Course Specifications

Course Title:	**Data Science**
Course Code:	**ICS 421**
Program:	**Information & Computer Sciences**
Department:	**Computer Science and Information**
College:	**Science at Al-Zulfi**
Institution:	**Majmaah**

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A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: Level 8
4. Pre-requisites for this course (if any)**:** ICS 211 and MATH 220
5. Co-requisites for this course (if any)**: Nil**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	44	80 %
2	**Blended**	3	5 %
3	**E-learning**	3	5 %
4	**Correspondence**	3	5 %
5	**Other**	3	5 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	20
3	**Tutorial**	5
4	**Others** (specify)	5
	Total	**60**
Other Learning Hours*		
1	**Study**	10
2	**Assignments**	20
3	**Library**	10
4	**Projects/Research Essays/Theses**	20
5	**Others** (specify)	0
	Total	**60**

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces an introduction to the fundamentals of data science principles and a basic understanding of data analysis techniques required to tackle real-world, data-rich problems in business and academia, including:

- Data acquisition, cleaning, and aggregation
- Exploratory data analysis and visualization
- Feature engineering
- Data Model creation and validation
- Basic statistical and mathematical foundations for data science.
- Feature Selection and extraction based on PCA, ICA and Data Pipelines.
- Basic supervised and unsupervised learning methods.

2. Course Main Objective

1. Students will develop relevant programming abilities.
2. Students will demonstrate proficiency with statistical analysis of data.
3. Students will develop the ability to build and assess data-based models.
4. Students will execute statistical analysis with professional software.
5. Students will demonstrate skill in data analysis and management.

3. Course Learning Outcomes

Upon successful completion, students will have the knowledge and skills to:

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Acquire familiarity with the basic concepts of data science .	a2
1.2	Identify the problems and tasks involved in the life-cycle of a Data Science project, including data collection, data preprocessing and data analysis.	
1.3	An understanding of problems solvable with data science and an ability to attack them from a statistical perspective.	
1.4	An understanding of when to use supervised and unsupervised statistical learning methods on labeled and unlabeled data-rich problems.	
2	**Skills :**	
2.1	Distinguish between different kinds of data and identify challenges related to big data.	b1
2.2	The ability to create data analytical pipelines and applications in Python.	
2.3	Familiarity with the Python data science ecosystem and the various tools needed to continue developing as a data scientist.	
3	**Competence: الكفاءات**	
3.1	Execute statistical analysis with professional software(Python).	c3
3.2	Applying proficiency with statistical analysis of data using Python.	
3.3	Applying supervised and unsupervised statistical learning methods on dataset	

CLOs		Aligned-PLOs
	using Python.	

C. Course Content

No	List of Topics	Contact Hours
1	**Review Statistics and Linear Algebra:** - Basic data structures/types - Basic probability and probability distributions, general properties of some common distributions. - Basic linear algebra: matrices, vectors, and some of their properties.	12
2	**Exploratory Data Analysis and Visualization:** - Exploratory Data Analysis - Developing a Visualization Aesthetic - Chart Types - Interactive Visualization.	12
3	**Data Modeling: Supervised/Unsupervised Learning and Model Evaluation**: - Basic kinds of statistical models, - Supervised learning: Linear Regression and Logistic Regression. - Clustering using K-Means method, Glean information.	12
4	**Data Modeling: Feature Selection, Engineering, and Data Pipelines**: - Principal Component Analysis - Independent Component Analysis - Construct complete data pipelines - Model construction and evaluation.	12
5	**Data Modeling: Advanced Supervised/Unsupervised Learning:** - Naive Bayesian classifier - Advanced supervised learning approaches support vector machines, decision trees, and random forest models for regression and classification.	12
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods Live Learning: Lecture, PowerPoint slides and discussion

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Acquire familiarity with the basic concepts of data science .	▪ **Direct Teaching:** Lectures, PowerPoint slides and discussion. ▪ **Aimed Teaching** Discovery and Oral Questions.	- Homework tasks - Quiz - Midterms - Final Exam
1.2	Identify the problems and tasks involved in the life-cycle of a Data Science project, including data collection, data preprocessing and data analysis.		
1.3	An understanding of problems solvable with data science and an ability to attack them from a statistical perspective.		- E-learning - Internet search - Oral Exam
1.4	An understanding of when to use supervised and unsupervised statistical learning methods on labeled and unlabeled data-rich problems.		
2.0	**Skills**		
2.1	Distinguish between different kinds of data and identify challenges related to big data.	**Indirect Teaching:** Brainstorming - Free Discovery – Inquiry	- Lab Exercises - Lab Exam - Oral Exam - Presentations
2.2	The ability to create data analytical pipelines and applications in Python.		
2.3	Familiarity with the Python data science ecosystem and the various tools needed to continue developing as a data scientist.		
3.0	**Competence**		
3.1	Execute statistical analysis with professional software(Python).	**Course Project: (Work group)** critical thinking and ability to seek solutions.	Introduce group project and case study approaches to enable students to have an experience in problem solving situations.
3.2	Applying proficiency with statistical analysis of data using Python.		
3.3	Applying supervised and unsupervised statistical learning methods on dataset using Python.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework 1	2	2%
2	QUIZ 1	3	5%
3	Homework 2	4	2%
4	QUIZ 2	5	5%
5	Midterm 1	6	10%
6	Homework 3	7	2%
7	QUIZ 3	8	5%
8	Homework 4	9	2%
9	QUIZ 4	10	5%
10	Midterm 2	11	10%
11	Lab Exam/ Project Evaluation	14	12%
12	Final Exam	16	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- Determine meeting appointments for the weak' students to solve their problems and give them academic advices.
- One office hour daily
- Dealing a workshops.
- Motivate students

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	An Introduction to Data Science, Jeffrey S. Saltz, Wiley, 2018, ISBN-13: 978-1506377537
Essential References Materials	The Data Science Handbook, Cady Field , Wiley, 2017, ISBN-13: 978-1119092940
Electronic Materials	https://www.kaggle.com/learn/overview
Other Learning Materials	Matlab toolboxes: Data mining/ Data Science / machine learning

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom - Laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show – Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Matlab software – Weka – Python Programming

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
1. Questionnaires (course evaluation) filled by the students and acquired electronically by the University	Students	Indirect Assessment
2. Students-faculty management meetings		
3. Midterms and Final Exam	Course Coordinator	Direct Assessment

Evaluation Areas/Issues	Evaluators	Evaluation Methods
4. Project Evaluation	Staff	
5. Departmental internal review of the course.	Reviewer Committee	Final Exam Evaluation
6. Course Portfolio	External Reviewer	Course Evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	