OSTIM TECHNICAL UNIVERSITY
FACULTY OF ECONOMICS AND ADMINISTRATIVE SCIENCES
MANAGEMENT INFORMATION SYSTEMS DEPARTMENT
COURSE SYLLABUS FORM

MIS 308 Data Analysis							
Course Name	**Course Code**	**Period**	**Hours**	**Application**	**Laboratory**	**Credit**	**ECTS**
Data Analysis	MIS 308	6	2	1	0	3	4

Language of Instruction	English
Course Status	Compulsory
Course Level	Bachelor
Learning and Teaching Techniques of the Course	Lecture, Question-Answer, Problem Solving, Computer Applications

Course Objective

The course aims at introducing the basic concepts used in unsupervised and supervised learning in data analysis. It presents fundamental concepts in statistics and probability and shows how to effectively clean, analyze, and draw inferences from big data in order to find solution to business problems. The emphasis will be placed on statistical reasoning, problem solving, computer applications, and interpretation of the results.

Learning Outcomes

The students who become successful in this course will be able;

- to learn how to develop and investigate a research question in business.
- to understand how to make data-driven business decisions.
- to have knowledge about data analysis with Python.
- to master the basic concepts of statistics and be familiar with machine learning algorithms.
- to upgrade their data analytics skills by learning the theory and practical application of supervised and unsupervised learning.
- to evaluate and enhance data for effective statistical analysis.

Course Outline

This course includes discussions on basic Python syntax and the basics of statistics & probability. The course also introduces statistical reasoning, emphasizing how Statistics can help us understand the world. Topics include basic Python syntax, explanatory data analysis, visualization of the data, supervised and unsupervised machine learning. Students will learn to apply statistical concepts to data and reach conclusions about real-world problems with the applications of Jupyter Notebook

Weekly Topics and Related Preparation Studies		
Weeks	**Topics**	**Preparation Studies**
1	Introduction to Python	– Introduction to Python and Jupyter notebooks. – Variables and data types – Input-Output statements – Operators in Python
2	Introduction to Python	– List, tuples, and dictionaries. – Conditionals - if, elif, else, and loops – Functions in python – Maps and Filters
3	Basic Statistics	– An introduction to basic statistics – Population, Sample, Parameter, Statistic – Sources and Types of data – Measures of central tendency – Measures of dispersion – Measures of variation – Five Point Summary – Data Visualization – Introduction to probability – Rules for computing probability – Marginal Probability
4	Inferential Statistics	– Introduction to Inferential Statistics – Fundamentals of Probability Distributions – Foundations of Sampling and Inference – The Central Limit Theorem – Estimation
5	Hypothesis Testing	– Introduction to Hypothesis Testing – One-tailed and Two-tailed Tests – Confidence Intervals and Hypothesis Testing – Hypothesis Testing Steps
6	Python for Data Science	– Numpy and Pandas: Operations and functions to work with data – Pandas Dataframes & Series: Operations and applications – Data Visualization: The Matplotlib and Seaborn libraries
7	Exploratory Data Analysis and Visualization	– Data collection – Hypothesis testing and practical applications – Multiple testing issues – Exploratory data analysis: PCA

		– Multi-dimensional scaling – t-SNE
8	**MIDTERM EXAM**	
9	Network Analysis	– Network representation through an adjacency matrix – Quantitative measures of a network: connected components, edge density, degree distribution, diameter and average path length, and homophily – Centrality measures: degree, Eigenvector, closeness, and betweenness centrality – Practical applications of Network Analysis
10	Unsupervised Learning	– Introduction to clustering – K-means clustering – Gaussian Mixture Models – Hierarchical clustering – DBSCAN – Clustering in networks: The Louvain Method for community detection – Modularity maximization – Practical applications of Clustering
11	Machine Learning- Supervised Learning: Regression	– Elementary Statistics – Maximum likelihood and Bayesian Estimators – Linear Regression – Performance Assessment - Estimating parameter means and confidence intervals for prediction
12	Machine Learning- Model Evaluation, Cross-Validation and Bootstrapping	– Prediction vs Modelling – Assumptions behind Regression – Overfitting and Regularization – Bias-variance tradeoff – Cross-validation – Bootstrapping
13	Machine Learning- Supervised Learning: Classification	– Classification – Gaussian Models – Bayesian formulation – Logistic Regression – Performance Assessments – Other classification algorithms - K-NN
14	Capstone Project	–Presentations
15	**FINAL EXAM**	
Textbook(s)/References/Materials:		

Textbook: Vanderplas, J. T. (2016). Python Data Science Handbook: Tools and Techniques for Developers. O'Reilly.
Supplementary References: McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
Other Materials: -

