ROCHESTER INSTITUTE OF TECHNOLOGY
COURSE OUTLINE FORM

COLLEGE OF SCIENCE

Chester F. Carlson Center for Imaging Science

NEW COURSE: COS-IMGS-341- Interaction Between Light and Matter

1.0 Course Approvals

Required course approvals:	**Approval Requested Date:**	**Approval Granted Date:**
Academic Unit Curriculum Committee	9/1/2010	9/14/2010
College Curriculum Committee	12/1/2010	12/7/2010

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

2.0 Course information:

Course title:	Interaction Between Light and Matter
Credit hours:	3
Prerequisite(s):	COS-PHYS-213
Co-requisite(s):	none
Course proposed by:	Rich Hailstone
Effective date:	Fall 2013

	Contact hours	**Maximum students/section**
Classroom	3	30
Lab		
Studio		
Other (specify)		

2.1 Course Conversion Designation (Please check which applies to this course)

x	Semester Equivalent (SE) Please indicate which quarter course it is equivalent to: 1051-313 Interaction Between light & Matter
	Semester Replacement (SR) Please indicate the quarter course(s) this course is replacing:
	New

2.2 Semester(s) offered (check)

Fall	Spring x	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:

2.3 Student Requirements

Students required to take this course: (by program and year, as appropriate) Imaging Science majors
Students who might elect to take the course: Students who satisfy the prerequisites

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

To demonstrate a basic knowledge of atomic, molecular, and solid state structure and be able to relate these structural features to light absorption and its consequences.

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:

COS-IMGS-341 Interaction Between Light & Matter This course introduces the principles of how light interacts with matter. The principles of atomic physics as applied to simple atoms are reviewed and extended to multi-electron atoms to interpret their spectra. Molecular structure and spectra are covered in depth, including the principles of lasers. The concepts of statistical physics concepts are introduced and applied to the structure of crystalline solids, their band structure and optical properties. These concepts are then used to understand electronic imaging devices, such as detectors. (COS-PHYS-213) **Class 3, Credit 3 (S)**

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

5.1 Kenneth Krane, *Modern Physics*, John Wiley and Sons, New York, NY
5.2 Instructor course notes

6.0 Topics (outline):

6.1 Atomic Physics
- 6.1.1 Hydrogen atom
- 6.1.2 Radial probability densities
- 6.1.3 Angular momentum and probability densities
- 6.1.4 Intrinsic spin
- 6.1.5 Energy levels and spectroscopic notation
- 6.1.6 Fine structure
- 6.1.7 Pauli exclusion principle
- 6.1.8 X rays
- 6.1.9 Optical spectra

6.2 Molecular Structure and Spectra
- 6.2.1 Hydrogen molecule and covalent bond
- 6.2.2 Molecular vibrations
- 6.2.3 Molecular Spectra –absorption and emission
- 6.2.4 Lasers

6.3 Statistical Physics
- 6.3.1 Maxwell-Boltzmann distribution
- 6.3.2 Quantum statistics
- 6.3.3 Fermi-Dirac statistics

6.4 Solids
- 6.4.1 Ionic and covalent solids
- 6.4.2 Band theory
- 6.4.3 Intrinsic and impurity semiconductors
- 6.4.4 Semiconductor devices
- 6.4.5 Optical Properties of Solids
- 6.4.6 Absorption and emission

6.5 Detectors
- 6.5.1 Single pixel detectors and their interaction with light
- 6.5.2 Charge-coupled devices (CCDs) and complementary metal-oxide semiconductors (CMOS) and their interactions with light

7.0 Intended course learning outcomes and associated assessment methods of those outcomes

Course Learning Outcome	Assessment 1	Assessment 2
7.1 Describe the factors governing light absorption by atoms.	Homework	Examinations
7.2 Explain how molecules interact with and emit light.	Homework	Examinations
7.3 Explain the principles and application of Fermi-Dirac statistics.	Homework	Examinations
7.4 Identify the structural aspects of solids that give rise to their energy levels.	Homework	Examinations
7.5 Describe how the structural aspects of solids determine their light absorption and emission.	Homework	Examinations
7.6 List the factors that determine how detectors and detector arrays interact with light.	Homework	Examinations

8.0 Program outcomes and/or goals supported by this course

8.1 Provides a knowledge base for understanding how light interacts with all forms of matter.
8.2 Apply knowledge of imaging systems, physics, mathematics, and digital processing to formulate, analyze, and solve practical problems in imaging science.

9.0

	General Education Learning Outcome Supported by the Course	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		
X	Explain basic principles and concepts of one of the natural sciences	Homework, Examinations
X	Apply methods of scientific inquiry and problem solving to contemporary issues	Homework, Examinations
	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.)

Smart classroom