Linear Models and Multivariate Analysis
STAT 7023
FALL SEMESTER 2025
WF 2:00 pm – 3:20 pm, 60WCHARL 273

INSTRUCTOR:

Instructor:	Dr. Siva Sivaganesan, Professor, Statistics.
Office:	Room 5402 French Hall West, Phone: 513 556-4806
E-mail:	sivagas at ucmail.uc.edu
Office Hours:	Wed. 1:00-1:500 PM (in-person), Th. 9-10 am (Virtual), or by appointment (in-person or virtual). Please send an email at least 30 min ahead. If virtual, you will be sent a Zoom link.

TEXTBOOKS/REFERENCES/NOTES:
Design and Analysis of Experiments, by Montgomery, D.,8th or 7th eds.
Analysis of Messy Data, Vol I, by Milliken, G.A. and Johnson, D.E.
Applied Multivariate Statistical Analysis by Johnson, R. A. and Wichern, D. W.
SAS Book for Linear Models
Notes taken by students during class. You are strongly urged to take notes during class.

Prerequisites: Students are required to have satisfactorily completed STAT 6021,6022, 6031 and 6032, or obtain permission from the instructor.

MATERIAL COVERED: Design and Analysis topics: Quick review of fixed effects. Random effects models, Mixed effects models, Nested models, Split plot designs, Repeated measures, Multivariate Analyses topics: Multivariate Normal Distribution (MVN), inference for parameters of MVN, Test of hypotheses, Hoteling T-squared test, Principal Component Analysis, Factor Analysis, Discriminant analysis, and Cluster analysis (if time permits). *You are strongly encouraged to take notes in class and ask me for any clarification.*

CANVAS: Please follow Canvas closely for important announcements, homework assignments and grades.

SOFTWARE: We will use SAS, and R less frequently. You can access SAS OnDemand at this link: https://www.sas.com/en_us/software/on-demand-for-academics.html. You can use SAS OnDemand for Academics for relevant lab/homework, exam or project. Note that using this doesn't require installing SAS on your computer, but it requires an internet connection. If you plan to use it for any assignment, you also need to pay attention to its maintenance time when it is not available. The due date of the assignment shall not be changed solely due to the maintenance of SAS OnDemand. Sample/template code, data sets, and other information will be provided in Canvas.

HOMEWORK: Homework will be assigned through Canvas. You need to submit a scanned pdf document of your homework solution to Canvas. No late homework will be accepted unless there are extenuating circumstances of extreme nature. Homework needs to be presented using a word processor (e.g., Word) and include the goal(s) or question(s) to be answered, the models used, a brief description of the statistical analyses, results relevant to answer the questions, plots of data and results as applicable, and the conclusion, all in the main body, with the code and relevant output given in an appendix. Sloppy or illegible answers will not be graded and will receive zero credit.

ATTENDANCE: Class attendance is important for learning and knowing what is covered. Make sure to attend each class. Avoid arriving late or leaving before the end of class and get advance permission from the instructor if you must miss a class. Attendance will be taken regularly and one percent of the course total per missed class (up to a total of 10 percent) will be deducted for missing a class without advance permission from instructor via email, except in cases of extreme circumstances supported by documentation.

TESTS and PROJECTS: There will be two tests and a final, all in-person. Approximate schedule for the midterms are given below. You may be asked to do a project and submit a report by the due date during the last 2-3 weeks of class. More details will be made available during the course.

Personal Communication Devices Policy: Cell phones must be either turned off or put on vibrate mode during class, and must be turned off during exams. Additionally, please make all efforts not to use cell phones during the class time.

TENTATIVE EXAM SCHEDULE AND COURSE GRADE DETERMINATION

Work	Date	Percent towards Course Grade
Homework (and Project)	Periodically	20%
Attendance and participation		See policy on Attendance
TEST #1	**Fri. October 3**	25%
TEST #2	**Fri. November 7**	30%
Final exam	**Wed. December 10, 2:45 pm - 4:45 pm**	25%

COURSE GRADES

96-100:	A	87-89:	B+	77-79:	C+	67-69:	D+	<60:	F
90-95:	A-	83-86:	B	73-76:	C	63-66:	D		
		80-82:	B-	70-72:	C-	60-62:	D-		

Withdrawal: Friday, November 22 is the last day to withdraw from the class. If you withdraw, the instructors will be required to affirm whether or not you minimally participated in the class. Although the instructors will do the best to answer accurately, in the absence of any evidence to the contrary the instructors will affirm that you did not minimally participate. Ways for you to provide clear evidence of your presence in the class include taking a test, turning in a homework, or signing an attendance sheet.