Assessment		
Studies	**Number**	**Contribution margin (%)**
Attendance		
Lab		
Class participation and performance	**1**	**10**
Field Study		
Course-Specific Internship (if any)		
Quizzes / Studio / Critical		
Homework		
Presentation		
Projects	**1**	**20**
Report		
Seminar		
Midterm Exam/Midterm Jury	**1**	**20**
General Exam / Final Jury	**1**	**50**
Total		**100**
Success Grade Contribution of Semester Studies		**50**
Success Grade Contribution of End of Term		**50**
Total		**100**

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Course hours (Including the exam week): 15 x total course hours)	15	3	45
Laboratory			
Application			
Course-Specific Internship (if any)			
Field Study			
Study Time Out of Class	10	4	40
Presentation / Seminar Preparation			
Projects	1	10	10
Reports			
Homework			
Quizzes / Studio Review			
Preparation Time for Midterm Exams / Midterm Jury	1	12	12
Preparation Period for the Final Exam / General Jury	1	13	13
Total Workload	**(120/30 =4)**		**120**

Course' Contribution Level to Learning Outcomes						
Nu	**Learning Outcomes**	**Contribution Level**				
		1	**2**	**3**	**4**	**5**
LO1	to learn how to develop and investigate a research question in business.					X
LO2	to understand how to make data-driven business decisions.					X
LO3	to have knowledge about data analysis with Python.					X
LO4	to master the basic concepts of statistics and be familiar with machine learning algorithms.					X
LO5	to upgrade their data analytics skills by learning the theory and practical application of supervised and unsupervised learning.					X
LO6	to evaluate and enhance data for effective statistical analysis.					X

Relationship Between Course Learning Outcomes and Program Competencies (Department of Management Information Systems)								
Nu	**Program Competencies**	**Learning Outcomes**						**Total Effect (1-5)**
		LO1	**LO 2**	**LO3**	**LO4**	**LO5**	**LO6**	
1	Recognize and distinguish the basic concepts such as data, information, and knowledge in the field of Management Information Systems and know the processes to be followed for data acquisition, storage, updating, and security	x	x	x		x		**5**
2	Develop and manage databases suitable for collecting, storing, and updating data			x	x			**5**
3	As a result of his/her ability to think algorithmically, easily find solutions to the problems concerning the basic business functions		x		x	x	x	**5**
4	Learn programming logic, have information about current programming languages			x				**4**
5	Be able to use up-to-date programming languages			x				**5**
6	Be able to take part in teamwork or lead a team using knowledge of project management processes	x	x					**5**
7	Know ethical and legal rules, use professional field knowledge within the scope of ethical and legal rules							
8	Have knowledge in the fundamental areas of business administration namely management and organization, production, finance, marketing, numerical methods, accounting, etc., and have the knowledge and skills to			x				**2**

	work in-depth in at least one of them							
9	Be able to solve the problems encountered in the field of internet programming by designing web applications			x	x			**1**
10	Develop and manage logistics and supply chain management activities.							
11	Adapt his/her theoretical knowledge and the experience he/she will gain through practice at the departments of businesses such as information technologies, R&D, and management to real life.							
12	Be able to develop strategies that will provide a competitive advantage with his/her advanced knowledge of management strategies and management functions							
13	Develop a business idea, commercialize the business idea, and design and manage his/her own venture using entrepreneurial knowledge							
14	By using English effectively, they can follow, read, write, speak and communicate universal information in the field of management information systems in a foreign language with professional competence.							
Total Effect								**32**

Policies and Procedures
Web page: https://www.ostimteknik.edu.tr/management-information-systems-english-1241/915
Exams: The exams aim at assessing various dimensions of learning: knowledge of concepts and theories and the ability to apply this knowledge to real-world phenomena, through analyzing the situation, distinguishing problems, and suggesting solutions. The written exams can be of two types, ie. open-ended questions, which can also be in the form of problems or multiple-choice questions.
Assignments: Homework (Assignments) might be applicable. Scientific Research Ethics Rules are very important while preparing assignments. The students should be careful about citing any material used from outside sources and reference them appropriately.
Missed exams: Any student missing an exam needs to bring an official medical report to be able to take a make-up exam. The medical report must be from a state hospital.
Projects: Not applicable.
Attendance: Attendance requirements are announced at the beginning of the term. Students are usually expected to attend at least 70% of the classes during each term.
Objections: If the student observes a material error in his/her grade, he/she has the right to place an objection to the Faculty or the Department. The claim is examined and the student is notified about its outcome.