COURSE: COS-MATH-655 Biostatistics

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>10-20-10</td>
<td>10-27-10</td>
</tr>
<tr>
<td>College Curriculum Committee</td>
<td>11-01-10</td>
<td>9-27-11</td>
</tr>
</tbody>
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<tr>
<th>Optional Course Designations:</th>
<th>Yes</th>
<th>No</th>
<th>Approval Request Date</th>
<th>Approval Grant Date</th>
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<tbody>
<tr>
<td>General Education</td>
<td></td>
<td>✓</td>
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<tr>
<td>Writing Intensive</td>
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<td>Honors</td>
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2.0 Course information:

- **Course Title:** Biostatistics
- **Credit Hours:** 3
- **Prerequisite(s):** Permission of instructor
- **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>
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<tbody>
<tr>
<td>Classroom</td>
<td>3</td>
</tr>
<tr>
<td>Lab</td>
<td></td>
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<tr>
<td>Workshop</td>
<td></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) to: 1016-719
- □ 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 the course:
Graduate students in Environmental Science

Students who might elect to take the course:
Graduate students in Bioinformatics, Biology, Biotechnology, or Chemistry. Students with a minor in Statistics. Applied or Computational Mathematics graduate students.

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

3.1 To introduce the topics in probability and statistics which are useful in biological and medical sciences.
3.2 To present selected probability models, with examples, commonly used in biostatistics.
3.3 To develop the statistical techniques useful for analyzing data in the fields of biological and medical science.
3.4 To relate the topics in probability and statistics covered in this course to some of the statistical computer packages (e.g., R, Minitab).

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

COS-MATH-655 Biostatistics
This course is an introduction to the probabilistic models and statistical techniques used in the analysis of biological and medical data. Topics include univariate and multivariate summary techniques, one and two sample parametric and nonparametric inference, censoring, one and two way analysis of variance, and multiple and logistic regression analysis. (Permission of instructor) Class 3, Credit 3 (F)

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

5.1 D’Agostino, Sullivan, Beiser, Introductory Applied Biostatistics, Thompson, Tampa, FL.
5.2 Pagano, Gavreau, Principles of Biostatistics, Duxbury, North Scituate, MA.
5.3 Zar, Biostatistical Analysis, Prentice Hall, Upper Saddle River, NJ.
5.4 Rosner, Fundamentals of Biostatistics, Thompson, Tampa, FL.
5.5 SPSS software, Chicago, IL.

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

6.1 Review of Descriptive Statistics (Univariate and Multivariate)
   6.1.1 Numerical and graphical summaries
   6.1.2 Computer techniques for data summary

6.2 Probability and Random Variables
   6.2.1 Rules and properties of probabilities
   6.2.2 Expected values and variances of probability distributions for random variables
6.2.3 The binomial, Poisson, normal, and exponential distributions
6.2.4 Applications in biostatistics

6.3 Statistical Analysis - One Sample
   6.3.1 Review of hypothesis testing and confidence intervals
   6.3.2 Parameters and parameter estimation, P-values
   6.3.3 Sample size determination
   6.3.4 Analysis of right censored data
   6.3.5 Applications in biostatistics

6.4 Statistical Analysis - Two Samples
   6.4.1 Independent samples
   6.4.2 Dependent samples
   6.4.3 Applications in biostatistics

6.5 Categorical Data
   6.5.1 Cross tabulation tables
   6.5.2 Diagnostic tests: sensitivity and specificity
   6.5.3 Chi-square tests (goodness of fit test, independence)
   6.5.4 Comparing risks in two populations

6.6 Analysis of Variance
   6.6.1 Fixed vs. random effects
   6.6.2 Evaluating treatment effects
   6.6.3 One-way and two-way models
   6.6.4 Multiple comparisons
   6.6.5 Repeated measures analysis of variance

6.7 Correlation and Regression
   6.7.1 Correlation analysis
   6.7.2 Simple linear regression
   6.7.3 Multiple regression
   6.7.4 Logistic regression

6.8 Nonparametric Procedures
   6.8.1 Two dependent samples
   6.8.2 Two independent samples
   6.8.3 Spearman correlation
   6.8.4 The Kruskal-Wallis test
7.0 Intended learning outcomes and associated assessment methods of those outcomes: Assessment methods with an asterisk(*) are at the instructor’s discretion

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Assessment Methods</th>
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<tbody>
<tr>
<td></td>
<td>Homework</td>
</tr>
<tr>
<td>7.1 Identify topics useful in biological science and medicine</td>
<td>✓</td>
</tr>
<tr>
<td>7.2 Recognize probability models useful in biological science and medicine</td>
<td>✓</td>
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<tr>
<td>7.3 Apply statistical models in biostatistics</td>
<td>✓</td>
</tr>
<tr>
<td>7.4 Develop statistical techniques useful for the analysis of data in biology and medicine</td>
<td>✓</td>
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<tr>
<td>7.5 Apply biostatistical computer packages</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.

9.0 General education learning outcomes and/or goals supported by this course: Not applicable

10.0 Other relevant information: (such as special classroom, studio, or lab needs, special scheduling, media requirements, etc.)

Computer lab and software: Excel, SPSS