A. **TITLE:** Introduction to Photonics

B. **COURSE NUMBER:** PHYS 301

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 weeks

F. **SEMESTER(S) OFFERED:** Fall/Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   3 lecture hours per week

H. **CATALOG 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.

I. **PRE-REQUISITES/CO-REQUISITES:**
   a. Pre-requisite(s): PHYS 132 (University Physics II) or PHYS 122 (College Physics II) or permission of instructor
   
   b. Co-requisite(s): None

J. **GOALS (STUDENT LEARNING OUTCOMES):**
   By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tr>
<td>a. Choose basic principles of physics that relate to the field of photonics</td>
<td>1. Communication 2. Crit. Thinking 3. Prof. Competence</td>
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<td>b. Integrate physics concepts of light, geometric and wave optics, lasers, fiber optics, holography as they apply to their practical applications in photonics</td>
<td>1. Communication 2. Crit. Thinking 3. Prof. Competence</td>
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<td>d. Use algebra to describe the behavior of optical sources and detectors</td>
<td>1. Communication 2. Crit. Thinking 3. Prof. Competence</td>
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<tr>
<td>e. Describe both mathematically and diagrammatically the propagation of light through optical fibers and modulators</td>
<td>1. Communication 2. Crit. Thinking 3. Prof. Competence</td>
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K. **TEXTS:**

L. **REFERENCES:** N/A

M. **EQUIPMENT:** Existing physics laboratory equipment will be used.

N. **GRADING METHOD:** A-F

O. **MEASUREMENT CRITERIA/METHODS:**
- Exams
- Homework
- Quizzes
- Projects

P. **DETAILED COURSE OUTLINE:** (must use the outline format listed below)

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
   B. Optical Fiber Types and their Properties.
   C. Optical Fiber Light Sources, Optical Sensors and Connectors.
   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. **LABORATORY OUTLINE:** N/A