CERTIFICATE IN PHOTONICS & LASERS TECHNICAL SPECIALIST

OPSC 103 LASER SYSTEMS AND APPLICATIONS II

Contact hours: Thirty (30) lecture hours & thirty (30) laboratory hours – 4 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: This is the second of two courses covering more advanced concepts in photonics and the operating principles, output characteristics, diagnostics, and applications for the most widely used laser types. These are described and classified according to their active medium, output wavelength, and applications. This second course covers diode lasers, Argon-Ion laser, Nd:YAG lasers, and laser systems integration. Their operation and the measurement of beam parameters will be covered in the laboratory session. Requirements OPSC102.

Competences / Objectives:

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

1. Understand why some lasers are appropriate for certain applications.
2. Identify which laser systems are used in various technology areas.
3. Select one or two types of lasers that are suitable for a particular application.
4. Read and understand specifications for commercially available laser systems.
5. Describe what are the facility requirements, utility services and safety requirements for installing a commercially available laser system in a commercial, laboratory, or industrial setting.
6. Measure the output characteristics of a laser.
7. Engage in basic troubleshooting of laser equipment.
8. Recognize the applications of the specific types of lasers studied to different industries and the used of these systems to address the needs of society at large.
9. Access information sources related to photonics and lasers effectively and use this information ethically and legally.

Course Content:

a. Diode Lasers and Their Applications
Energy Transfer in Semiconductor Lasers
Basic Semiconductor Laser Design
Output Characteristics of Semiconductor Lasers
Materials Used in Semiconductor Lasers
Developments in Semiconductor Lasers
Damage Mechanisms and Prevention of Damage
Applications

b. Argon-Ion Lasers and Their Applications
- Energy Transitions in Ion Lasers
- Ion Plasma Tube Design
- Operating Parameters
- Optical Cavities
- General Characteristics
- Applications

c. Nd:YAG Lasers and Their Applications
- CW Nd:YAG Lasers
- Pulsed Nd:YAG Lasers
- Nd:YAG Laser Applications

d. Systems Integration in Photonics
- Sample Systems
- System Integration
- System Integration Steps

LABORATORY - LASER SYSTEMS AND APPLICATIONS II

This second Laser Systems and Applications course will introduce the student to the theory and practice of three of the most common types of lasers (diode, Argon-Ion, and Nd:YAG), and to the topic of integration of laser systems. At the end of the course, the student will understand the principles of laser operation, safety guidelines, measurement of output beam characteristics, basic troubleshooting, and applications. This will allow the student to understand and operate lasers in research, commercial, and industrial settings, and will give him or her the skills to choose appropriate laser systems and the knowledge to setup, operate, and understand their value as part of more complex integrated systems.

Laboratory Content

a. Diode Laser Operation and Measurements

b. Argon-Ion Laser Operation and Measurements
- Safety Procedures
- Alignment of an Open-Cavity HeNe Laser

c. Nd:YAG Laser Operation and Measurements
- Output Characteristics of a CW Nd:YAG Laser System
- Output Characteristics of a Pulsed Nd:YAG Laser System

d. Systems Integration: Developing a Fiber-Optic Communication System

Grading Policy:

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

Textbook: National Center for Optics and Photonics Education OP-TEC. (2014). *Laser Systems and Applications*. Waco, TX: OP-TEC.

References:

a. Printed Resources

DeCusatis, C., & DeCusatis, C. S. (2006). *Fiber Optic Essentials*. Amsterdam: Elsevier/Academic Press.

Desmet, E., & Thys, M. (2011). Laser Beams : *Theory, Properties, and Applications.* Hauppauge, N.Y.: Nova Science Publishers.

Ghafouri-Shiraz, H. (2004). *The Principles of Semiconductor Laser Diodes and Amplifiers : Analysis and Transmission Line Laser Modeling*. London: Imperial College Press.

b. Audiovisual Resources

OP-TEC. (Producer). (2014). Laser Systems and Applications. Course 2: Laser Systems and Applications. [Video file]. Retrieved from http://optecvideo.opteccrm.org/laser-systems-and-applications/lab-videos/index.html

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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