ROCHESTER INSTITUTE OF TECHNOLOGY
COURSE OUTLINE FORM

COLLEGE OF SCIENCE

Chester F. Carlson Center for Imaging Science

REVISED COURSE: COS-IMGS-211

1.0 Course Approvals

Required course approvals:	**Approval Requested Date:**	**Approval Granted Date:**
Academic Unit Curriculum Committee		
College Curriculum Committee		
Optional course designation approvals:		
General Education Committee		
Writing Intensive Committee		
Honors		

2.0 Course information:

Course title:	Probability and Statistics for Imaging
Credit hours:	3
Prerequisite(s):	COS-MATH-182 or COS-MATH-173 or equivalent
Co-requisite(s):	None
Course proposed by:	Rich Hailstone and Maria Helguera
Effective date:	September 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)

	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:
x	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) Second year students in imaging science
Students who might elect to take the course:

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

Provide students with the basic knowledge in probability and statistics required in other imaging science courses and research.

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-211 Probability and Statistics for Imaging Science This course is an introduction to probability and statistics. The first half of the course will cover probability distributions for discrete and continuous random variables, expectation, variance, and joint distributions. The second half of the course will cover point estimation, statistical intervals, hypothesis testing, inference, and linear regression. (P: COS-MATH-182 or COS-MATH-173 or equivalent) **Class 3, Lab 0, Credit 3 (Spring)**

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

5.1 Devore, *Probability and Statistics for Engineering and the Sciences* ,7th edition, Thomson, New York, 2008.
5.2 MatLab, MINITAB, DesignExpert

6.0 Topics (outline):

6.1 Discrete Random Variables and Probability Distributions
- 6.1.1 Random variables
- 6.1.2 Probability distributions for discrete RVs
- 6.1.3 Expectation
- 6.1.4 Example discrete probability distributions
- 6.1.5 Imaging applications

6.2 Continuous Random Variables and Probability Distributions
- 6.2.1 Probability density functions
- 6.2.2 Cumulative distribution functions and expected values
- 6.2.3 Normal distribution
- 6.2.4 Exponential and chi-squared distributions
- 6.2.5 Imaging applications

6.3 Joint Probability Distributions and Random Samples
- 6.3.1 Jointly distributed RVs
- 6.3.2 Expected values, covariance, and correlation
- 6.3.3 Statistics and their distributions
- 6.3.4 Distribution of the sample mean

6.3.5 Imaging applications

6.4 Point estimation
- 6.4.1 General concepts of point estimation
- 6.4.2 Methods of point estimation

6.5 Statistical Intervals Based on a Single Sample
- 6.5.1 Basic properties of confidence intervals
- 6.5.2 Large sample confidence interval
- 6.5.3 Intervals based on a normal population interval
- 6.5.4 Imaging applications

6.6 Tests of Hypotheses Based on a Single Sample
- 6.6.1 Hypotheses and test procedures
- 6.6.2 Tests about a population mean
- 6.6.3 Tests concerning a population proportion
- 6.6.4 P values
- 6.6.5 Imaging applications

6.7 Inferences Based on two Samples
- 6.7.1 z tests
- 6.7.2 Confidence intervals for a difference between two populations
- 6.7.3 Two-sample t test and confidence interval
- 6.7.4 Analysis of paired data
- 6.7.5 Imaging applications

6.8 Least Squares
- 6.8.1 Estimation with Least Squares
- 6.8.2 Fit to a straight line
  - 6.8.2.1 Minimizing χ^2.
  - 6.8.2.2 Error estimation
- 6.8.3 Fit to a polynomial
  - 6.8.3.1 Determinant solution
  - 6.8.3.2 Matrix solution
- 6.8.4 Maximum Likelihood
- 6.8.5 Testing the fit
  - 6.8.5.1 χ^2 test for goodness of fit
  - 6.8.5.2 Linear Correlation coefficient

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

Course Learning Outcome	**In class attendance and evaluation**	**Homework Assignments**

Demonstrate a knowledge of discrete and continuous random variables and their distributions, as well as their application in imaging.	X	X
Explain expectation, variance, covariance and correlation and their application in imaging.	X	X
Identify joint probability distributions and random sampling, and their application in imaging.	X	X
Describe point estimation and its methods.	X	X
Explain statistical intervals for a single sample and their application in imaging.	X	X
Demonstrate a knowledge of hypothesis testing and its application in imaging.	X	X
Explain inferences based on two samples and its application in imaging.	X	X
Illustrate how least squares regression is used to judge the appropriateness of a model in fitting experimental data.	X	X

8.0 Program outcomes and/or goals supported by this course

Prepares undergraduate students for advance imaging science courses.

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.)

9.1 Smart classroom

11.0 Supplemental information for Optional Course Designations: If the course is to be considered as writing intensive or as a general education or honors course, include the sections of the course syllabus that would support this designation.

11.1 General Education Committee:

Feedback to course proposers:

11.2 Writing Intensive Committee:

Feedback to course proposers:

Programform.doc
NYSED Documentation Form

Audience
This document is intended for all department chairs and program directors.

Summary

This document includes the information and required forms for submission of program to NYSED for semester conversion.

Change Log

Responsible	Date	Version	Short description
<your name here>	<date>	1	Document originator