	**SULTAN QABOOS UNIVERSITY** **COLLEGE OF SCIENCE** **DEPARTMENT OF COMPUTER SCIENCE** **BACHELOR OF SCIENCE IN ARTIFICIAL INTELLIGENCE** **COURSE OUTLINE**

I. COURSE INFORMATION		
COURSE CODE	COMP4603	
COURSE TITLE	MACHINE LEARNING	
OMAN QUALIFICATION FRAMEWORK (OQF) LEVEL	6	
CREDIT HOURS	3	
CONTACT HOURS	4	
PRE-REQUISITES	(COMP3203) OR (COMP4517) OR (COMP3202)	
CO-REQUISITES		
EQUIVALENT COURSES	COMP4513, CSAI3101	
INCOMPATIBLE COURSES		
COURSE CATEGORY	☐ University Requirement	☐ University Elective
	☐ College Requirement	☐ College Elective
	☐ Department Requirement	☐ Department Elective
	☒ Major Requirement	☐ Major Elective
	☐ Specialization Requirement	☐ Specialization Elective
	☐ Other (specify):	
COURSE OWNER	College: Science	Department: Computer Science
	Center:	Unit:

DELIVERY MODE	☒ Face to Face	☐ Blended	☐ Online
COURSE TYPE	☐ Lecture	☒ Lecture/Lab	
	☐ Lecture/Seminar	☐ Lecture/Studio	
	☐ Lecture/Tutorial	☐ Lecture/Lab/Tutorial or Seminar	
	☐ Tutorial	☐ Laboratory (Practical)	
	☐ Field or Work Placement	☐ Studio	
	☐ Seminar	☐ Internship	
	☐ Workshop	☐ Project	
	☐ Thesis	☐ Other (specify):	
LANGUAGE OF INSTRUCTION	English		
COURSE DESCRIPTION	This course provides a broad introduction to machine learning. Machine learning is the science of getting computers to act without being explicitly programmed. Students will not only learn about the theoretical underpinnings of learning, but also will gain the practical knowledge needed to apply these techniques to solve new problems. Topics include: supervised learning, unsupervised learning, learning theory, reinforcement learning and adaptive control. The course will also discuss recent applications of machine learning, such as robotic control, data mining, autonomous navigation, bioinformatics, speech recognition, and text and web data processing.		
TEACHING AND LEARNING STRATEGIES	☐ Augmented Reality	☐ Flipped Classroom	
	☒ Blended Learning	☐ Problem-Based Learning	
	☐ Discovery-Based Learning	☒ Project-Based Learning	
	☐ Student-Led Learning	☐ Team-Based Learning	
	☐ Work-Based Learning	☐ Other (specify):	
ASSESSMENT COMPONENT AND WEIGHT	☒ **In-term examination(s) (20%)**	☐ **Quizzes (%)**	☐ Other (specify): (%)
	☒ **Homework (10%)**	☒ **Project (15%)**	
	☒ **Final examination (40%)**	☒ **Practical/ Lab (15%)**	
TEXTBOOKS AND EDUCATIONAL MATERIAL	1. Hands-On Machine Learning with Scikit-Learn & TensorFlow, Aurelien Geron, Oreilly 2017. 2. Instructor's Handouts 3. Coursera courses: Machine Learning (Stanford University) and		

	Applied Machine Learning in Python (University of Michigan).		
GRADING METHOD	☒ A-F Scale	☐ Pass/Not Pass	☐ Other (specify):

GRADING METHOD DESCRIPTION

	Range	Letter Grade	Description
A-F GRADING SCALE:	90 – 100	A	**Exceptional performance:** All course objectives were achieved and met in a consistently outstanding manner.
	86 – 89.9	A-	
	81– 85.9	B+	**Very Good Performance:** The majority of the course **objectives** were achieved (the majority being at least two-thirds) and met in a consistently thorough manner.
	77 – 80.9	B	
	73 – 76.9	B-	
	68 – 72.9	C+	**Satisfactory Performance:** At least most of the course objectives have been achieved and met satisfactorily.
	64 – 67.9	C	
	60 – 63.9	C-	
	55 – 59.9	D+	**Minimally Acceptable Performance:** The course **objectives** met at a minimally acceptable level.
	50 – 54.9	D	
	0 – 49.9	F	**Unacceptable performance:** The course objectives were not met at a minimally acceptable level

