Course Specification

(Postgraduate Programs)

Course Title:	**Data Science in Finance and Insurance**
Course Code:	**AFM 6111**
Program:	**Executive Master of Science in Actuaries and Financial Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2025 – V1**
Last Revision Date:	**None**

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A. General information about the course:

1. Course Identification

1. Credit hours:					
3 (2 Lectures, 2 Lab, 0 Tutorial)					
2. Course type					
A.	☐University	☐ College	☐ Department	☐Track	☒ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: Level 2 / Year 1					
4. Course general Description:					
This course provides an in-depth exploration of the foundational concepts, tools, and techniques used to analyze and solve complex problems in the financial and insurance sectors. Students will learn to apply data science methodologies, including predictive modeling, statistical analysis, and machine learning, to assess risks, optimize financial strategies, and drive data-informed decision-making. Emphasizing both theoretical understanding and practical application, the course integrates case studies and real-world data to develop skills in financial modeling, risk assessment, and data interpretation. Additionally, students will cultivate professional values, ethical responsibility, and teamwork capabilities, preparing them for impactful careers in finance and insurance analytics.					
5. Pre-requirements for this course (if any):					
None.					
6. Co-requisites for this course (if any):					
None.					
7. Course Main Objective(s):					
The main objective of this course is to: • Understand foundational principles of data science and their applications in the finance and insurance industries. • Apply statistical and machine learning techniques to analyze and predict financial risks and opportunities. • Develop and implement actuarial models to address life-contingent and other financial risks. • Master the data analysis process, including data preparation, modeling, evaluation, and interpretation, to solve business problems. • Utilize advanced tools and software to build and deploy predictive models in real-world financial and insurance contexts. • Interpret and communicate analytical findings effectively to stakeholders for informed decision-making. • Foster ethical practices and professional standards in data-driven financial and insurance decision-making. • Enhance teamwork and collaboration skills for working in interdisciplinary and diverse teams.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0%

No	Mode of Instruction	Contact Hours	Percentage
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**	30
3.	**Field**	0
4.	**Tutorial**	0
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	**Demonstrate understanding of fundamental probability tools to assess risks and insurance issues.**	**K1**	**- Lectures with real-world examples - Case studies on insurance risk scenarios**	**Direct: - Written exams - Quizzes - Case study evaluations**
1.2	**Explain quantitative concepts and financial analysis basics relevant to insurance companies.**	**K2**	**- Lectures and discussions - Problem-solving sessions on financial metrics**	**Direct: - Written exams - Assignments - Presentation assessments**
2.0	**Skills**			
2.1	**Apply actuarial and financial risk models to solve specific problems in insurance and finance.**	**S1**	**- Interactive workshops - Problem-based learning (PBL)**	**Direct: - Case studies - Practical problem-solving tasks**
2.2	**Identify and execute the steps of the modeling process to solve financial and insurance problems.**	**S2**	**- Hands-on modeling sessions - Guided use of software tools (e.g., R, Python)**	**Direct: - Project-based evaluations - Individual assignments**
2.3	**Analyze real-world business data to extract insights for decision-**	**S3**	**- Data analysis exercises - Industry-focused case studies**	**Direct: - Data analysis projects**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	making in finance and insurance.			- Reports with presentations
2.4	Evaluate the results of data models and interpret their impact in a financial or insurance context.	S2,S3	- Interactive discussions - Peer review of model results	Direct: - Peer-reviewed assignments - Oral presentations
3.0	**Values, autonomy, and responsibility**			
3.1	Perform and collaborate effectively in diverse teams to tackle financial and insurance challenges.	V1	- Group projects - Role-playing activities	Direct: - Group project evaluations - Peer assessment
3.2	Generate the highest standards of ethical conduct and professional behavior, critical, interpersonal and communication skills as well as a commitment to life-long learning	V2	Teamwork and class discussions.	Direct: Real-life project

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Data Science in Finance and Insurance** Overview of data opportunities in finance and insurance, Examples of fraud detection, risk assessment, customer segmentation, Data science versus traditional approaches in these sectors, Strategic use of data and big data evolution (Big Data 1.0 to 2.0), Importance of data-analytic thinking	6
2.	**Business Problems and Data Science Solutions** Translating business problems into data mining tasks, Supervised and unsupervised methods with applications in credit scoring and claims management Data mining process: Understanding, preparation, modeling, evaluation, deployment, Additional techniques (statistics, machine learning, data warehousing)	8
3.	**Predictive Modeling and Risk Analysis** Supervised segmentation and predictive modeling fundamentals, Decision trees and other models for customer churn and default prediction, Attribute selection and its importance in financial models, Case study: Using predictive models for insurance underwriting	10
4.	**Model Fitting and Overfitting Avoidance** Classification models (logistic regression, SVMs, neural networks), Overfitting: Causes, examples, and remedies, Cross-validation techniques, Evaluation metrics relevant to financial decisions	10
5.	**Clustering and Similarity-Based Methods** Clustering for customer segmentation and portfolio analysis, Nearest-neighbor methods for credit scoring and recommendation systems, Practical aspects:	8

	Dimensionality, computational efficiency, and domain knowledge, Case study: Clustering insurance claims data for fraud detection	
6.	**Decision Analytic Thinking and Model Evaluation** Evaluating classifiers using accuracy, ROC, AUC, and lift charts, Importance of expected value frameworks in financial decision-making, Case studies: Evaluating risk-adjusted returns, designing marketing strategies for banks	6
7.	**Visualizing Model Performance** Ranking instead of Classifying, Profit Curves, ROC graphs, The area under the ROC curve (AUROC)	6
8.	**Advanced Topics and Data Science Strategy** Data reduction, ensemble methods, and bias-variance tradeoff, Achieving and sustaining competitive advantage with data science, Link Prediction and Social Recommendation	6
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Quizzes, Mini projects, Real-life project**	**During the semester**	**30%**
2.	**Midterm**	**Week 8-9**	**30%**
3.	**Final Exam**	**Week 15**	**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. Data Science for Business** – by Foster Provost and Tom Fawcett, O'REILLY, 1st Edition, ISBN: 978-1-449-36132-7
Supportive References	**1. Data Science and Risk Analytics in Finance and Insurance** – by Tze Leung Lai, Haipeng Xing, CRC Press, eBook ISBN: 9781315117041
Electronic Materials	**None**
Other Learning Materials	**None**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities	▪ **Each class room should be equipped with a whiteboard and a projector.**

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ 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.
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.
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.	20/1446
DATE	11/08/1446 (10/02/2025)