STATE UNIVERSITY OF NEW YORK !
COLLEGE OF TECHNOLOGY !
CANTON, NEW YORK !

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
PHYS 301 - INTRODUCTION TO PHOTONICS

Created by: Feng Hong

Updated by: Feng Hong

Canino School of Engineering Technology !

Department: PHYSICS !

Semester/Year: FALL/2018 !

A. **TITLE**: Introduction to Photonics

B. **COURSE NUMBER:** PHYS 301

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 3
 # Lecture Hours: 3 **per week**
 # Lab Hours: **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER !
***If course satisfies more than one*:** GER !

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

This course explores the production and nature of light including: the laws of reflection and refraction, theory of image formation, principles of wave optics (including interference, diffraction and polarization), fundamentals of fiber optic theory, principles of lasers and laser safety, and the basics of holography with image processing. Throughout the course, emphasis is placed on applications of photonics in medicine, transportation, manufacturing, communications, environmental monitoring and consumer devices.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

PHYS 132 (University Physics II) or permission of instructor

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
a. Choose basic principles of physics that relate to the field of photonics	N/A	N/A	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W CA Subsets Subsets
b. Integrate physics concepts of light, geometric and wave optics, lasers, fiber optics, holography as they apply to their practical applications in photonics	N/A	N/A	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W PS Subsets Subsets
c. Calculate the polarization and coherence of light waves	N/A	N/A	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W PS Subsets Subsets
d. Use algebra to describe the behavior of optical sources and detectors	N/A	N/A	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W PS Subsets Subsets
e. Describe both mathematically and diagrammatically the propagation of light through optical fibers and modulators	N/A	N/A	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W PS Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator !

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

N/A

L. REFERENCES:

Robert O. Naess (2001). Physics curriculum: Optics for Technology Students. Upper Saddle River, NJ: Prentice-Hall.

M. EQUIPMENT: None ☐ **Needed:** Existing physics laboratory equipment will be used.

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

- **Exams**
- **Homework**
- **Quizzes**
- **Projects**

P. DETAILED COURSE OUTLINE:

I. Introduction to Photonics
- **A. What Photonics is.**
- **B. Applications in Our Daily Lives.**

II. Introduction to Light

III. Light Sources

IV. Geometrical Optics
- **A. Light as a Ray.**
- **B. Law of Reflection including Plane Mirrors.**
- **C. Law of Refraction including Optical Fiber Applications.**
- **D. Prisms and Thin Lenses.**

V. Aberration Theory

VI. Principles of wave optics
- **A. Interference and Interference Applications.**
- **B. Diffraction and Diffraction Gratings.**
- **C. Polarization Principles.**

VII. Interferometers

VIII. Detectors

- **A. ! P-n junctions.**
- **B. ! Rate equations.**

IX. Introduction to Lasers

- **A. ! Optical gain**
- **B. ! Gain Saturation**
- **C. ! Optical Detectors with Low and High Power Laser Applications in Photonics**
- **D. ! Laser Safety**

X. Fiber Optics

- **A. ! Optical Fiber Construction, System Components and Characteristics.**
- **B. ! Optical Fiber Types and their Properties.**
- **C. ! Optical Fiber Light Sources, Optical Sensors and Connectors.**
- **D. ! Optical Fiber Measurement and Testing Terminology.**
- **E. ! Fiber Optic Communications and Non-Communication Fundamentals and Applications.**

IX. Basics of holography with image processing.

- **A. Theory and Basic Principles.**
- **B. Image and Optical Signal Processing with Applications in Photonics.**

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