

DeCAIR Course Syllabus Form

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Author Organization Name(s)	Tafila Technical University		
Work Package Number & Title	Work Package 2: Development of new MSc and BSc programs in AIR		
Activity Number & Title	Activity 2.2: Designing and developing syllabi and content for the agreed upon courses in the new programs		
Work Package Leader	Francesco Masulli, University of Genoa		
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Revision History

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1	13/11/2021	Jafar AbuKhait	Original (base) document	C	1-6
2	11/12/2021	Jafar AbuKhait	Revised version	U	1-6
3	16/01/2022	Jafar AbuKhait	Revised based on a peer review	U	1-6
4	2/2/2022	Jafar AbuKhait	Revised based on an expert review	U	1-6

(*) Action: C = Creation, I = Insert, U = Update, R = Replace, D = Delete

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Course title	Statistical Analysis and Data Science													
Course number	0112550													
Credit hours (lecture and lab)	3													
ECTS (weekly contact and self-study load)	6 (3 + 3)													
Prerequisites/co-requisites by course number and name	Linear Algebra 1 (0203241)													
Prerequisites by topic (other than the formal prerequisites above)	Students are assumed to have good background in programming, calculus, and algebra. Programming in Python will be used throughout the course.													
Level and type (mandatory, elective)	Undergraduate mandatory course													
Year of study and semester	Third year; first semester													
Catalogue description	This course provides a foundation for exploring data through computing and statistical analysis in real-world applications. It introduces the necessary skills and basic concepts to manage, visualize and analyze data such as exploratory data analysis, statistical inference and modeling, machine learning, and visualization. It explores the complexities of data mining algorithms, software tools, and techniques employed in modern analytics and massive datasets.													
Objectives	<ol style="list-style-type: none"> 1. Introduce the concepts of Data Science and its significance in solving problems. 2. Recognize basic concepts of probability and statistical definitions in Data Science. 3. Introduce the techniques of Collection, Manipulation, and Blending Data from Different Data Sources. 4. Introduce Data Visualization and Perform Exploratory Data Analysis. 5. Introduce the basics of Supervised Machine Learning and Regression Analysis Techniques in Data Science. 6. Apply classification and clustering strategies for data analysis. 													
Intended learning outcomes	<p>Upon successful completion of this course, students will be able to:</p> <table border="1"> <thead> <tr> <th>No</th> <th>Intended learning Outcome (ILO)</th> <th>Program learning outcome (PLO)*</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Develop practical data analysis skills and basic concepts of data science.</td> <td>1</td> </tr> <tr> <td>2</td> <td>Apply Data Collection, Manipulation, and Visualization techniques on big Datasets.</td> <td>2, 7</td> </tr> <tr> <td>3</td> <td>Implement Statistical Inference, Machine Learning</td> <td>6, 7</td> </tr> </tbody> </table>		No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*	1	Develop practical data analysis skills and basic concepts of data science.	1	2	Apply Data Collection, Manipulation, and Visualization techniques on big Datasets.	2, 7	3	Implement Statistical Inference, Machine Learning	6, 7
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		and Regression Analysis to solve real-life problems.																	
	4	Develop applied experience with data science software, programming, applications and processes.	6, 7																
	5	Use Python and its specialized libraries with real-world data analysis.	7																
	(*) The PLOs are listed in the appendix																		
Teaching and learning methods	<p>Development of ILOs is promoted through the following teaching and learning methods:</p> <ul style="list-style-type: none"> Lectures will be delivered through Microsoft Teams and will be recorded for later access. The Intelligent Systems Lab. is open for the students to practice the practical aspects and solve the programming homework assignments. The student attends the class presentations and participates in the discussions. The student joins the related online team/group and participates in its discussions. The student studies the reference material, including books and videos. The student solves the programming assignments in Data Science. The student carries out a term project for solving a problem using Data Science techniques. The student develops a professional report for the term report. The student presents the term project in class. 																		
Learning material type	Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.																		
Resources and references	<p>A- Required book(s), assigned reading and audio-visuals:</p> <ol style="list-style-type: none"> Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications, Laura Igual, and Santi Seguí, 2017. A Hands-On Introduction to Data Science, Chirag Shah, 2020. <p>B- Recommended book(s), material and media:</p> <ol style="list-style-type: none"> Tamhane, Ajit C., and Dorothy D. Dunlop. Statistics and Data Analysis: From Elementary to Intermediate. Prentice Hall, 1999. ISBN: 9780137444267. Introduction to Data Science: Data Analysis and Prediction Algorithms with R by Rafael A. Irizarry, 2020. An Introduction to Data Science by Jeffrey S. Saltz, Jeffrey M. Stanton, 2018. 																		
Topic outline and schedule	<table border="1"> <thead> <tr> <th>Week</th> <th>Topic</th> <th>ILO</th> <th>Resources</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Introduction to Data Science</td> <td>1</td> <td>1, 2</td> </tr> <tr> <td>2</td> <td>Python for Data Science</td> <td>1, 5</td> <td>1</td> </tr> <tr> <td>3, 4</td> <td>NumPy Basics and Pandas Data Structures</td> <td>1, 5</td> <td>1</td> </tr> </tbody> </table>			Week	Topic	ILO	Resources	1	Introduction to Data Science	1	1, 2	2	Python for Data Science	1, 5	1	3, 4	NumPy Basics and Pandas Data Structures	1, 5	1
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2	Python for Data Science	1, 5	1																
3, 4	NumPy Basics and Pandas Data Structures	1, 5	1																

