Course Specification
(Bachelor)

Course Title: Introduction to Regression

Course Code: STA 1221

Program: Bachelor of Science in Actuarial and Financial Mathematics

Department: Mathematics and Statistics

College: Science

Institution: Imam Mohammad Ibn Saud Islamic University

Version: 2024 – V1

Last Revision Date: None

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:

3 (2 Lectures, 0 Lab, 2 Tutorial)

2. Course type

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

3. Level/year at which this course is offered: Level 3 / Year 2

4. Course general Description:

In statistics, linear regression is a fundamental technique to approach linearly of statistical modelling, in which we aim to model a response variable using one or more explanatory variables. This course covers the broad class of linear regression models, which are widely used in practice by using basic example data sets. The course aims to teach how to formulate such models and fit them to data, how to make predictions with associated measures of uncertainty, and how to select appropriate explanatory variables. Both theory and practical aspects are covered, including the use of computer software for regression.

5. Pre-requirements for this course (if any)**:**

None.

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

None.

7. Course Main Objective(s):

Regression analysis consists of a collection of techniques used to explore and understand the relationship between variables and is perhaps the most widely used and most useful of all the techniques in modern Statistics. The objectives of this course are:
- to help students to have a firm understanding of the underlying theory.
- to learn the tools needed to carry out statistical regression analysis in a variety of applications.
- to provide students with facility and experience in regression model building, evaluation, and analysis using a modern computer approach.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	0	0%
4	Distance learning	0	0%

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	0
3.	Field	0
4.	Tutorial	30
5.	Others (specify)	0
Total		**60**

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	Outline the concept of linear regression model and properties of model parameters for prediction purposes.	K1, K2	2 lecture hours\week	Direct: Regular Exams
1.2	Define regression analysis and its limitations.	K2, K3	• 2 tutorial hours\week • Self-study	Direct: Short Quizzes
2.0	**Skills**			
2.1	Analyze procedures of statistical inference for linear regression models.	S1, S2	• Self-study • Real-life problems	Direct: • Participations • Short Quizzes
2.2	Differentiate the situation where linear regression is appropriate	S2	Self-study	Direct: Participations
2.3	Interpret statistical outputs.	S3	Real-life problems	Direct: Short Quizzes
2.4	Construct linear regression models with the appropriate software.	S2	Self-study	Direct: Participations
2.5	Implement advanced methods in regression analysis for applications.	S2, S3	Self-study	Direct: Participations
3.0	**Values, autonomy, and responsibility**			
3.1	Use ethical concepts and rules to determine	V2	Personal questions	Direct: Participation

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	viable alternatives in any given situation.			
3.2	Show findings and results with others.	V2	Teamwork and class discussions.	Direct: Homework and Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Regression Analysis:** Regression Models. Formal uses of regression analysis. The data base.	8
2.	**The Simple Linear Regression Model:** The model description; Assumption and interpretation of model parameters; Last square formulation; Partitioning total variability; Test of hypothesis on a slope and intercept; Quality of fitted model; Confidence interval on mean response and prediction intervals; A look at a residual.	18
3.	**Selection of Variables:** Contribution of a variable in the model; Forward selection and backward elimination; Stepwise procedure; All possible subsets and other techniques of selection variables.	18
4.	**Statistical diagnostics:** Analysis of residual; Diagnostic plots; Detection of outliers; Influence diagnostics.	16
	Total	**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homework's, Quizzes, Mini projects**	**During the term**	**10%**
2.	**First Midterm**	**Week 5-6**	**25%**
3.	**Second Midterm**	**Week 10-11**	**25%**
4.	**Final Exam**	**Week 13**	**40%**

*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	1. *Classical and Modern Regression with Applications;* 2nd Edition, Raymond H. Myers, Duxbury Classic, 2000. ISBN-13: 978-0534380168. **(Main Reference)** 2. *Regression Modeling with Actuarial and Financial Applications;* Edward W. Frees, Cambridge University Press, 2010. ISBN-13 978-0-521-13596-2. **(Main Reference)**

Supportive References	1. *Regression analysis by example,* 5th Edition, Samprit Chatterjee and Alis S. Hadi, Wiley Series in Probability and Statistics, 2012. 2. *Applied Regression,* 4th Edition, Sanford Weisberg, Wiley Series in Probability and Statistics, 2013. 3. *Applied Regression Analysis and Multivariable Methods,* 5th Edition, D. G. Kleinbaum, L. L. Kupper, A. Nizam, and E. S. Rosenberg, Cengage Learning, 2013. 4. *Introduction to Linear Regression Analysis*, **5th Edition**; Douglas C. Montgomery, Elizabeth A. Peck, and G. Geoffrey Vining, Wiley Series in Probability and Statistics, 2012.
Electronic Materials	**Regression Analysis, Theory, Methods and Applications**, A Sen and M. Srivastava, Springer-Verlag, 1990. (it can be download from IMAMU domain)
Other Learning Materials	• **Online Linear Regression Calculator** • **linear regression** (UC Business Analytics R Programming Guide)

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each classroom should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (projector, smart board, software)	**The rooms should be equipped with data show and Smart Board.** **All computers should be equipped with the following software: Microsoft Excel, IBM SPSS, R-Project, MATLAB, Minitab**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Effectiveness of Students assessment	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**

Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Other	**None**	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	**8/1446**
DATE	**05/04/1446 (08/10/2024)**