The Ohio State University
Colleges of the Arts and Sciences Course Change Request

Statistics
Academic Unit

Statistics 742
Book 3 Listing (e.g., Portuguese) Course Number

Summer Autumn X Winter Spring Year 2008

Proposed effective date: choose one quarter and put an "X" after it; and fill in the year. See the OAA curriculum manual for deadlines.

A. *Course Offerings Bulletin* Information. Follow instructions in the OAA curriculum manual. Before you fill out the "Present Course" information, be sure to check the latest edition of the Course *Offerings Bulletin* and subsequent Circulating Forms. You may find that the changes you need have already been made or that additional changes are needed. If the course offered is less than quarter or term, please also complete the Flexibly Scheduled/OffCampus/Workshop Request form.

COMPLETE ALL ITEMS THIS COLUMN	COMPLETE ONLY THOSE ITEMS THAT CHANGE
Present Course	**Changes Requested**
1. Book 3 Listing: Statistics	1.
2. Number: 742	2.
3. Full Title: Analysis of Variance	3. Theory of Linear and Mixed Models
4. 18-Char. Transcript Title: Analysis of Variance	4. Linear Model Theory
5. Level and Credit Hours U G 3	5. U G 4
6. Description: Theory of the general linear model; least square estimates and properties, especially in non-full rank models; analysis of variance technique; factorial designs (25 words or less)	6. Theory of the general linear model: least square estimates and properties, especially in non-full rank models; analysis of variance technique; multi-factor models, random effects and mixed models
7. Qtrs. Offered : Autumn	7.
8. Distribution of Contact Time: 3 cl (e.g., 3 cl, 1 3-hr lab)	8. 2hr 2 cl
9. Prerequisite(s): 521 or 623, and Math 471 or 601	9. (Stat 621 or Stat 623) and (Stat 666 or Math 568) or permission of instructor
10. Exclusion: (Not open to....)	10.
11. Repeatable to a maximum of _____ credits.	11.
12. Off-Campus Field Experience:	12.
13. Cross-listed with:	13.
14. Is this a GEC course? No	14.
15. Grade option (circle): (Ltr) S/U P If P graded, what is the last course in the series?	15.
16. Is an honors version of this course available? Y ☐ N☐ Is an Embedded Honors version of this course available? Y ☐ N☐	16.
17. Other general course information:	17.

B. General Information

1. Do you want the prerequisites enforced electronically (see the OAA manual for what can be enforced)? Yes

2. Does this course currently satisfy any GEC requirement, if so indicate which category?

3. What other units require this course? Have these changes been discussed with those units?

4. Have these changes been discussed with academic units that might have a jurisdictional interest in the subject matter? Attach relevant letters.

5. Is the request contingent upon other requests, if so, list the requests?

6. **Purpose of the proposed change. (If the proposed change affects the content of the course, attach a revised syllabus and course objectives and e-mail to asccurrofc@osu.edu.)** Random effects models and mixed effects models are becoming widely used in many disciplines. Since we do not feel the need for a separate course devoted solely to these topics at this time, and since the topics naturally follow from the theoretcial study of linear models, we propose to increase scope of the syllabus of the current Stat 742. In addition, we change 'factorial designs' to 'multi-factor models' since the latter is a better description of what is currently covered in the course. Also, we propose to include Stat 656 as a prerequisite because of its coverage of the multivariate normal distribution and statistical matrix computation; and to replace Math 471, which no longer exists, or Math 601, which is now at a more abstract level than required, with Math 568 for appropriate knowledge of linear algebra. With the proposed prerequisites, topics in 742 may be covered more efficiently.

7. Please list Majors/Minors affected by the proposed change. Attach revisions of all affected programs. This course is (check one): ☐ Required on major(s)/minor(s) ☐ A choice on major(s)/minors(s) ☐ An elective within major(s)/minor(s) ☐ A general elective:

8. Describe any changes in library, equipment or other teaching aids needed as a result of the proposed change or if the proposed change involves budgetary adjustments, describe the method of funding:

Approval Process The signatures on the lines in ALL CAPS (e.g. ACADEMIC UNIT) are required.

1. Academic Unit Undergraduate Studies Committee Chair	Printed Name	Date
Elizabeth A. Stasny	Elizabeth A. Stasny	5/17/07
2. Academic Unit Graduate Studies Committee Chair	Printed Name	Date
Douglas A. Wolfe	Doug A. Wolfe	5/17/07
3. **ACADEMIC UNIT CHAIR/DIRECTOR**	**Printed Name**	**Date**

4. **After the Academic Unit Chair/Director signs the request, forward the form to the ASC Curriculum Office, 105 Brown Hall, 190 West 17th Ave. or fax it to 688-5678. Attach the syllabus and any supporting documentation in an e-mail to asccurrofc@osu.edu. The ASC Curriculum Office will forward the request to the appropriate committee.**

