

COURSE DESCRIPTION FORM

INSTITUTION Fast University of Computer and Emerging Sciences

PROGRAM (S) TO BE BS(CS)

EVALUATED

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS-4048
Course Title	Data Science
Credit Hours	3
Prerequisites by Course(s) and Topics	Data Structures
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Assignments, Project, MidTerm1, MidTerm2 (Programming based), Final
Course Coordinator	Dr. Muhammad Nouman Durrani
URL (if any)	
Current Catalog Description	Data Science is a dynamic and fast-growing field at the interface of Statistics and Computer Science. It is an interdisciplinary field about processes and systems to extract knowledge or insights from data in various forms (Wikipedia). This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools including data collection and integration, data cleaning, data analysis using machine learning, visualization and effective communication. The main focus of these topics will be on understanding and integration of concepts and their application to solving problems.
Textbook (or Laboratory Manual for Laboratory Courses)	Lecture Notes Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Science, Big data, machine learning, and more, using Python tools, May 2016
Reference Material	Journals: Machine Learning, Pattern Recognition

Program Learning Outcomes	Conferences: ICPR, ICDM, ICML, KDD www.datacamp.com (Students are given free access on many tutorials)			
	PLO1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✓
	PLO2	Problem Analysis	Identify, formulate, research literature, and analyse complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✓
	PLO3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✓
	PLO4	Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods	✓
	PLO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✓
	PLO6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems..	✓
	PLO7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	✓
	PLO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	✓
	PLO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✓
	PLO10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	✓
	PLO11	Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	✓
	PLO12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	✓

Course Goals	<p>Course Learning Objectives:</p> <p>CLO 1: Student should able to describe what Data Science is and the skill sets needed to be a data scientist.</p> <p>CLO 2: Students should able to get inside knowledge about data such as using data to get information about an unknown quantity of interest.</p> <p>CLO 3: Students should able to understand supervised and unsupervised modelling, over fitting and its avoidance, visualization</p> <p>CLO 4: Students should able to apply most important data science methods, using open-source tools</p> <p>CLO 5: Students should able to work as a team while integrating important components in data science</p> <hr/> <p><i>Student Outcomes Addressed by the Course (From ABET)</i></p> <p>(a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline</p> <p>(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution</p> <p>(f) An ability to communicate effectively with a range of audiences</p> <p>(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices [CS]</p> <p>(k) An ability to apply design and development principles in the construction of software systems of varying complexity [CS]</p>																														
Relation between CLOs and PLOs	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 15%;">CLO No.</th><th style="width: 25%;">Domain</th><th style="width: 20%;">Taxonomy level</th><th style="width: 20%;">PLO</th><th style="width: 20%;"></th></tr> <tr> <td>1</td><td>Cognitive</td><td>3</td><td>1</td><td></td></tr> <tr> <td>2</td><td>Cognitive</td><td>4</td><td>2</td><td></td></tr> <tr> <td>3</td><td>Cognitive</td><td>5</td><td>2</td><td></td></tr> <tr> <td>4</td><td>Cognitive</td><td>4</td><td>5</td><td></td></tr> <tr> <td>5</td><td>Cognitive</td><td>5</td><td>9</td><td></td></tr> </table>	CLO No.	Domain	Taxonomy level	PLO		1	Cognitive	3	1		2	Cognitive	4	2		3	Cognitive	5	2		4	Cognitive	4	5		5	Cognitive	5	9	
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Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="5" style="background-color: #e0e0e0;">1. Topics to be covered:</th></tr> <tr> <th style="width: 55%;">List of Topics</th><th style="width: 15%;">No. of Weeks</th><th style="width: 15%;">Contact Hours</th><th style="width: 15%;">CLO</th><th style="width: 10%;"></th></tr> <tr> <td>Basics of Data Science, Motivating Examples, Introduction to Python</td><td style="text-align: center;">1</td><td style="text-align: center;">3</td><td style="text-align: center;">1, 4</td><td></td></tr> <tr> <td>Data Preparation: Data Cleaning EDA: Compute Simple Statistics, Simple Visualization, Case</td><td style="text-align: center;">2</td><td style="text-align: center;">6</td><td style="text-align: center;">1,2, 4</td><td></td></tr> </table>	1. Topics to be covered:					List of Topics	No. of Weeks	Contact Hours	CLO		Basics of Data Science, Motivating Examples, Introduction to Python	1	3	1, 4		Data Preparation: Data Cleaning EDA: Compute Simple Statistics, Simple Visualization, Case	2	6	1,2, 4											
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	Studies, Practical Examples				
	Supervised Classification (kNN, Naïve Bayes, SVM, Decision Tree, Logistic Regression, Neural Networks)	3	9	3,4	
	Unsupervised Classification & Feature Extraction (K-means, PCA, SVD, LDA)	2	6	3,4	
	Regression Analysis	1	3	2,3,4	
	Ensemble Classifiers	2	6	2,3,4	
	Associative Learning	1	3	3,4	
	Introduction to Graph Analytics / Visualization, Hadoop Map Reduce	3	9	1,3,4	
	Group Project Presentations	1	3	5	
	Total	16	48		
Laboratory Projects/Experiments Done in the Course	Yes. Project and Regular Lab Classes once a week				
Programming Assignments Done in the Course	Yes. Infect Midterm 2 was conducted on Lab totally based on programming				
Class Time Spent on (in credit hours)	Theory	Problem Analysis	Solution Design	Social and Ethical Issues	
	40 %	25 %	25%	10%	
Oral and Written Communications	Every student is required to submit at least __1__ written reports of typically __4__ pages and to make __1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.				

Instructor Name Dr Muhammad Nouman Durrani

Instructor Signature _____

Date 08/02/2022