



Course Specification

DIPLOMA

Course Title: **Machine Learning**

Course Code: **APDA3210**

Program: **Diploma in Data Analytics**

Department: **Diploma Department**

College: **The Applied College**

Institution: **Umm Al-Qura University**

Version: **1**

Last Revision Date: **05 May 2025**



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A. General information about the course:

1. Course Identification

1. Credit hours:

4

2. Course type

- A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
- B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: Level 3, 2nd Year

4. Course General Description:

This course provides a comprehensive introduction to machine learning, covering essential concepts and practical techniques to address real-world problems. Students will explore the data analysis pipeline, including model training, and evaluation, while gaining hands-on experience with tools like Scikit-Learn. The curriculum includes foundational algorithms such as linear and logistic regression, nearest neighbours, support vector machines, decision trees, and ensemble methods like random forests and boosting. Additionally, students will learn about unsupervised learning methods like clustering. By the end of the course, students will have the skills to design, evaluate, and deploy machine learning models effectively.

5. Pre-requirements for this course (if any):

APDA1202 Statistics and Probabilities
APDA2206 Advanced Programming

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

The objective of this course is to provide students with a thorough understanding of machine learning principles and techniques, enabling them to design, implement, and evaluate models for real-world applications. Students will grasp the foundational concepts of supervised and unsupervised machine learning methods, such as regression, classification and clustering. Emphasis will also be placed on addressing challenges such as overfitting, model evaluation, and creating a pipeline. By the end of the course, students will be capable of applying machine learning techniques to solve complex problems and leveraging tools like Scikit-Learn to build robust and scalable solutions.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%





No	Mode of Instruction	Contact Hours	Percentage
2	E-learning	None	
3	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 	None	
4	Distance learning	None	

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	30
3.	Field	None
4.	Tutorial	None
5.	Others (specify)	None
Total		75

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	Identify appropriate analysis tools and techniques.	K1	<ul style="list-style-type: none"> Lectures Lab Exercises 	<ul style="list-style-type: none"> Midterm and Final exams Quiz Lab assessment
1.2	Discuss the role of machine learning methods for solving real-world problems.	K2	<ul style="list-style-type: none"> Lectures Lab Exercises 	<ul style="list-style-type: none"> Midterm and Final exams Quiz Lab assessment
1.3	Explain and differentiate between at least three key methods	K3	<ul style="list-style-type: none"> Lectures Lab Exercises 	<ul style="list-style-type: none"> Midterm and Final exams Quiz Lab assessment





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	and algorithms used in data science, highlighting their applications, strengths, and weaknesses.			• Project
2.0	Skills			
2.1	Apply appropriate machine learning techniques to support problem-solving and decision making.	S1	<ul style="list-style-type: none"> • Lectures • Lab Exercises 	<ul style="list-style-type: none"> • Midterm and Final exams • Quiz • Lab exam • Project
2.2		S3	<ul style="list-style-type: none"> • Lectures • Lab Exercises 	<ul style="list-style-type: none"> • Midterm and Final exams • Lab assessment • Project
2.3	Show data interpretation abilities.	S4	<ul style="list-style-type: none"> • Lectures • Lab Exercises 	Project
3.0	Values, autonomy, and responsibility			
3.1	Evaluate and justify ethical decision-making in data collection, storage, processing, and sharing, ensuring compliance with relevant regulations.	V2	<ul style="list-style-type: none"> • Lectures • Lab Exercises 	Project

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Machine Learning: <ul style="list-style-type: none"> • What is a Machine Learning? • Why Use Machine Learning Systems? • Types of Machine Learning Systems • Main Challenges of Machine Learning • Testing and Validating 	5
2.	Introduction to Scikit-Learn	5



3.	<p>Training a Binary Classifier</p> <p>Classification Performance Measures</p> <ul style="list-style-type: none"> • Confusion Matrix • Precision and Recall • Precision/Recall Tradeoff • The ROC Curve <p>Multiclass Classification</p> <p>Multilabel Classification</p>	5
4.	Linear Regression and Logistic Regression	5
5.	Classification using Support Vector Machines (SVMs): linear SVM , nonlinear SVM	5
6.	<p>Classification using Nearest Neighbors</p> <p>Classification using Bayesian Classifier</p>	5
7.	Classification using Decision Trees	5
8.	Ensemble Learning including Voting Classifiers, Bagging , Boosting, and Random Forests.	5
9.	<p>Model Overfitting and underfitting</p> <p>Model Selection and Training:</p> <ul style="list-style-type: none"> • Training and Evaluating on the Training Set • Better Evaluation using Cross Validation including k-fold and leave-one-out approaches. <p>Methods for Comparing Classifiers</p>	10
10.	Association Analysis: Basic Concepts and Algorithms	5
11.	<p>Unsupervised Learning:</p> <ul style="list-style-type: none"> • k-means Clustering Algorithm • Evaluating Clustering Algorithm • Different applications for clustering including Image segmentation, Using clustering for preprocessing and for semi-supervised learning. 	5
12.	<p>Building Machine Learning Pipelines</p> <p>Fine-Tune Machine Learning model</p> <ul style="list-style-type: none"> • Grid search • Randomized Search • Analyze the Best Models and their Errors • Evaluate on Test Set • Lunch and monitor and maintain Machine Learning System 	10
13.	Final Project Presentation	5
Total		75





D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Week 3,9,12	15%
2.	Midterm Exam	Week 7	20%
3.	Lab Assessment	Week 2-11	10%
4.	ML Project	Continuous	15%
5.	Final Exam	Week 16	40%

*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	<ul style="list-style-type: none"> Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. 2nd ed. Sebastopol, CA: O'Reilly Media. Pang-Ning Tan, Michael Steinbach, Vipin Kumar (2021). Introduction to Data Mining. Addison-Wesley. ISBN-13: 9780137506286.
Supportive References	<ul style="list-style-type: none"> Müller, A. C., & Guido, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists. Sebastopol, CA: O'Reilly Media. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. New York: Springer. Murphy, K. P. (2022). Probabilistic Machine Learning: An Introduction. Cambridge, MA: MIT Press.
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Data show projector Collab
Other equipment (depending on the nature of the specialty)	Google Collab using Python version 3



F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect Course survey and students' feedback.
Effectiveness of Students	Faculty Members, Peer Reviewers	Direct Report on the satisfaction of exam standards.
Quality of learning resources	Faculty Member, Course Coordinators	Direct Learning resources evaluation survey.
The extent to which CLOs have been achieved	Faculty Members, Program Leaders	Direct Course reports.
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
REFERENCE NO.	851281214463/193664
DATE	1447/01/20

