Course Specification

(Postgraduate Programs)

Course Title:	Tiny Machine Learning (TinyML)
Course Code:	CE6102
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

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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 introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence. Tiny Machine Learning (TinyML) is one of the fastest-growing areas of Deep Learning and is rapidly becoming more accessible. This course provides a foundation for the students to understand this emerging field.				
5. Pre-requirements for this course (if any)**:**				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
Tiny Machine Learning (TinyML) is a growing field that combines embedded systems with Machine Learning. This course focuses on practical experience in training and deploying ML models on small microcontroller-based devices. Students will discuss recent literature on TinyML and work on projects using a TinyML kit, which includes a microcontroller, sensors, and a camera. This setup enables tasks like image, sound, and gesture recognition. By the end of the course, students will have developed and mastered implementing and deploying a complete TinyML models.				

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**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
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	Explain the fundamental concept of TinyML	K1 and K2	Lectures, Readings	Quizzes, Projects
2.0	**Skills**			
2.1	Configure various sensors on using TinyML development kit	S1 and S2	Lectures, Readings	Quizzes, Projects
2.2	Deploy TinyML models and applications on microcontrollers	S1 and S2	Lectures, Readings	Quizzes, Projects
2.3	Evaluate the performance of TinyML applications	S4	Lectures, Readings	Quizzes, Projects

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.4	Demonstrate an application that is implemented with TinyML	S3	Project	Project
3.0	**Values, autonomy, and responsibility**			
3.1	Recognize the ethical challenges and issues of modern TinyML applications	V1	Lectures, Readings	Quizzes, Projects
3.2	Work effectively in a team to develop, run, and evaluate TinyML applications.	V2	Project	Project

C. Course Content:

No	List of Topics	Contact Hours
1.	Foundations of TinyML: Introduction to IoT and TinyML, the machine learning paradigm, Building blocks of Deep Learning, Image classification with CNN, Datasets, Model performance metrics, Overfitting	15
2.	Sensors: TinyML kit overview, kit setup, sensor testing, sensor fusion	6
3.	TinyML Apps and Deployment to Microcontrollers: TFLight, Quantization	9
4.	Energy harvesting techniques	3
5.	Security in IoT	3
6.	Responsible AI	2
7.	Recent Trends on ML on embedded devices	7
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Weekly Quizzes	1-15	15%
2.	Biweekly Programming and Hacking Assignments	1-15	35%
3.	Presenting Recent TinyML Literature	14,15	20%
4.	Semester-long Project	15	30%

*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	"Machine Learning Systems: Principles and Practices of Engineering Artificially Intelligent Systems", by: Vijay Janapa Reddi, Harvard University, https://mlsysbook.ai. "TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers", 1st Edition, by Pete Warden, Daniel Situnayake, 2020, ISBN-10: 1492052043, ISBN-13: 978-1492052043
Supportive References	
Electronic Materials	**https://www.dejazzer.com/eece4710** **https://efficientml.ai** **https://tinyml.seas.harvard.edu/courses** **https://tinyml.seas.upenn.edu**
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)	Students should use the following kit to apply what they are learning in the course: **https://store.arduino.cc/products/arduino-tiny-machine-learning-kit**

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