National Instruments Corporation.

Shields, T. (n.d.). *Practical Teaching Ideas With Multisim.* 11 (8th ed., p. 300). National Instruments Corporation.

b. Audiovisual Resources

Almedasur. [almedasur]. (2011, August 16). *Voltage Measurement using NI ELVIS II - Part 1.* [Video file]. Retrieved from http://youtu.be/2fZiepOpbE8

National Instruments. (Producer). (2014a). *NI ELVIS Guided Tour: An Introductory Overview* [Video file]. Retrieved from http://www.ni.com/video/645/en/

National Instruments. (Producer). (2014b). *NI ELVIS Guided Tour: The NI Electronics Education Platform* [Video file]. Retrieved from http://www.ni.com/video/1141/en/

National Instruments. (Producer). (2014c). *User Solutions* [Video file]. Retrieved from http://us.ni.com/academic/user-solutions

Students with Special Needs (ADA):

Students receiving Vocational Rehabilitation services, who present evidence, should communicate with his/her professor at the beginning of the semester to arrange for reasonable accommodations and the necessary assistance equipment. Any student needing any special accommodations should communicate these needs to the professor during the first week of class.

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