



Course Specifications (Postgraduate Degree)

Course Title:	Principles of Data Science
Course Code:	501PMDS-3
Program:	Professional Master of Data Science
Department:	Computer Science
College:	Computer Science and Information Systems
Institution:	Najran University

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A. Course Identification

1. Credit hours: 3
2. Course type
a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered: year 1/ level 1
4. Pre-requisites for this course (if any):
5. Co-requisites for this course (if any): NA

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	50	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	20
3	Tutorial	
4	Others (specify)	
	Total	50

B. Course Objectives and Learning Outcomes

1. Course Description

Businesses, governments, and individuals create massive collections of data as a by-product of their activity. Increasingly, decision-makers and systems rely on intelligent technology to analyze data systematically in order to improve decision-making. In many cases automating analytical and decision-making processes is necessary because of the volume of data and the speed with which new data are generated. We will examine how data analysis technologies can be used to improve decision-making. We will study the fundamental principles and techniques of data science, and we will examine real-world examples and cases to place data science techniques in context, to develop data-analytic thinking, and to illustrate that proper application is as much an art as it is a science. In addition, we will work hands-on with the Python programming language and its associated data analysis libraries.

2. Course Main Objective

The purpose of this course is to provide the students with a comprehensive introduction to the recent developments in data science and its applications. On completion of this course, students should: understand the ideas of statistical approaches to learning, understand how to approach answering statistical questions involving large and complex data sets, appreciate the range of basic techniques available to Data Scientists, and be familiar with the use of statistical software for computation and for visualization.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge	
1.1	Describe the role of data science and the data science lifecycle.	K1
1.2	Explain the technical issues that are present in the stages of a data analysis task and the properties of different technologies and tools that can be used to deal with the issues.	K1, K2
1.3	Understand the process of the data science lifecycle.	
2	Skills	
2.1	Acquire data through web-scraping and data APIs.	S1, S2
2.2	Clean and reshape messy datasets.	S3
2.3	Apply exploratory tools such as clustering and visualization tools to analyze data.	
2.4	Perform linear regression analysis.	S2
2.5	Evaluate outcomes and make decisions based on data.	S3
2.6		
3	Competences:	
3.1	Work cooperatively in a small group environment	
3.2		
3.3		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to data science and big data	3
2	Data exploration with Spreadsheets	6
3	Data exploration with Python	6
4	Cleaning and storing data	6
5	Querying and summarizing data	6
6	Hypothesis testing and evaluation	6
7	Data mining: association rules and dimensionality reduction	4
8	Data mining: clustering	4
9	Machine learning: regression	8
10	Machine learning: classification	4
11	Unstructured data	3

12	1. Product thinking and ethics: 2. Information, actionable knowledge from data, and link to effective decision making	3
13	Final Exam	
Total		50

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Describe the role of data science and the data science lifecycle.	TS-1: Relate Course Learning Outcomes (CLOs) to the topics TS-2: Giving Lectures in PPT, recalling the lecture through asking Questions. Clarifying doubts on Lecture. TS-3: Conducting a discussion of real life problems, among teacher, students. These learning outcomes will be taught in a combined form of seminars and lab sessions. Readings will be assigned every week and students are expected to participate in discussion during the seminars. Students are also expected to participate in lab sessions and complete lab exercises on computers.	Quiz Assignments Midterm Examination Final Examination
1.2	Explain the technical issues that are present in the stages of a data analysis task and the properties of different technologies and tools that can be used to deal with the issues.		
1.3	Understand the process of the data science lifecycle.		
...			
2.0	Skills		
2.1	Acquire data through web-scraping and data APIs.	TS-1: Relate Course Learning Outcomes (CLOs) to the topics TS-2: Giving Lectures in PPT, recalling the lecture through asking Questions. Clarifying doubts on Lecture. TS-3: Conducting a discussion of real life	Quiz Assignments Lab Assignments, Midterm Examination Final Examination,
2.2	Clean and reshape messy datasets.		
2.3	Apply exploratory tools such as clustering and visualization tools to analyze data.		
2.4	Perform linear regression analysis		
2.5	Evaluate outcomes and make decisions based on data.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.6	Evaluate outcomes and make decisions based on data.	problems, among teacher, students TS-4: Cooperative learning among the students. Encourage students to browse different journals, seminars or websites at their leisure time to have a better understanding about the course. These learning outcomes will be taught in a combined form of seminars and lab sessions. Readings will be assigned every week and students are expected to participate in discussion during the seminars. Students are also expected to participate in lab sessions and complete lab exercises on computers.	
3.0	Competences		
3.1	Work cooperatively in a small group environment		Final Project
3.2			
...			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz1	3 rd week	5%
2	Midterm	6 th week	20%
3	Project	5 th week	10%
4	Theory Assignments	2 th , 5 th , 8 th , 10 th weeks	10%
5	Lab Assignments	7 th week	10%
6	Quiz2	10 th week	5%
8	Final Exam	12 th or 13 th week	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 :

- Weekly office hours + Appointments
- Weekly academic advising hours
- Extra weekly 2 office hours prior to exams.
- Tutorials are also provided to the students

F. Learning Resources and Facilities

1. Learning Resources

<p>Required Textbooks</p>	<p><u>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython</u> <u>Read for free on Campus</u> 2nd edition Wes McKinney O'Reilly Media (2017)</p> <p><u>Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems</u> <u>Read for free on Campus</u> Aurélien Géron O'Reilly Media (2017)</p>
<p>Essential References Materials</p>	
<p>Electronic Materials</p>	
<p>Other Learning Materials</p>	<p><u>Data Science from Scratch: First Principles with Python</u>, Joel Grus O'Reilly Media (2015) <u>Code</u></p> <p><u>Doing Data Science: Straight Talk from the Frontline</u> Cathy O'Neil, Rachel Schutt O'Reilly Media (2013) <u>Blog that was the basis for this book</u></p> <p><u>Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization</u> Matt Harrison CreateSpace Independent Publishing Platform (2016)</p> <p><u>Mining of Massive Datasets</u> Jure Leskovec, Anand Rajaraman, and Jeffrey David Ullman 2nd ed., Cambridge University Press (2014) <u>Download from book website</u></p> <p><u>Data Mining: Concepts and Techniques</u> Jiawei Han, Micheline Kamber, and Jian Pei 3rd ed., Morgan Kaufmann (2011)</p> <p><u>An Introduction to Statistical Learning</u> Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani</p>

	Springer Texts in Statistics (2015) <u>Read for free</u>
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2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Room B-58 Laboratory A-16L
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, PCs. The software chosen for the class
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	<ul style="list-style-type: none"> • Printer is important in the lab to print reports and some snapshots. • Projector and PC for the lab instructor is required

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Online course survey	Students	Indirect
Focus group discussion with small groups of students.	Instructor	Direct
Extent of achievement of course learning outcomes	instructor	Direct

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	Computer Science Departmental Council
Reference No.	14440203-0185-00002
Date	1st Sep, 2022