CERTIFICATE IN PHOTONICS & LASERS TECHNICAL SPECIALIST

OPSC 100 MATHEMATICS FOR OPTICS AND PHOTONICS

Contact hours: Forty-five (45) – 3 Credit

Prepared by: **Dr. Andrés Díaz – 2014**
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Course Description: In this course students will review and develop the mathematics skills required for the technical certificate in Photonics and Lasers. To help aspiring photonics technicians begin their studies with adequate math skills, this course pulls together topics in numerical representation, usage and conversion of physical units, algebra, geometry, trigonometry, and phasors, applying those skills to specific, real-world optics and photonics scenarios. At the same time, students will become acquainted with the terminology used to describe electromagnetic waves, electromagnetic energy, and laser and optical fiber systems.

Competences / Objectives:

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

1. Make simple arithmetic calculations such as those used in optics and photonics.
2. Make basic algebraic calculations and manipulations.
3. Make geometric diagrams with specific angles and measures, including scale drawings.
4. Measure angles and dimensions.
5. Make basic linear and polar plots.
6. Carry out basic trigonometric operations.
7. Calculate exponents, logarithms.
8. Calculate vector parameters using both trigonometric functions and complex numbers.

Course Content:

a. Scientific Notation

Photonics scenario involving scientific notation and numerical representation
Basics of Scientific Notation
Cases: numbers greater than 1; numbers less than 1; engineering notation
Practice exercises

b. Unit Conversion

Photonics scenario involving unit conversion
Basics of Units
Practice exercises
Introductory Algebra
Photonics scenario involving introductory algebra
Formulas and mathematical representation of statements

Order of operations
Practice exercises
Powers and Roots
Photonics scenario involving powers and roots
Powers: base and exponents
Roots
Practice exercises

c. Ratio and Proportion
Photonics scenario involving ratio and proportion
What is ratio?
What is percent?
What is a proportion?
Practice exercises

d. Exponents and Logarithms
Photonics scenario involving exponents and logarithms
Basics of exponents and logarithms
Common and natural logarithms
Practice exercises

e. Graphing in Rectangular Coordinates
Photonics scenario involving graphing in rectangular coordinates
Basics of graphing in rectangular coordinates
Quadrants
Reading graphs
Drawing graphs
Practice exercises

f. Geometry
Photonics scenario involving geometry
Parallel and perpendicular lines
Angles
Triangles
Practice exercises

g. Angle Measures in Two and Three Dimensions
Photonics scenario involving angle measures in two and three dimensions
Radians and degrees
Solid Geometry: solid angle, steradians, using solid angles
Practice exercises

h. Trigonometry
Photonics scenario involving trigonometry
Key trigonometry concepts
Applications of trigonometry
Practice exercises

i. Special Graphs
Photonics scenario involving special graphs
Graphs of exponentials
Polar coordinates: representation; conversion to/from rectangular coordinates
Practice exercises

j. Representation of sinusoidal functions

Photonics scenario involving sinusoidal functions
Mathematical representation of sinusoids: amplitude, time, period, angular frequency, phase angle, time shift
Power of sinusoidal signals
Important measurements: average value, effective value, RMS value, average power

k. Complex Numbers

Representation of complex numbers in the complex number plane
Representation of complex numbers as phasors on a polar coordinate system
Conversion between rectangular and polar forms
Operations between complex numbers
Phasors

Grading Policy:

30% Homework, attendance, and class & Blackboard discussion forum participation
40% Two (2) partial exams
30% One (1) comprehensive final exam

Textbook:

National Center for Optics and Photonics Education OP-TEC and University of Central Florida. (2015). Essential Mathematics for Engineering Technicians.

References:

a. Printed Resources

Barrio Estévez, L. d. (2005). *Matemáticas*. [edition, Laura del Barrio Estévez]. Barcelona: Spes - Biblograf, 2005.

Bello, I. (2009). *Matemáticas básicas universitarias*. México: McGraw Hill, c2009.

Escudero Trujillo, R., & Rojas Alvarez, C. (2010). *Matemáticas básicas*. [electronic resource]. Bogotá: Ediciones de la U, 2010.

National Center for Optics and Photonics Education OP-TEC. (2014). *Mathematics for Photonics Education*. Waco, TX: Cord Communications.

Tussy, A. S., Gustafson, R. D., González Guzmán, A., & Ramírez Grycuk, E. (2007). *Matemáticas básicas.* México, D.F.: Cengage Learning, c2007.

b. Audiovisual Resources

CORD. (Producer). (2010). *Mathematics for Photonics Education: Lessons presented by John Chamberlain*, CORD. [Video file]. Retrieved from http://optecvideo.opteccrm.org/mpt-videos/

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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