PASS/NOT PASS:	
OTHER:	

II. SEMESTER INFORMATION			
SEMESTER/YEAR	**FALL2024**	**SECTION(S)**	**10,11**
DAY AND TIME	**SUN-TUE 8:00-9:50**	**VENUE(S)**	**0022S**
COURSE COORDINATOR	**Dr. Hamza ZIDOUM**	**COURSE TEAM**	
COORDINATOR OFFICE	**0020**	**OFFICE HOURS**	**SUN 10-12**
COORDINATOR EXTENSION	**1484**	**COORDINATOR EMAIL**	**zidoum@squ.edu.om**

III. ALIGNMENT OF COURSE LEARNING OUTCOMES (CLO), PROGRAM LEARNING OUTCOMES (PLO),

GRADUATE ATTRIBUTES (GA), AND OMAN QUALIFICATION FRAMEWORK (OQF) CHARACTERISTICS

CLO	PLO	SQU GA	OQF CHARACTERISTICS
1. **Describe and Apply** the proper process for developing Machine Learning applications	PLO1, PLO2, PLO3	1, 2, 3	1, 2, 3
2. Identify and Apply adequate models for supervised and unsupervised Machine Learning tasks**.**	PLO1, PLO2	1, 2	1, 2
3. Demonstrate understanding of the mathematical representation commonly used in Machine Learning models	PLO1	1	1
4. Design and Implement Machine Learning Solutions to classification, regression and clustering problems	PLO1, PLO2, PLO6	1, 2, 4, 6	1, 2, 4, 6
5. Evaluate developed Machine Learning solutions	PLO1**,** PLO2	1, 2	1, 2
6. Communicate Effectively the proposed Machine learning solution	PLO3	3	3

IV. COURSE LEARNING OUTCOMES (CLOS) AND ASSESSMENT CRITERIA AND METHODS (FOR EACH

CLO)

CLO1: Describe and Apply the proper process for developing Machine Learning applications

ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		ASSESSMENT METHODS
A)	Describe the commonly used process for conducting a Machine Learning project	Midterm, Final Exam
B)	Apply properly the Machine Learning Development Workflow	Homework Assignments, Project
1. CLO2: Identify and Apply adequate models for supervised, and unsupervised Machine Learning tasks**.**		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Identify adequate models for supervised Machine Learning tasks	Homework Assignments, Project
B)	Identify adequate models for unsupervised Machine Learning tasks	
C)	Apply adequate models for supervised Machine Learning tasks	
D)	Apply adequate models for unsupervised Machine Learning tasks	
CLO3: Demonstrate understanding of the mathematical representations commonly used in Machine Learning models		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Describe the mathematical representations of commonly used Machine Learning models	Midterm, Final Exam
B)	Describe the Objective functions commonly used in Machine Learning models	
C)	Demonstrate understanding of the optimization process performed by the Gradient Descent algorithm	
CLO4: Design and Implement Machine Learning Solutions to classification, regression and clustering problems		
ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)		**ASSESSMENT METHODS**
A)	Design and implement solutions to real-life regression problems	Homework Assignments, Project
B)	Design and implement solutions to real-life classification problems	

C)	Design and implement solutions to real-life clustering problems	
CLO5: Evaluate developed Machine Learning solutions		
A)	Identify proper evaluation metrics for evaluating a Machine Learning solution	Final Examination, Homework Assignments, Project.
B)	Conduct a proper evaluation of a Machine Learning solution.	
CLO6: Communicate effectively the proposed Machine Learning solution		
A)	Clearly describe, orally and in writing, the addressed problem	Project
B)	Explain, orally and in writing, the functionality of the proposed solution	
C)	Discuss, orally and in writing, the limitations of the proposed solution	

