ROCHESTER INSTITUTE OF TECHNOLOGY
COURSE OUTLINE FORM

COLLEGE OF SCIENCE

Chester F. Carlson Center for Imaging Science

NEW COURSE: COS-IMGS-723 - Remote Sensing: Spectral Image Analysis

1.0 Course Approvals

Required course approvals:	**Approval request date:**	**Approval granted date:**
Academic Unit Curriculum Committee	9/15/2010	9/30/2010
College Curriculum Committee	9/28/2011	10/11/2011

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:	Remote Sensing: Spectral Image Analysis
Credit hours:	3
Prerequisite(s):	IMGS-619 and IMGS-722, or permission of instructor
Co-requisite(s):	None
Course proposed by:	John Schott
Effective date:	Fall 2013

	Contact hours	**Maximum students/section**
Classroom	3	20
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: 1051-763 Remote Sensing: Spectral Image Analysis
	Semester Replacement (SR) Please indicate the quarter course(s) this course is replacing:
	New

2.2 Semester(s) offered (check)

Fall X	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: N/A

2.3 Student Requirements

Students required to take this course: Graduate students in Imaging Science Remote Sensing track

Students who might elect to take the course:
Non-matriculated students with undergraduate degrees in the Physical Sciences or Engineering with permission of Instructor. Graduate students in the College of Science or College of Engineering.

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

Provide a thorough exposure to spectral remote sensing image analysis techniques and methods, to model and assess end-to-end image fidelity in remotely sensed images.

4.0 Course description

IMGS-723 Remote Sensing: Spectral Image Analysis

This course is focused on analysis of high-dimensional remotely sensed data sets. It begins with a review of the properties of matter that control the spectral nature of reflected and emitted energy. It then introduces three mathematical ways to characterize spectral data and methods to perform initial analysis of spectral data to characterize and preprocess the data. These include noise characterization and mitigation, radiometric calibration, atmospheric compensation, dimensionality characterization, and reduction. Much of the course focuses on spectral image analysis algorithms employing the three conceptual approaches to characterizing the data. These analytical tools are aimed at segmentation, subpixel or pixel unmixing approaches and target detection including treatment of signal processing theory and application. There is also a significant emphasis on incorporation of physics based algorithms into spectral image analysis. The course concludes with an end-to-end treatment of image fidelity incorporating atmospheres, sensors, and image processing effects. (IMGS-619 and IMGS-722, or permission of instructor) **Class 3, Credit 3 (F)**

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

Schott, *Remote Sensing: The Image Chain Approach*, Oxford University Press, New York, NY.

6.0 Topics (outline):

6.1 Spectroscopic Image Analysis
- 6.1.1 Perspective on Spectral Data
- 6.1.2 Issues of Dimensionality and Noise
- 6.1.3 Geometric Approaches
- 6.1.4 Statistical Approaches
- 6.1.5 Spectral Features and Hybrid Approaches

6.2 Use of Physics Based Models

6.2.1 Thermal IR Analysis
6.2.2 Model Matching using Radiative Transport Models
6.2.3 Statistical Inversion Models
6.2.4 Physics Based Models for Algorithm Training
6.3 Weak Links in the Chain
6.3.1 Resolution Effects
6.3.2 Radiometric Effects
6.3.3 Spectral and Polarimetric Effects
6.3.4 Spatial, Spectral and Radiometric Tradeoffs
6.3.5 Image Quality Metrics
6.4 Synthetic Scene Generation

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

Course Learning Outcome	Homework	Exams
7.1 Differentiate between geometric, statistical and feature based models of spectral data	X	X
7.2 Solve for spectral anomalies in a spectral image cube	X	X
7.3 Solve for the likelihood of spectral targets in a spectral image cube	X	X
7.4 Model the propagation of an image fidelity metric through the image chain	X	X

8.0 Program outcomes and/or goals supported by this course

Prepares graduate students in science and engineering for careers in the field of remote sensing

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		
	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.)

Smart classroom