**Advanced Statistics for Biologists**

**STT 814 Sections III & IV**

**Michigan State University**

**Spring, 2014**

COURSE:                               Statistics 814 – Advanced Statistics for Biologists

INSTRUCTOR:                      Dr. R.J. Tempelman

                                                Department of Animal Science

                                                1205J Anthony Hall

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GRADER:                               Mr. Sayan Dasgupta (dasgup13@stt.msu.edu)

OFFICE HOURS:                   **Tempelman:**   Monday 11:10 a.m.-11:30 p.m.

                                                                        Wednesday 11:10 a.m. – 11:30 p.m.

Thursday 3:20 p.m. - 4:00 p.m.

LECTURE:                             10:20-11:10    Mondays, Wednesdays, and Fridays

                                                Room 1260 Anthony Hall

SECTION 3 LAB:                   1:00 – 2:50 Thursdays, 1210 Anthony Hall

SECTION 4 LAB:                   3:00 – 4:50 Thursdays, 218 Natural Resources

TEXTS:

***Required****:*

       *Applied Linear Statistical Models, Fifth Edition* (2005) by M.H. Kutner, C.J. Nachtsheim, J. Neter, and W. Li., McGraw-Hill Irwin, New York  ISBN 0-07-238688-6

***Recommended:***

       *SAS System for Regression, Third Edition* (2000) by R.J. Freund and R.C. Littell.  SAS Publishing (<http://support.sas.com/publishing/bbu/companion_site/57313.html> ) **ISBN:978-1-58025-725-1**.

       *SAS System for Mixed Models, Second Edition* (2006) by R.J. Littell, G.A. Milliken, W.W. Stroup, R.D. Wolfinger, and O. Schabenberger. SAS Publishing (<http://support.sas.com/publishing/bbu/companion_site/59882.html> ) **ISBN: 978-1-59047-500-3**.

       *Analysis of Messy Data, Volume 1.  Designed Experiments*(2009) by G.A. Milliken and D.E. Johnson. CRC Press, Boca Raton, FL ISBN-13:978-1-58488-334-0. <http://www.crcnetbase.com.proxy1.cl.msu.edu/ISBN/978-1-58488-334-0>

       *Design and Analysis of Experiments with SAS* (2010) by John A. Lawson. Chapman and Hall/CRC Press, Boca Raton, FL. ISBN: 978-1-4200-6060-7

FREE ONLINE RESOURCES (TO MSU COMMUNITY):

     Applied Medical Statistics using SAS (2012) by Brian S. Everitt.  Chapman and Hall

o   (<http://www.crcnetbase.com.proxy1.cl.msu.edu/ISBN/978-1-4398-6797-6>)\

     Handbook of statistical analyses using SAS, Second Edition (2002) by Geoff Der & Brian S. Everitt.

o   <http://www.crcnetbase.com/isbn/978-1-58488-245-9>

     SAS and R Data Management, Statistical Analysis, and Graphics (2010) by Ken Kleinman & Nicholas J. Horton, CRC Press

o   <http://www.crcnetbase.com/isbn/978-1-4200-7057-6>

     SAS Programming, the One Day Course (2004) by Neil Spencer.

o   <http://www.crcnetbase.com/isbn/978-1-58488-409-5>

     Sharpening Your SAS Skills (2005) by Sunil Gupta and Curt Edmonds.

o   <http://www.crcnetbase.com/isbn/978-1-58488-501-6>

     Applied Linear Models with SAS (2010) by Daniel Zelterman.

o   <http://site.ebrary.com.proxy1.cl.msu.edu/lib/michstate/docDetail.action?docID=10399245>

     SAS Essentials: A Guide to Mastering SAS for Research by Alan C. Elliot and Wayne A. Woodward.

o   <http://site.ebrary.com.proxy2.cl.msu.edu/lib/michstate/docDetail.action?docID=10355241>

     SAS for Data Analysis: Intermediate Statistical Methods (2008) by Mervyn G. Marasinghe and [William J. Kennedy](http://link.springer.com.proxy2.cl.msu.edu/search?facet-author=%22William+J.+Kennedy%22) , Springer

o   <http://link.springer.com.proxy2.cl.msu.edu/book/10.1007/978-0-387-77372-8/page/1>