5. **COLLEGE CURRICULUM COMMITTEE**	**Printed Name**	**Date**
6. **ARTS AND SCIENCES EXECUTIVE DEAN**	**Printed Name**	**Date**
7. Graduate School (if appropriate)	Printed Name	Date
8. University Honors Center (if appropriate)	Printed Name	Date
9. Office of International Affairs (study tours only)	Printed Name	Date
10. **ACADEMIC AFFAIRS**	**Printed Name**	**Date**

Statistics 742 Theory of Linear and Mixed Models **Autumn 2005**
Course Web Site: http://www.stat.ohio-state.edu/~goel

Instructor:
Professor Prem Goel, 204C Cockins Hall, 292-8110
E-mail: goel@stat.ohio-state.edu
Office Hours: MW 3:00PM-4:36PM or by appointment.

Graduate Teaching Assistant:
Ms. Lai Wei, E-mail: weil@stat.ohio-state.edu
Office Hours: Wednesday 1:00PM- 3:00PM in CH412C

Course Goals: To develop a critical understanding of the theoretical basis of statistical methods for linear models. *This course builds a foundation for all statistical modeling. Extensive problem solving is critical for a thorough understanding of the course material.*

Prerequisites:
- Knowledge of basic theoretical statistics at the level of Stat 620-622
- Linear Algebra (Finite dimensional vector spaces and matrices): Stat 656 or Math 568

Text Book:
- N. Ravishanker and D. Dey (2002) *A First Course in Linear Model Theory*, Chapman & Hall. Details of the Numerical Examples in the text book available at http://www.stat.uconn.edu/~nalini/

Supplementary Texts:
- Arnold, Steven F. (1981) *The Theory of Linear Models and Multivariate Analysis*, John Wiley & Sons
- David Harville (1997) *Matrix Algebra from a Statistician's Perspective*, Springer-Verlag
- Y. Hochberg and A. Tamhane (1987) *Multiple Comparison Procedures*, J. Wiley & Sons
- C.R. Rao and Helge Toutenburg (1999) *Linear models: Least Squares and Alternatives*, Springer-Verlag
- Henry Scheffe (1959) *The Analysis of Variance*, J. Wiley & Sons
- George A. F. Seber (1977) *Linear Regression Analysis*, J. Wiley & Sons

Home Work Assignments: Problem sets consisting of important theoretical facts used in lecture and examples illustrating the theory outlined in lecture will be assigned. A total of seven home work assignments will be given on Thursdays (9/28, 10/5, 10/12, 10/19, 11/2, 11/9, 11/16). Submit your home work as you enter the classroom on the following Thursday. You are encouraged to discuss homework problems in study teams, but you must write your own solutions. Solutions to Home work and the Midterm Exam will be posted on the website. **To be fair to everyone, late assignment will not be accepted. The six best scores will be counted towards the grade.**

Examinations (Closed book, Closed notes): Midterm Exam - In Class on Thursday, October 26, Comprehensive Final Exam - 1:30PM - 3:18 PM on Tuesday, December 5.

Course Grades: Based on clusters in the overall scores with the following weights: Home Work Assignments - 25%, Mid Term Exam - 25%, Final Exam - 50%

Course Outline

I. Preliminaries

- Introduction
- Review of Linear Algebra **(Chap. 1)**
- Special Matrices **(Chap. 2)**
- Generalized Inverses and Solutions to Linear Systems **(Chap. 3)**
- Distribution Theory
    1. Multivariate Normal **(Sec. 5.1- 5.2)**
    2. Noncentral Chi-Square, T, and F **(Sec. 5.3)**
    3. Quadratic Forms **(Sec 5.4)**

II. Theory of Fixed Effects Linear Models

- Introduction to the Linear Model **(Sec 4.1)**
- Point Estimation **(Sec. 4.2, 4.3, 4.4, 4.6)**
    1. Full-rank case
    2. Non-full rank case
- Generalization from $\sigma^2\mathbf{I}$ to $\sigma^2\mathbf{V}$ **(Sec. 4.5)**
- Testing Hypotheses
    1. Properties of Least Squares Estimates **(Sec. 7.1)**
    2. General Linear Hypotheses **(Sec. 7.2)**
    3. Examples
- Testing Several Hypotheses **(Sec. 7.4)**
    1. Nested Hypotheses
    2. Orthogonal Hypotheses
- Simultaneous Confidence Intervals **(Sec. 7.3.1)**
- Robustness of Normal Theory Tests and Confidence Sets **(Handout)**
    1. Non-normality of Errors
    2. Inequality of Variances
    3. Dependence of Observations

III. Multiple Comparison Methods (Sec. 7.3.2 - 7.3.3)

- Introduction
- Tukey Method
- Scheffe Procedure
- Other Methods

IV. Mixed and Random Effects Models (Chapter 10)

- Introduction
- Estimating Variance Parameters