Minnesota State University Moorhead

BIOL 275: Quantitative Biology

A. COURSE DESCRIPTION

Credits: 4

Lecture Hours/Week: 3

Lab Hours/Week: 37

OJT Hours/Week: *.*

Prerequisites:
BIOL 111 - Cell Biology AND MATH 127 - College Algebra AND BIOL 115 - Organismal Biology

Corequisites: None

MnTC Goals: None

The application of mathematics and statistics to biology. With lab that will emphasize computer applications. Two 1.15-hour lectures and one 3-hour lab each week.

B. COURSE EFFECTIVE DATES: 05/16/2011 - Present

C. OUTLINE OF MAJOR CONTENT AREAS

1. Course Introduction.
2. Functions & Graphs.
3. Biological Processes Featuring Linear, Power, & Exponential Functions.
4. Biological Processes Featuring Saturation.
5. Hump-Shaped Biological Processes: Polynomial, Sinusoidal, & Maximum Functions.
6. Confronting Functions with Data: Least Squares.
7. Nonlinear and Linear Regression Methods.
8. Model Selection Based on Least Squares.
9. The Meaning of Bias & Model Validation.
10. Modelling Biological Dynamics with Differential Equations.
11. Information Theoretic Model Selection: Akaike Information Criteria.
12. Akaike Weights & An Introduction to Inferential Statistics.
13. Populations, Samples, Confidence Intervals, & Basics of Sampling Design.
14. The Statistical Distribution, Poisson Regression, Hypothesis Testing, and P-values.
15. Comparing Two Groups: t-tests & Nonparametric Analogs
16. Comparing More Than Two Groups: One-Way ANOVA & Nonparametric Analogs.16
17. Experimental Design I: Two-Way ANOVA, Randomized Block Designs, and Repeated Measures.
18. Experimental Design II: ANOVA Interactions, More Repeated Measures, & ANCOVA.
19. Experimental Design III: Nested & Split-Plot Designs.
20. Statistics with Qualitative Responses: ChiSquare, Contingency Tables, & Fischers Exact Test.
21. Logistic Regression & Survivorship Analyses including Kaplein Meier Estimation.
22. Distance Measures & Cluster Analysis.
23. Indirect Gradient Analysis (NMDS, PCA, and PcoA).
24. Direct Gradient Analysis (RDA, db-RDA).
25. Biological Modeling I.
26. Biological Modeling II.
27. Biological Modeling III.

D. LEARNING OUTCOMES (General)

1. To learn quantitative vocabulary in biology applications.
2. To understand how mathematical functions interface with biology.
3. To expose students to computer applications for common math and statistics.
4. To communicate quantitative ideas effectively in writing, and in the construction of figures and tables.
5. To be able to choose appropriate statistical methods for applied biological problems.
6. To assist students in understanding mathematics and statistics in peer-reviewed biology papers.
7. To prepare students for quantitative assignments in advanced biology courses.

E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

None

F. LEARNER OUTCOMES ASSESSMENT

As noted on course syllabus

G. SPECIAL INFORMATION

None noted