ROCHESTER INSTITUTE OF TECHNOLOGY
COURSE OUTLINE FORM

COLLEGE OF SCIENCE

School of Mathematical Sciences

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

1.0 Course designations and approvals:

Required Course Approvals:	**Approval Request Date**	**Approval Grant Date**
Academic Unit Curriculum Committee	4-08-10	4-15-10
College Curriculum Committee	11-01-10	11-16-10

Optional Course Designations:	**Yes**	**No**	**Approval Request Date**	**Approval Grant Date**
General Education	✓			
Writing Intensive		✓		
Honors		✓		

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

	Contact Hours	**Maximum Students/section**
Classroom	3	35
Lab		
Workshop		
Other (specify)		

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)
Second-year Applied Statistics, Applied Mathematics, Computational Mathematics, Electrical Engineering, and Computer Engineering majors

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 courses emphasizes the application of elementary probability and statistics in problem-solving. Topics include 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, and interval estimation. 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.)

5.1 Devore, *Probability and Statistics for Engineering and the Sciences*, Brooks/Cole, Pacific Grove, CA.

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

5.3 Hines, Montgomery, Goldsman, Borror, *Probability and Statistics in Engineering*, Wiley, Hoboken, NJ.

5.4 Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, Academic Press, New York, NY.

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 Applications of discrete and continuous distributions
    - 6.4.1.1 Discrete: Bernoulli, binomial, Poisson and Poisson process
    - 6.4.1.2 Continuous: uniform, exponential, normal, gamma, Weibull
  - 6.4.2 Relation among exponential, Poisson and gamma distributions
  - 6.4.3 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 and interpretation 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	Assessment Methods				
	Homework	Quiz/Exam/Final	Project	Computer Work	Class Presentation
7.1 Explain the basic definitions, concepts, rules, vocabulary, and notation of probability	✓	✓			
7.2 Use ideas and techniques from the study of probability to solve problems	✓	✓			
7.3 Explain the fundamentals of set probability, random variables, and probability distributions	✓	✓			
7.4 Apply the basic ideas of probability, descriptive statistics and interval estimation	✓	✓			

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:

	General Education Learning Outcomes	Assessment Methods				
		Homework	Quiz/Exam/Final	Project	Computer Work	Class Presentation
9.1	**Communication**					
	Express themselves effectively in common college-level written forms using standard American English					

	General Education Learning Outcomes	Assessment Methods				
		Homework	Quiz/Exam/Final	Project	Computer Work	Class Presentation
	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					
9.2	**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					
9.3	**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					
9.4	**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					
9.5	**Creativity, Innovation and Artistic Literacy**					
	Demonstrate creative/innovative approaches to course-based assignments or projects					

	General Education Learning Outcomes	Assessment Methods				
		Homework	Quiz/Exam/Final	Project	Computer Work	Class Presentation
	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