School of Mathematical Sciences

☑ New ☐ Revised COURSE: COS-MATH-251 Probability and Statistics I

1.0 Course designations and approvals:

<table>
<thead>
<tr>
<th>Required Course Approvals:</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Unit Curriculum Committee</td>
<td>4-08-10</td>
<td>4-15-10</td>
</tr>
<tr>
<td>College Curriculum Committee</td>
<td>11-01-10</td>
<td>11-16-10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Optional Course Designations:</th>
<th>Yes</th>
<th>No</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>✓</td>
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<tr>
<td>Writing Intensive</td>
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<td>✓</td>
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<tr>
<td>Honors</td>
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2.0 Course information:

Course Title: Probability and Statistics I
Credit Hours: 3
Prerequisite(s): COS-MATH-173 or -182 or -182a
Co-requisite(s): None
Course proposed by: School of Mathematical Sciences
Effective date: Fall 2013

<table>
<thead>
<tr>
<th>Contact Hours</th>
<th>Maximum Students/section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>3</td>
</tr>
<tr>
<td>Lab</td>
<td></td>
</tr>
<tr>
<td>Workshop</td>
<td></td>
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<tr>
<td>Other (specify)</td>
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</table>

2.1 Course conversion designation: (Please check which applies to this course)

☑ Semester Equivalent (SE) to: 1016-351
☐ Semester Replacement (SR) to:
☐ New

2.2 Semester(s) offered:

☑ Fall ☑ Spring ☑ Summer
☐ Offered every other year only ☐ Other
2.3 **Student requirements:**

**Students required to take this course:** (by program and year, as appropriate)

**Students who might elect to take the course:**
Students pursuing a minor in Mathematics or Statistics

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

3.1 To introduce the basic techniques of probability and descriptive statistics.

3.2 To introduce the basic discrete and continuous probability models.

3.3 To provide the background necessary for inferential statistics, mathematical modeling and related subjects.

3.4 To become aware of the applications of probability and descriptive statistics to real-world problems.

4.0 **Course description:** (as it will appear in the RIT Catalog, including pre- and co-requisites, semesters offered)

**COS-MATH-251 Probability and Statistics I**
This course introduces sample spaces and events, axioms of probability, counting techniques, conditional probability and independence, distributions of discrete and continuous random variables, joint distributions (discrete and continuous), the central limit theorem, descriptive statistics, interval estimation, and applications of probability and statistics to real-world problems. A statistical package such as Minitab or R is used for data analysis and statistical applications. (COS-MATH-173 or COS-MATH-182 or COS-MATH-182a) **Class 3, Credit 3 (F, S, Su)**

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


5.2 Miller, Freund and Johnson, *Probability and Statistics for Engineers*, Prentice Hall, Upper Saddle River, NJ.


6.0 **Topics: (outline)** Topics with an asterisk(*) are at the instructor’s discretion, as time permits

6.1 Descriptive Statistics

6.1.1 Numerical and graphical techniques

6.1.2 Univariate and bivariate data summaries

6.1.3 Measures of location and variability

6.1.4 Computer applications
6.2 Basic Probability Concepts
   6.2.1 Axiomatic probability
   6.2.2 Sample spaces
   6.2.3 Combinatorics
   6.2.4 Conditional probability: Bayes’ rule and the law of total probability
   6.2.5 Independent events

6.3 Discrete and Continuous Random Variables
   6.3.1 Probability mass function, probability density function
   6.3.2 Cumulative probability distribution function
   6.3.3 Expectation and variance of a random variable and functions of a random variable
   6.3.4 Chebyshev’s inequality

6.4 Specific Random Variable Families
   6.4.1 Discrete: Bernoulli, binomial, Poisson and Poisson process
   6.4.2 Continuous: uniform, exponential, normal, gamma, Weibull
   6.4.3 Relation among exponential, Poisson and gamma distributions
   6.4.4 Checking normality; normal probability plots

6.5 Joint Distributions and Random Samples
   6.5.1 Joint distributions: discrete and continuous
   6.5.2 Marginal and conditional distributions, independence
   6.5.3 Covariance, correlation of random variables; expectation of functions of random variables
   6.5.4 Linear combinations of random variables
   6.5.5 Central limit theorem

6.6 Interval Estimation – Single Population
   6.6.1 Construction of confidence intervals
   6.6.2 Confidence intervals for proportion, mean, and variance
   6.6.3 Prediction intervals and tolerance intervals
   6.6.4 Sample size determination
   6.6.5 Computer applications

7.0 Intended learning outcomes and associated assessment methods of those outcomes:
### Learning Outcomes

<table>
<thead>
<tr>
<th>Assessment Methods</th>
<th>Homework</th>
<th>Quiz/Exam/Final</th>
<th>Project</th>
<th>Computer Work</th>
<th>Class Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Explain the basic definitions, concepts, rules, vocabulary, and notation of probability</td>
<td>✓</td>
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<td>7.2 Demonstrate the necessary skills required to solve problems in probability</td>
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<tr>
<td>7.3 Explain the fundamentals of set probability, random variables, and probability distributions</td>
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<tr>
<td>7.4 Apply the basic ideas of probability, descriptive statistics and interval estimation</td>
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### 8.0 Program goals supported by this course:

8.1 To develop an understanding of the mathematical framework that supports engineering, science, and mathematics.
8.2 To develop critical and analytical thinking.
8.3 To develop an appropriate level of mathematical literacy and competency.
8.4 To provide an acquaintance with mathematical notation used to express physical and natural laws.
8.5 To produce graduates who can effectively use mathematics and/or statistics to model, analyze, and solve problems arising in science, engineering, business, and other disciplines.

### 9.0 General education learning outcomes and/or goals supported by this course:

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<tr>
<td>General Education Learning Outcomes</td>
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<tr>
<td>9.1 Communication</td>
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<tr>
<td>Express themselves effectively in common college-level written forms using standard American English</td>
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<tr>
<td>Revise and improve written and visual content</td>
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### General Education Learning Outcomes

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</table>

#### 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.)

None