     Optimum Experimental Designs with SAS by A.C. Adkinson, A.N. Donov, and R.D. Tobias (2007), Oxford University Press

o   <http://site.ebrary.com.proxy2.cl.msu.edu/lib/michstate/docDetail.action?docID=10194254>

     Analysis of Correlated Data With SAS and R (2007), Third Edition by M . M . Shoukri and C . A . Pause, CRC Press.

o   <http://www.crcnetbase.com.proxy2.cl.msu.edu/ISBN/978-0-8493-1095-9>

GRADING PROCEDURE:

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| --- | --- |
| **Assessment** | **Percentage of Grade** |
| Hourly Test (~February 21, 2014) | 20 |
| Take-home Test (handed out early April, due within 48 hours) | 25 |
| (Bi)Weekly Laboratory Assignments | 30 |
| Final Examination (2 hours Wednesday April 30, 2014 @ 10:00 a.m.) | 25 |

 The first test will be in class. The second test will be a take-home test due by the subsequent class period (i.e. within 48 hours).

HOMEWORK GRADING:

A homework grader (Mr. Sayan Dasgupta)has been assigned for this course.  If you have questions on pending homeworks, please ask me.  If you have questions about the grading of your homework, please first consult the homework key (uploaded to ANGEL after the grades are assigned) before checking with the grader.  If you still have questions after all that, then please consult with me.

OBJECTIVE:

To enhance the student's statistical and software-intensive toolbase for the design and analysis of experimental and observational research data in the biological sciences.

COURSE CATALOG DESCRIPTION:

Concepts of reducing experimental error: covariance, complete and incomplete block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs.

CLASS TOPIC SCHEDULE:

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| --- | --- |
| **TOPIC** | **APPROXIMATE NUMBER OF LECTURES** |
| ***Introduction:***  Scientific inquiry and the linear model | 1 |
| ***Regression***  Linear regression and residual diagnostics           review, Lack-of-fit hypothesis testing  Matrix algebra and modelling  Introduction to multiple linear regression  Modelling response surfaces  Type I /Type III sums of squares  Multiple regression influence/diagnostics | 13 |
| ***Factorial Designs***  Completely randomized designs  Two-factor analysis of variance  Multifactor analysis of variance  Regression approach to factorial designs  Analysis of covariance  Power assessments | 9 |
| ***Blocking Designs***  Randomized Block Designs  Incomplete Block Designs | 7 |
| ***Hiearchical Designs***  Nested designs and Subsampling  Split plot designs  Repeated Measures Analysis  Mixed effects models | 7 |
| ***"Efficient" Designs***  Latin Square Designs  Crossover Designs | 6 |

TENTATIVE LABORATORY SCHEDULE:

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| **WEEK** | **TOPIC** |
| ***1*** | Data Management and Editing using SAS and Introduction to Regression Analysis Using SAS PROC REG |
| ***2*** | Regression Analysis and Diagnostics using SAS PROC REG |
| ***3*** | Matrix Algebra using SAS PROC IML |
| ***4*** | Multiple Regression Analysis and Diagnostics using SAS PROC REG |
| ***5*** | Response Surface Designs and Analysis using SAS PROC RSREG |
| ***6*** | Completely randomized designs using SAS PROC GLM |
| ***7*** | Factorial Design Analysis using SAS PROC GLM/GLIMMIX (Part I) |
| ***8*** | Factorial Design Analysis using SAS PROC GLM GLIMMIX (Part II) |
| ***9*** | Analysis of Covariance using SAS PROC GLM/GLIMMIX - Power Analysis for Experimental Designs |
| ***10*** | Analysis of Randomized Block Designs using SAS PROC MIXED/GLIMMIX |
| ***11*** | Power Analyses |
| ***12*** | Analysis of Split Plot and Repeated Measures Designs using SAS PROC MIXED/GLIMMIX |
| ***13*** | Analysis of Replicated Latin Squares and Crossover designs using SAS PROC MIXED/GLIMMIX |

The statistical software SAS will form a major component of the data analysis training in this course. Example SAS programs and datasets required for labs will periodically be available on the course MSU ANGEL webpage ([www.angel.msu.edu](http://www.angel.msu.edu/))