



COURSE DESCRIPTION FORM: CS-4085: MLOps

INSTITUTION FAST School of Computing, National University of Computer and Emerging Sciences, Islamabad Campus

PROGRAM TO BE EVALUATED BS-CS: Fall-2025

Course Description

Course Code	CS-4085	
Course Title	MLOps	
Credit Hours	3	
Course Instructors	Dr. Hammad Majeed	
Grading Policy	Absolute grading	
Policy about missed assessment items in the course	<p>Retake of missed assessment items (other than sessional/ final exam) will not be held. Student who misses an assessment item (other than sessional / final exam) is awarded zero marks in that assessment item i.e. late submission will not be accepted.</p> <p>For missed sessional/ final exam, exam retake/ pretake application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee decides the exam retake/ pretake cases.</p>	
Course Plagiarism Policy	<p>Plagiarism in project or sessional/ final exam will result in F grade in the course. Plagiarism in an assignment will result in zero marks in the whole assignments category. Use of Generative AI as an Coach is allowed. The copying the code from Gen AI based tools will result in zero marks.</p>	
Prerequisites by Course(s) or Topics		
Assessment Instruments with Weights (homeworks, quizzes, sessional exams, final exam, assignments, etc.)	Assessment with the weight.	
	Assessment Type	Weight
	Assignments	20
	Sessional Exams 1	10
	Sessional Exams 2	10
	Project	20
	Final Exam	40
Course Coordinator	Dr. Hammad Majeed	
URL (if any)		
Course Catalog	The course is o help professionals become certified MLOps Engineers and provide an	

Description	opportunity to build a career in the field. Our goal is to spread knowledge and help professionals learn the most critical skills in the MLOps sphere.																																																											
Textbook	Practical MLOps: Operationalizing Machine Learning Models 1st Edition by Noah Gift, Alfredo Deza																																																											
Reference Material																																																												
Course Goals	<table border="1"> <tr> <th align="left" colspan="3">A. Course Learning Outcomes (CLOs)</th></tr> <tr> <td colspan="3">After course completion, the students shall be able to:</td></tr> <tr> <td colspan="3">1. Manage ML infrastructure on the multi-cloud and on-premises environments</td></tr> <tr> <td colspan="3">2. Containerize ML applications</td></tr> <tr> <td colspan="3">3. Optimize and refactor machine learning code and understand data scientists' challenges</td></tr> <tr> <td colspan="3">4. Deploy CI/CD pipelines for machine learning workflow</td></tr> <tr> <td colspan="3">5. Orchestrate machine learning pipelines using Kubeflow</td></tr> <tr> <td colspan="3">6. Create data engineering pipelines using Airflow</td></tr> <tr> <td colspan="3">7. Deploy ML models in REST API using Flask and FastAPI</td></tr> <tr> <td colspan="3">8. Prototype end-to-end ML application with a modern stack</td></tr> <tr> <td colspan="3">9. Work with a team to tackle production problems in MLOps</td></tr> <tr> <th align="left" colspan="3">B. Program Learning Outcomes (PLOs)</th></tr> <tr> <td>PLO 1</td><td>Computing Knowledge</td><td>Apply knowledge of mathematics, natural sciences, co and a computing specialization to the solution of comp problems.</td></tr> <tr> <td>PLO 2</td><td>Problem Analysis</td><td>Identify, formulate, research literature, and analyze co problems, reaching substantiated conclusions using fir mathematics, natural sciences, and computing sciences</td></tr> <tr> <td>PLO 3</td><td>Design/Develop Solutions</td><td>Design solutions for complex computing problems and components, and processes that meet specified needs v consideration for public health and safety, cultural, soc environmental considerations.</td></tr> <tr> <td>PLO 4</td><td>Investigation & Experimentation</td><td>Conduct investigation of complex computing problem knowledge and research based methods</td></tr> <tr> <td>PLO 5</td><td>Modern Tool Usage</td><td>Create, select, and apply appropriate techniques, resou computing tools, including prediction and modelling f problems.</td></tr> <tr> <td>PLO 6</td><td>Society Responsibility</td><td>Apply reasoning informed by contextual knowledge to safety, legal, and cultural issues relevant to context of problems.</td></tr> <tr> <td>PLO 7</td><td>Environment and Sustainability</td><td>Understand and evaluate sustainability and impact of p work in the solution of complex computing problems</td></tr> </table>			A. Course Learning Outcomes (CLOs)			After course completion, the students shall be able to:			1. Manage ML infrastructure on the multi-cloud and on-premises environments			2. Containerize ML applications			3. Optimize and refactor machine learning code and understand data scientists' challenges			4. Deploy CI/CD pipelines for machine learning workflow			5. Orchestrate machine learning pipelines using Kubeflow			6. Create data engineering pipelines using Airflow			7. Deploy ML models in REST API using Flask and FastAPI			8. Prototype end-to-end ML application with a modern stack			9. Work with a team to tackle production problems in MLOps			B. Program Learning Outcomes (PLOs)			PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, co and a computing specialization to the solution of comp problems.	PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze co problems, reaching substantiated conclusions using fir mathematics, natural sciences, and computing sciences	PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and components, and processes that meet specified needs v consideration for public health and safety, cultural, soc environmental considerations.	PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problem knowledge and research based methods	PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resou computing tools, including prediction and modelling f problems.	PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to safety, legal, and cultural issues relevant to context of problems.	PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of p work in the solution of complex computing problems
A. Course Learning Outcomes (CLOs)																																																												
After course completion, the students shall be able to:																																																												
1. Manage ML infrastructure on the multi-cloud and on-premises environments																																																												
2. Containerize ML applications																																																												
3. Optimize and refactor machine learning code and understand data scientists' challenges																																																												
4. Deploy CI/CD pipelines for machine learning workflow																																																												
5. Orchestrate machine learning pipelines using Kubeflow																																																												
6. Create data engineering pipelines using Airflow																																																												
7. Deploy ML models in REST API using Flask and FastAPI																																																												
8. Prototype end-to-end ML application with a modern stack																																																												
9. Work with a team to tackle production problems in MLOps																																																												
B. Program Learning Outcomes (PLOs)																																																												
PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, co and a computing specialization to the solution of comp problems.																																																										
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze co problems, reaching substantiated conclusions using fir mathematics, natural sciences, and computing sciences																																																										
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and components, and processes that meet specified needs v consideration for public health and safety, cultural, soc environmental considerations.																																																										
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problem knowledge and research based methods																																																										
PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resou computing tools, including prediction and modelling f problems.																																																										
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to safety, legal, and cultural issues relevant to context of problems.																																																										
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of p work in the solution of complex computing problems																																																										

