Course Specifications

Course Title:	**Machine Learning**
Course Code:	**AI 411**
Program:	**Information and Computer Sciences**
Department:	**Computer Science and Information**
College:	**Science at Al-Zulfi**
Institution:	**Majmaah**

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A. Course Identification

1. Credit hours: 2 (1 lect. and 2 lab)
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: Level 7
4. Pre-requisites for this course (if any)**: Artificial Intelligence –A314**
5. Co-requisites for this course (if any)**: Nil**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	44	80 %
2	**Blended**	3	5 %
3	**E-learning**	3	5 %
4	**Correspondence**	3	5 %
5	**Other**	3	5 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	**60**
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	30
3	**Library**	20
4	**Projects/Research Essays/Theses**	20
5	**Others** (specify)	0
	Total	**100**

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will give students the basic ideas and intuition behind modern machine learning methods supervised and unsupervised learning methods and as well as a bit more formal understanding of how, why, and when they work. Supervised learning (parametric/non-parametric algorithms, support vector machines, kernels, neural networks). Unsupervised learning (clustering, dimensionality reduction, recommender systems, deep learning). Best practices in machine learning (bias/variance theory; innovation process in machine learning and AI). Students will also gain practice implementing the machine learning techniques and getting them to work for problem solving as pattern recognition, classification and clustering.

2. Course Main Objective

After completing this course students must be able to:

1. Demonstrate advanced and integrated understanding of supervised and unsupervised machine learning models
2. Analyze critically and apply efficient machine learning algorithms in theory to create an software application
3. Analyze critically and evaluate optimal learning methods based on application via a case study
4. Identify, interpret and intelligently resolve human-computer problems presented in case studies

3. Course Learning Outcomes

Upon successful completion, students will have the knowledge and skills to:

CLOs		Aligned-PLOs
1	**Knowledge:**	
1.1	Understand a wide variety of learning algorithms.	K3-AI
1.2	Understand how to evaluate models generated from data.	
2	**Skills :**	
2.1	Develop an appreciation for what is involved in learning models from data	S3-AI
2.2	Apply supervised and unsupervised learning algorithms in classification, clustering and recognition problems	
3	**Competence: الكفاءات**	
3.1	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that achieved by applying the models.	**C3-AI**
3.2	Evaluate the right models which will be generated for solving the problems	

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction:** What is Machine Learning (ML); Problems, data, and tools; Visualization; Matlab (I)	4
2	Linear regression; SSE; gradient descent; closed form; normal equations; features	4

	Overfitting and complexity; training, validation, test data, and introduction to Matlab (II)	
3	Classification problems; decision boundaries; nearest neighbor methods	4
4	**Unsupervised learning**: Probability and classification, Bayes optimal decisions Naive Bayes and Gaussian class-conditional distribution	8
5	Linear classifiers and Bayes' Rule and Naive Bayes Model	4
6	Logistic regression, online gradient descent, Neural Networks and Decision tree	12
7	Ensemble methods: Bagging, random forests, boosting A more detailed discussion on Decision Tree and Boosting	8
8	**Unsupervised learning:** clustering, k-means, hierarchical agglomeration	4
9	Advanced discussion on clustering and EM	4
10	Latent space methods; Principal Component Analysis(PCA).	4
12	Text representations; naive Bayes and multinomial models; clustering and latent space models	8
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods Live Learning: Lecture, PowerPoint slides and discussion

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Understand a wide variety of learning algorithms.	☒ Lectures ☒ Tutorial ☒ Exercises ☒ Practical Lab ☒ Discussions	- Homework tasks - Quiz - Midterms - Final Exam
1.2	Understand how to evaluate models generated from data.		
2.0	**Skills**		
2.1	Develop an appreciation for what is involved in learning models from data	☒ Lectures ☒ Tutorial ☒ Exercises ☒ Practical Lab ☒ Discussions	- Lab Exercises - Lab Exam - Oral Exam - Presentations
2.2	Apply supervised and unsupervised learning algorithms in classification, clustering and recognition problems		
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that achieved by applying the models.	**Course Project: (Work group)** critical thinking and ability to seek solutions.	Course's project
3.2	Evaluate the right models which will be generated for solving the problems		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework 1	2	2%
2	QUIZ 1	3	5%
3	Homework 2	4	2%
4	QUIZ 2	5	5%
5	Midterm 1	6	10%
6	Homework 3	7	2%
7	QUIZ 3	8	5%
8	Homework 4	9	2%
9	QUIZ 4	10	5%
10	Midterm 2	11	10%
11	Lab Exam/ Project Evaluation	14	12%
12	Final Exam	16	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- Determine meeting appointments for the weak' students to solve their problems and give them academic advices.
- One office hour daily
- Dealing a workshops.
- Motivate students

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	A First Course in Machine Learning , 2nd edition, Kindle Edition , Simon Rogers and Mark Girolami , CRC press, 2020
Essential References Materials	Machine Learning, Mitchell, TM, McGraw Hill.
Electronic Materials	

Other Learning Materials	☒ Matlab Package ☒ R- Programming

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom - Laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show – Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Matlab `software – Weka – Python Programming

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
1. Questionnaires (course evaluation) filled by the students and acquired electronically by the University	Students	Indirect Assessment
2. Students-faculty management meetings		
3. Departmental internal review of the course.	Department Council	Questionnaires
4. Discussion with the industrial partners to enhance the courses in order to meet their needs.	Stockholders	Meetings
5. Midterms and Final Exam	Course Coordinator Staff	Direct Assessment
6. Project Evaluation		

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	