REVISED COURSE: COS-IMGS-211

1.0 Course Approvals

<table>
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<tr>
<th>Required course approvals:</th>
<th>Approval Requested Date:</th>
<th>Approval Granted Date:</th>
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<tbody>
<tr>
<td>Academic Unit Curriculum Committee</td>
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<td>College Curriculum Committee</td>
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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 |

<table>
<thead>
<tr>
<th>Contact hours</th>
<th>Maximum students/section</th>
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<tbody>
<tr>
<td>Classroom</td>
<td>3</td>
</tr>
<tr>
<td>Lab</td>
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<tr>
<td>Studio</td>
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<tr>
<td>Other (specify)</td>
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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)

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
<th>Other</th>
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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:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>COS-IMGS-211</td>
<td>Probability and Statistics for Imaging Science</td>
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</table>

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.)


5.2 MatLab, MINITAB, DesignExpert

6.0 Topics (outline):

<table>
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<tr>
<th>Section</th>
<th>Topics</th>
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</table>
| 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 $\chi^2$.
      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 $\chi^2$ 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

<table>
<thead>
<tr>
<th>Course Learning Outcome</th>
<th>In class attendance and evaluation</th>
<th>Homework Assignments</th>
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3
| 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

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<tr>
<th>Responsible</th>
<th>Date</th>
<th>Version</th>
<th>Short description</th>
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<td>1</td>
<td>Document originator</td>
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