ROCHESTER INSTITUTE OF TECHNOLOGY
COURSE OUTLINE FORM

COLLEGE OF SCIENCE

Center for Imaging Science

NEW COURSE (COS- IMGS-789): Special Topics: Optical Component, System Design and Performance Evaluation

1.0 Course Designations and Approvals

Required course approvals:	**Approval request date:**	**Approval granted date:**
Academic Unit Curriculum Committee	10/8/2014	10/8/2014
College Curriculum Committee		

Optional designations:	**Is designation desired?**		***Approval request date:**	****Approval granted date:**
General Education:		No		
Writing Intensive:		No		
Honors		No		

2.0 Course information:

Course title:	Optical Component, System Design and Performance Evaluation
Credit hours:	3
Prerequisite(s):	Geometric Optics (IMGS 321) or Optics for Imaging (IMGS 633) or Modern Optics for Engineers (EEEE-505&705) or Physical Optics (IMGS 322 or PHYS 365)**,** or instructor permission.
Co-requisite(s):	
Course proposed by:	Jie Qiao
Effective date:	January 26, 2015

	Contact hours	**Maximum students/section**
Classroom	2 lectures, 75 minutes each	20
Software trainings, project preparations	75-minute	20, need to be a single session, a room that has power plugs for charging laptops are required.
Studio		
Other (specify)		Need to provide students with access to OSLO/ZEMAX/FRED design software, Windows operating system is required

2.a Course Conversion Designation* (Please check which applies to this course).**
*For more information on Course Conversion Designations please see page four.

	Semester Equivalent (SE) Please indicate which quarter course it is equivalent to:
	Semester Replacement (SR) Please indicate the quarter course(s) this course is replacing:
☑	**New**

2.b Semester(s) offered (check)

Fall	Spring ☑	Summer	Other

All courses must be offered at least once every 2 years. If course will be offered on a bi-annual basis, please indicate here:

2.c Student Requirements

Students required to take this course: (by program and year, as appropriate)
Students who might elect to take the course: Undergraduate or graduate students from Center for Imaging Science, Motion Picture Science, Physics Department, Microsystem / Microelectronics.

In the sections that follow, please use sub-numbering as appropriate (eg. 3.1, 3.2, etc.)

3.0 Goals of the course (including rationale for the course, when appropriate):

This course will provide the students with a firm understanding of the principles fundamental to optical system specification, design and evaluation. Upon completion of this course, students will gain conceptual understanding of typical optical components, optical systems, optical aberrations, and imaging. They will be able to specify, access, and analyze typical optical components and systems aided with commercial optical design software.

4.0 Course description (as it will appear in the RIT Catalog, including pre- and co-requisites, and quarters offered). Please use the following format:

Course number: IMGS-789
Name of Course: Optical Component, System Design and Performance Evaluation

The course will build on Geometric and Imaging Optics with primary objectives to teach critical optics and system concepts and skills to specify, design, simulate, and evaluate optical components and systems. A modern optical design program and various types of optical systems will be used to illustrate how to solve real-world optical engineering problems. The course is not a traditional lens design course which usually focuses on designing and optimizing individual lens elements. Instead the course will emphasize on analyzing systems which are often made with off-the-shelf optical components.

(Prerequisites: Geometric Optics (IMGS 321) or Optics for Imaging (IMGS 633) or Modern Optics for Engineers (EEEE-505&705), or Physical Optics (IMGS 322 or PHYS

365) or instructor permission.) **Class 3, Credit 3 (S).**

5.0 Possible resources (texts, references, computer packages, etc.)

Rober E. Fischer / Biljana Tadic – Galeb, Optical System Design, SPIE Press Book, Bellingham, WA

Smith W., Modern Lens Design, SPIE Press Book, Bellingham, WA

ZEMAX optical system design software or equivalent.

6.0 Topics (outline):

6.1 Basic optics and optical system specifications
6.2 Access optical components and systems with computer-based optical modeling software(s)
6.3 Optical system performance and computer evaluation: resolution, transvers ray aberration curves, spot diagrams, encircled energy, MTF
6.4 Geometrical optics and paraxial ray tracing
6.5 Concept of optical path difference and wave aberration polynomial
6.6 Diffraction, aberrations, and image quality
6.7 Review of specific geometrical aberrations and how to get rid of them
6.8 Spherical and aspheric surfaces
6.9 Design forms: Refractive, Reflective, Diffractive, Mirror, Prisms
6.10 Typical optical systems: Telescopes
6.11 Diffractive Optics and applications

7.0 Intended course learning outcomes and associated assessment methods of those outcomes (please include as many Course Learning Outcomes as appropriate, one outcome and assessment method per row).

Course Learning Outcome	Assessment Method
7.1 Demonstrate a solid understanding to principles fundamental to specifying, designing and analyzing optical components, systems.	Homework and exams
7.2 Demonstrate the ability to work in the field of optical engineering or do research that requires specifying / designing / building / analyzing various types of optical components and systems.	Homework and/or projects using optical modeling software(s).
7.3 Demonstrate the optical modeling skills and apply the optics knowledge learned from this course and from Geometric Imaging Optics / Physical Optics / Modern Optics to real-world optical system and instrumentation problems.	Projects and presentations.

8.0 Program outcomes and/or goals supported by this course

This course will provide optical component, system design and evaluation knowledge and skills to solve problems in optical science and engineering.

This course will prepare IMGS / Microsystem / Microelectronics / Physics undergraduate and graduate students to pursue a career in optical engineering. This course will also provide a viable curriculum element and pave the path to create a sustainable Master degree in Optical Science and Engineering or Photonics.

9.0

N/A	General Education Learning Outcome Supported by the Course, if appropriate	Assessment Method
Communication		
	Express themselves effectively in common college-level written forms using standard American English	
	Revise and improve written and visual content	
	Express themselves effectively in presentations, either in spoken standard American English or sign language (American Sign Language or English-based Signing)	
	Comprehend information accessed through reading and discussion	
Intellectual Inquiry		
	Review, assess, and draw conclusions about hypotheses and theories	
	Analyze arguments, in relation to their premises, assumptions, contexts, and conclusions	
	Construct logical and reasonable arguments that include anticipation of counterarguments	
	Use relevant evidence gathered through accepted scholarly methods and properly acknowledge sources of information	
Ethical, Social and Global Awareness		
	Analyze similarities and differences in human experiences and consequent perspectives	
	Examine connections among the world's populations	
	Identify contemporary ethical questions and relevant stakeholder positions	
Scientific, Mathematical and Technological Literacy		
	Explain basic principles and concepts of one of the natural sciences	
	Apply methods of scientific inquiry and problem solving to contemporary issues	
	Comprehend and evaluate mathematical and statistical information	
	Perform college-level mathematical operations on quantitative data	
	Describe the potential and the limitations of technology	
	Use appropriate technology to achieve desired outcomes	
Creativity, Innovation and Artistic Literacy		
	Demonstrate creative/innovative approaches to course-based assignments or projects	
	Interpret and evaluate artistic expression considering the cultural context in which it was created	

10.0 Other relevant information (such as special classroom, studio, or lab needs, special scheduling, media requirements, etc.)

10.1	Smart/electronic white-board in classroom and computer projection equipment.
10.2	Require every student to be able to access windows operating systems and optical design software.
10.3	Require a windows server at the Center for Imaging Science to host the site license(s)
10.4	Require a single 75-minute session for software training and project preparation. Access to power outlets for students to charge their laptops is required.
10.5	Laptop with a windows operating environment is required for each enrolled student.