Course Specification
— (Bachelor)

Course Title:	**Linear Models**
Course Code:	**STS 311**
Program:	**Applied Statistics & Data Management**
Department:	**Mathematics**
College:	**College of Science**
Institution:	**Majmaah University, Saudi Arabia**
Version:	**1**
Last Revision Date:	*26/09/2023*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (2 (2+0))

2. Course type

A.	☐University	☐College	☐Department	☐Track	Others
B.	☒Required			☐Elective	

3. Level/year at which this course is offered: (……….)

4. Course general Description:

A rigorous examination of the general linear model using vector space theory. Includes: generalized inverses; orthogonal projections; quadratic forms; Gauss-Markov theorem and its generalizations; BLUE estimators; non-full rank models; estimability considerations.

5. Pre-requirements for this course (if any)**: MTHS 211 Linear Algebra**

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

1- Understand the objective and assumptions for regression models.
2- Be able to perform regression in matrix terms and understand the rationale of least-squares estimation.
3- Understand and apply the techniques for testing a general linear hypothesis and the difference between confidence intervals and confidence regions.
4- Understand and apply the techniques for penalized regression and be able to use them properly in practice.
5- Be familiar with R programing and be able to use it to complete assignments

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	15	75 %
2	E-learning		
3	Hybrid • Traditional classroom • E-learning	5	25 %

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	20
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		20

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	The students should be able to Acquire and outline mathematical knowledge and skills in fundamental concepts.	K3	Direct teaching: Lectures Aimed teaching: Discovery and oral questions Indirect teaching: Cooperative Learning	. Homework · Quiz · Midterms · Final Exams
2.0	**Skills**			
2.1	Ability to think analytically and critically; Ability to understand and analyze the mathematical problems Students can complete assignments in due time; Students can actively and critically participate in class activities;	S3	Direct teaching: Inquiry-based instruction PowerPoints and discussions Aimed teaching: Discovery and oral questions Indirect teaching: Peer Learning.	. Homework · Quiz · Midterms · Final Exams -Discussions
3.0	**Values, autonomy, and responsibility**			
3.1	The students should be able to Critically interpret numerical and graphical data.	V3	Direct teaching: Inquiry-based instruction PowerPoints and	. Homework · Quiz · Midterms · Final Exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			discussions Aimed teaching: Discovery and oral questions Indirect teaching: Peer Learning.	

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction; review of simple linear regression and linear algebra.	6
2.	Multiple regression models: the regression model in matrix form, estimation, analysis of variance, hypothesis testing, confidence regions, variable selection.	9
3.	Penalized Regression: Introduction to Lasso, Ridge, Elastic Net and their corresponding Bayesian versions and cross-validation for modeling fitting.	9
4.	Logistic regression models and other generalized linear models.	6
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Week 6 and Week 12	10%
2.	Assignments/Exercises	Every Week	10%
3.	Mid Term Exam	Week 8	30%
4.	Final Exam	After Week 15	40%
5.	E-exam	Week 14	10%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Draper, N. R., & Smith, H. Applied regression analysis. John Wiley & Sons. 1998.
Supportive References	1. Rencher, A.C., & Schaalje, G.B. Linear Models in Statistics, Wiley, 2008 - 2nd edition. Hastie, T., Tibshirani, R., & Friedman, J. The elements of statistical learning: data mining, inference, and prediction, Springer Science & Business Media. 2009.

Electronic Materials	https://sites.ualberta.ca/~kashlak/data/stat378.pdf
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom.
Technology equipment (projector, smart board, software)	Smart Board, Projector .
Other equipment (depending on the nature of the specialty)	Laboratory.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of Students assessment	Peer Reviewer	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Peer Reviewer	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	