Course Specification

(Postgraduate Programs)

Course Title:	Machine Learning Engineering
Course Code:	CE6101
Program:	Master of Science in Computer Engineering
Department:	Computer and Network Engineering
College:	College of Computing
Institution:	Umm Al-Qura University
Version:	1.0
Last Revision Date:	12/4/2025

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☐ Department	☒ Track
B.	☒ Required in the Intelligent Systems Track		☒ Elective in all other tracks	
3. Level/year at which this course is offered: (Level 3 or 4)				
4. Course General Description:				
This course offers an in-depth exploration of machine learning techniques and their applications within the field of computer engineering. Students will learn fundamental concepts such as supervised and unsupervised learning, deep learning, and reinforcement learning. Through hands-on projects and real-world case studies, participants will develop skills in implementing machine learning algorithms using popular programming frameworks.				
5. Pre-requirements for this course (if any)**:**				
None				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
The main objective of this course is to equip Computer Engineering students with a thorough understanding of machine learning fundamentals, as well as the practical engineering skills required to design, implement, and optimize machine learning systems in real-world applications. 1. **Foundational Knowledge:** Provide students with a solid theoretical understanding of fundamental machine learning concepts and techniques, including supervised, unsupervised, and basic reinforcement learning methods.				

2. **Practical Engineering Skills:** Teach students how to translate theoretical concepts into engineered solutions, including data preprocessing, model development, deployment, and performance optimization.
3. **Tool Proficiency:** Familiarize students with common machine learning frameworks, libraries, and platforms used in industry, and prepare them to select and utilize these tools effectively.
4. **Ethical and Responsible AI:** Raise awareness of ethical, legal, and social implications of machine learning systems and instill responsible engineering practices.
5. **Domain Integration:** Enable students to integrate machine learning solutions into computer engineering contexts, such as embedded systems, hardware acceleration, and edge computing.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)……**	
	Total	45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Articulate key machine learning concepts, terminology, and methods and their mathematical foundations.	**K2**	Lectures and discussions	Quizzes
1.2	Select appropriate ML algorithms for a given problem	**K1**	Lectures and discussions	Quizzes
2.0	**Skills**			
2.1	Apply appropriate ML algorithms for a given problem	**S1 and S2**	Tutorials and discussions	Programming assignments and course project
2.2	Implement ML solutions using modern programming frameworks and tools	**S1 and S2**	Tutorials and discussions	Programming assignments and course project
2.3	Evaluate ML models using sound statistical and experimental methodologies	**S4**	Tutorials and discussions	Programming assignments and course project
2.4	Design scalable and maintainable ML systems for deployment	**S1 and S2**	Tutorials and discussions	Programming assignments and course project
2.5	Perform data preprocessing, cleaning, and exploratory data analysis to prepare datasets for machine learning models	**S1**	Tutorials and discussions	Programming assignments and course project
3.0	**Values, autonomy, and responsibility**			
3.1	Address ethical, fairness, and security considerations in ML	**V1**	Lectures and discussions	Project
3.2	Work effectively in a team on an ML project	**V2**	Project	Team project

C. Course Content:

No	List of Topics	Contact Hours
1.	The Machine Learning Landscape	2
2.	End-to-end Machine Learning project	2
3.	Classification	3
4.	Training Models and Regression	3
5.	Support Vector Machines	2
6.	Decision Trees	2
7.	Ensable and Randome Forests	3
8.	Unsupervised Learning	3
9.	Introduction to Neural Networks and Training deep networks	3
10.	Custom Models and Training with TF	2
11.	Deep Computer Vision using CNN	3
12.	Learning Sequences with RNN	3
13.	Natural Language Processing	3
14.	Autoencoders, GANs, and Diffusion Models	3
15.	Reinforcement Learning	3
16.	Training and Deploying TensorFlow Models at Scale	3
17.	Security, Privacy, and Ethics in ML	2
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Weekly	20
2.	Programming Assignments	Biweekly	30
3.	Course Project	16	50

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurélien Géron, 2022
Supportive References	"Machine Learning Systems: Principles and Practices of Engineering Artificially Intelligent Systems", by: Vijay Janapa Reddi, Harvard University, https://mlsysbook.ai.

Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
Facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Projector
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Leaders	Indirect
Effectiveness of students' assessment	Program Leaders	Direct
Quality of learning resources	Students, Faculty	Indirect
The extent to which CLOs have been achieved	Students, Faculty, Program Leaders	Direct and Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Computer and Network Engineering Department Council**
REFERENCE NO.	**The 18th Session Of The Academic Year 1446**
DATE	**15/4/2025**