	5	Basic probability & Random variables	1, 2	2, 3																								
	6	Data Collection and Data Blending	2, 3	1, 2																								
	7	Data Visualization	2	1																								
	8	Exploring Distributions (Discrete and Continuous)	3	1, 3																								
	9	Sampling Distributions of Statistics	3	3																								
	10	Descriptive Statistics	3	1																								
	11, 12	Statistical Inference	3	1																								
	13	Supervised Learning and Statistical models	3, 4	1, 2																								
	14	Simple Linear Regression and Correlation	3, 4	1, 2																								
	15	Multiple Linear Regression and Clustering	3, 4	1, 2																								
Evaluation tools	Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:																											
	<table border="1"> <thead> <tr> <th>Assessment tool</th> <th>Mark</th> <th>Topic(s)</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>Homework assignments</td> <td>20%</td> <td>Programming aspects</td> <td>W2-W14</td> </tr> <tr> <td>Midterm exam</td> <td>30%</td> <td>Data Collection, Visualization, and Statistical Inference</td> <td>W8</td> </tr> <tr> <td>Term Project report and presentation</td> <td>20%</td> <td>Practical and presentation aspects</td> <td>W14</td> </tr> <tr> <td>Final exam</td> <td>30%</td> <td>All material</td> <td>W16</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> </tr> </tbody> </table>				Assessment tool	Mark	Topic(s)	Time	Homework assignments	20%	Programming aspects	W2-W14	Midterm exam	30%	Data Collection, Visualization, and Statistical Inference	W8	Term Project report and presentation	20%	Practical and presentation aspects	W14	Final exam	30%	All material	W16	Total	100%		
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Student requirements	The student should have a computer and internet connection.																											
Course policies	A- Attendance policies: <ul style="list-style-type: none"> Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard. B- Absences from exams and not submitting assignments on time: <ul style="list-style-type: none"> A makeup exam for finals only can be arranged for students with acceptable absence causes. Assignments submitted late, but before announcing or discussing, the solution can be accepted with 25% penalty. The project report must be handed in in time. C- Health and safety procedures: <ul style="list-style-type: none"> All health and safety procedures of the university and the school should be followed. D- Honesty policy regarding cheating, plagiarism, misbehavior: <ul style="list-style-type: none"> All submitted work must be of the submitting student. Other text or code must be properly quoted with clear source specification. 																											

	<ul style="list-style-type: none"> • Cheating will not be tolerated. <p>E- Available university services that support achievement in the course:</p> <ul style="list-style-type: none"> • Microsoft Teams team and Moodle course page • Computer labs are available for practicing the practical aspects and solving the programming assignments. • Program announcements Facebook group
Additional information	None

Appendix

Learning Outcomes for the BSc in Computer Engineering

Students who successfully complete the BSc in Computer Engineering will be have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.