	PLO 8	Ethics	Apply ethical principles and commit to professional et and norms of computing practice.																																																																																																																																																													
	PLO 9	Individual and Team Work	Function effectively as an individual, and as a member teams and in multi-disciplinary settings.																																																																																																																																																													
	PLO 10	Communication	Communicate effectively on complex computing activ computing community and with society at large.																																																																																																																																																													
	PLO 11	Project Management and Finance	Demonstrate knowledge and understanding of manage economic decision making and apply these to one's ow a team.																																																																																																																																																													
	PLO 12	Life Long Learning	Recognize the need for, and have the preparation and a independent and life-long learning in the broadest con changes.																																																																																																																																																													
	C. Mapping of CLOs to PLOs (CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)																																																																																																																																																															
	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="12">PLOs</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> </tr> </thead> <tbody> <tr> <td rowspan="6">CLOs</td> <td>1</td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>4</td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>5</td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td></td> <td>7</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td></td> <td>8</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td></td> <td>9</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> </tbody> </table>															PLOs												1	2	3	4	5	6	7	8	9	10	11	12	CLOs	1			✓		✓				✓		✓	✓	2					✓				✓		✓	✓	3									✓		✓	✓	4			✓		✓				✓	✓	✓	✓	5			✓		✓				✓		✓	✓	6				✓	✓				✓		✓	✓		7	✓	✓	✓	✓	✓				✓		✓	✓		8	✓	✓	✓	✓	✓				✓		✓	✓		9	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
			PLOs																																																																																																																																																													
			1	2	3	4	5	6	7	8	9	10	11	12																																																																																																																																																		
	CLOs	1			✓		✓				✓		✓	✓																																																																																																																																																		
2						✓				✓		✓	✓																																																																																																																																																			
3										✓		✓	✓																																																																																																																																																			
4				✓		✓				✓	✓	✓	✓																																																																																																																																																			
5				✓		✓				✓		✓	✓																																																																																																																																																			
6					✓	✓				✓		✓	✓																																																																																																																																																			
	7	✓	✓	✓	✓	✓				✓		✓	✓																																																																																																																																																			
	8	✓	✓	✓	✓	✓				✓		✓	✓																																																																																																																																																			
	9	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓																																																																																																																																																			
Topics covered in the course (assume 15-week instruction and 3 contact hours per week)	<table border="1"> <thead> <tr> <th colspan="4">Topics to be covered:</th> </tr> <tr> <th>List of Topics</th> <th>No. of Weeks</th> <th>Contact Hours</th> <th>CLO(s)</th> </tr> </thead> <tbody> <tr> <td>Introduction to MLOps</td> <td align="center">1</td> <td align="center">3</td> <td align="center">1</td> </tr> <tr> <td>Basics of Machine Learning and Data Science</td> <td align="center">1</td> <td align="center">3</td> <td align="center">1,3</td> </tr> </tbody> </table>													Topics to be covered:				List of Topics	No. of Weeks	Contact Hours	CLO(s)	Introduction to MLOps	1	3	1	Basics of Machine Learning and Data Science	1	3	1,3																																																																																																																																			
Topics to be covered:																																																																																																																																																																
List of Topics	No. of Weeks	Contact Hours	CLO(s)																																																																																																																																																													
Introduction to MLOps	1	3	1																																																																																																																																																													
Basics of Machine Learning and Data Science	1	3	1,3																																																																																																																																																													



National Computing Education Accreditation Council
NCEAC



NCFAC FORM 001-D

	Software Development for Machine Learning Apps	1	3	1,3
	Containerizing ML application	1	3	2,7
	Microservices and REST API for ML Deployment	1	3	1,2
	Container Orchestration and environment concepts	1	3	2, 4
	Continuous Delivery: CI/CD Pipelines	2	6	4,5,6,7,8
	Data Pipelines	2	6	4,6
	Automated ML Pipelines	2	6	7,8,9
	Capstone project	3	9	7,8,9
		15	45	
Programming Language for Assignments	Python, YAML			
Class Time Spent (in percentage)	Theory	Problem Analysis	Solution Design	Social and Ethical Issues
	20	30	40	10
Oral and Written Communications	Every student is required to submit at least __5__ written reports of typically __5__ pages each and to make __1__ oral presentation of typically __10__ minutes' duration.			