Academic Integrity:

The University Rules, including the Student Code of Conduct, and other documented policies of the department, college, and university related to academic integrity will be enforced. If you are found responsible for academic misconduct of any kind, including acts of plagiarism or cheating, unauthorized use of material and tools, will be dealt with and sanction applied on an individual basis according to the severity of the misconduct. (http://www.uc.edu/conduct/Academic_Integrity.html)

Note: Any misconduct may result in **the failure of the entire course (with semester grade F)**, not only the failure of a test or homework.

In this class, the academic misconduct includes, but is not limited to, the following actions:

- Copy **classmates' homework** or cheat **classmates' exams**,
- Copy **homework solutions** provided to students who took the same course **in previous semesters**,
- Copy **homework solutions** downloaded or available **from internets** (even there are no copyrights or warnings on the documents displayed) or an anonymous source,
- Getting solutions using AI tools and providing them as your own solutions,
- as well as other misconducts which are prohibited by the Student Code of Conduct.

Personal Communication Devices Policy: Cell phones must be either turned off or put on vibrate mode during class and must be turned off during exams.

Email Communication Policy: All communications must be done via a **valid UC email**. The instructor will try his best to reply within one business day from receipt of emails. Any correspondence using a personal account, e.g., Gmail account, will not be responded.

Policy about early/make-up exams:
Except when prior arrangement is made and instructor's consent is obtained, make up for missed tests or homework will not be entertained unless there is an extenuating circumstance such as medical emergency and proper supporting documentation is provided.

The student must request the early/make-up test within a reasonable amount of time before/after one of the following **excusable** events occurs:

- **Illness**. Need official certification from your doctor, typed on medical stationery (with their license # to practice medicine).
- **Athletic event participation**. Need a signed letter from your coach no later than **one week prior to** the day of the exam.
- **Attending the funeral of an immediate relative**. Need proof of attending the funeral with the date of the ceremony.
- **Mandatory courtroom appearance**. Need a copy of your official court summons with the date.

Taking an exam early/late due to **a personal travel schedule** will not be permitted.

Special Needs Policy: If you have any special need related to your participation in this course, including identified visual impairment, hearing impairment, physical impairment, communication disorder, and/or specific learning disability that may influence your performance in this course, you should meet with the instructor to arrange for reasonable provisions to ensure an equitable opportunity to meet all the requirements of this course. At the discretion of the instructor, some accommodations may require prior approval by Disability Services. In order to take advantage of those available accommodations, students may contact the Disability Services Office at 210 University Pavilion (https://www.uc.edu/campus-life/accessibility-resources.html).

Regrading Policy: If a student believes that grading errors have occurred, the student should request for regrading **within the next four business days after receiving the graded work**. This will apply even if the student is absent on the day the work is returned unless prior permission was obtained from the instructor.

Religious Accommodation

Ohio law and the University's Student Religious Accommodations for Courses Policy 1.3.7 permits a student, upon request, to be absent for reasons of faith or religious or spiritual belief system or participate in organized activities conducted under the auspices of a religious denomination, church, or other religious or spiritual organization and/or to receive alternative accommodations with regard to examinations and other course requirements due to an absence permitted for the above-described reasons. Not later than fourteen days after the first day of instruction in the course, a student should provide the instructor with written notice of the specific dates for which the student requests alternative accommodations. For additional information about this policy, please contact the Executive Director of the Office of Equal Opportunity and Access at (513) 556-5503 or oeohelp@UCMAIL.UC.EDU.

***This syllabus is subject to change. Any changes will be notified either in class or via Canvas.**

Tentative Schedule
(This will be regularly updated)

Week # - Beginning date	**Topics**
1 - August 25	Quick review of fixed effects models. ANCOVA
2 -September 1	Random Effects and Mixed effects models. ***(No class on Monday, Sep .2 - Labor Day)***
3 -September 8	Mixed effects models.
4 -September 15	Mixed effects models and nested models
5- September 22	Nested-Factorial Design and Split Plot Design
6- September 29	Split Plot Design, **Midterm 1: Fri., Oct. 4 (Tentative. May be held another time/day)**
7 -October 6	Repeated Measures Designs ***(Friday, Oct. 11 – Reading Day, No Class.)***
8 -October 13	Multivariate analysis,
9 -October 20	Multivariate normal distribution and inference for means.
10- October 27	Multivariate ANOVA
11- November 3	MANOVA **Midterm 2: Fri. Nov. 8^{d} (Tentative. May be held another time/day)**
12- November 10	Principal Component Analysis ***(Veterans Day-Holiday, Monday, Nov. 11. No Class)***
13- November 17	Factor Analysis.
14 -November 24	Discriminant analysis. ***(Thanksgiving Holiday, Th. Nov. 27. Fri. Nov. 28. (No Class.)***
15- December 1	Cluster analysis (if time allows).
Final Exam Week- December 8	**Final Exam: Wednesday, December 10, 2:45 am - 4:45 pm**