V. COURSE CONTENT AND SCHEDULE				
WEEK	**LECTURES #**	**TOPICS/ SUBJECTS**	**READINGS/ CHAPTERS**	**REMARKS (e.g., ASSESSMENTS)**
1		Introduction to Machine Learning	Chap 1	Homework1, Midterm & Final
2		Data Preprocessing	Chap 2	Homework1, LT, Project, Midterm, and Final
3		Performance Evaluation & Model Selection	Chap 2	Homework1, LT, Project, Midterm, and Final
4		Basic Supervised Learning Models **Homework1 due**	Chap 3	Homework1, LT, Project, Midterm, and Final
5		Supervised Learning: Logistic Regression & Regularization	Chap 4	Homework, LT, Project, Midterm, and Final
6		Supervised Learning: Support Vector Machine 1	Chap 5	Homework, Midterm, Project, LT, and Final
7		Supervised Learning: Support Vector Machine 2 **Homework2 due**	Chap 5	Homework, Midterm, Project, LT, and Final
8		Supervised Learning: Decision Trees **MIDTERM EXAM**	Chap 6	Project, LT, and Final
9		Ensemble Learning: Random Forests **Project Proposal**	Chap 7	Project, LT, and Final
10		Dimensionality Reduction	Chap 8	Project, LT, and Final
11		Unsupervised Learning: Clustering algorithms	Chap 9	Project, LT, and Final
12		Artificial Neural Networks: Representation **Lab Test**	Chap 10 & Chap 11	Project, LT, and Final
13		Artificial Neural Networks: Learning **Project due**	Chap 10 & Chap 11	Project, and Final
14,15		**Project Report/Presentations**		

VI. ADDITIONAL INFORMATION (e.g., RUBRICS, etc.)

Assessment PLAN

Component	Weight (%)	When?
Lab	(5%)	Weekly
2 Homework	(10%)	Week4, Week7 SAT
Midterm	(20%)	Week8, TUE
Project	(15%)	Proposal Week9 SAT, Report/Presentation Week 14
Practical	(10%)	Week 12 TUE
Final examination	(40%)	TBA by A&R

VII. STUDENTS RESPONSIBILITIES

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirements and student academic code of conduct.

ACADEMIC INTEGRITY	The University expects the students to approach their academic endeavors with the highest academic integrity. Please refer to the **Undergraduate Academic Regulations**.
ADD AND DROP	Students who wish to drop or add the course should review the **Undergraduate Academic Regulations**.
ATTENDANCE	Sultan Qaboos University has a clear requirement for students to attend courses, detailed in the **Undergraduate Academic Regulations**.
ASSESSMENT AND GRADING	To ensure the provision of a sound and fair assessment and grading, please review the **Undergraduate Academic Regulations**.
GRADE APPEAL	Students who wish to appeal their grades should review the **Undergraduate Academic Regulations**.
CLASSROOM POLICIES	Students are expected to dress professionally during class time as required by the University. Use of phones or any other electronic devices in the classroom during class time is strictly prohibited. Unauthorized use may lead to faculty member confiscation of the device for the remainder of the class. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. A student responsible for disruptive behavior may be required to leave the class.

LATE AND MAKE-UP WORK	Students are required to meet the course objectives by submitting coursework no later than the assigned due date. Students may be allowed to submit late work if approved by the course coordinator. Assignments submitted after the due date may be penalized.
MISSED EVALUATIONS	All quizzes, tests, clinical evaluations, and exams must be completed by the date they are assigned. If a quiz, test, or exam is missed due to a documented emergency situation (e.g., medical emergency, death in the immediate family), it is the student's responsibility to contact the instructor.
OTHER	

Course Outline Appendix

A. Program Learning Outcomes

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the Artificial Intelligence discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing and Artificial Intelligence practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the Artificial Intelligence discipline.
6. Apply computer science theory, software development and Artificial Intelligence fundamentals to produce computing-based solutions.

B. SQU Graduate Attributes

1. Cognitive Capabilities
2. Skill and Professional Capability
3. Effective Communication
4. Autonomy and Leadership
5. Responsibility and Commitment
6. Development and Innovation

C. OQF Characteristics

1. Knowledge
2. Skills
3. Communication, Numeracy, and Information and Communication Technology Skills.
4. Autonomy and Responsibility
5. Employability and Values
6. Learning to learn