Course Specifications

Institution:	Majmaah University.
Academic Department :	College of Science at Az Zulfi.
Programme :	Computer Science and Information
Course :	Machine learning (CSI-441)
Course Coordinator :	Mr. ISSA ALSMADI
Programme Coordinator :	DR.YOSRY AZAAM
Course Specification Approved Date :	23/ 12 / 1435 H

A. Course Identification and General Information

1 - Course title : Machine learning	Course Code: (CSI-441)
2. Credit hours : 3 (2 lecture + 2 Laboratory)	
3 - Program(s) in which the course is offered:	Computer Science and Information Program
4 – Course Language ENGLISH	
5 - Name of faculty member responsible for the course:	ISSA ALSMADI
6 - Level/year at which this course is offered :	Elective
7 - Pre-requisites for this course (if any) : - Artificial Intelligence (CSI 411).	
8 - Co-requisites for this course (if any) : N/A	
9 - Location if not on main campus : College of Science at Az Zulf	

10 - Mode of Instruction (mark all that apply)

A - Traditional classroom	√	What percentage?	80 %
B - Blended (traditional and online)	√	What percentage?	5 %
D - e-learning		What percentage?	5 %
E - Correspondence		What percentage?	……. %
F - Other	√	What percentage?	10 %

Comments :

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B Objectives

What is the main purpose for this course?

Machine learning is the science of getting computers to act without being explicitly programmed. This course provides a broad introduction to machine learning.

Topics include:

    (i)   Supervised learning (parametric/non-parametric algorithms, support vector machines, kernels, neural networks).

    (ii)   (ii) Unsupervised learning (clustering, dimensionality reduction, recommender systems, deep learning).

    (iii)   (iii) Best practices in machine learning (bias/variance theory; innovation process in machine learning and AI).

Briefly describe any plans for developing and improving the course that are being implemented :
1. Using group discussion.
2. Updating the materials of the course to cover the new topics of the field.

C. Course Description
1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
1. **Introduction to Machine Learning:** What is Machine Learning, Types of Machine Learning, Learning Associations, Classification , Face Recognition, Regression Applications, Image Processing.	2	8
2. **Supervised Learning:** Learning a Class from Examples, Training set X, Class C, Hypothesis class H, S, G, and the Version Space, Margin VC Dimension, Probably Approximately Correct (PAC) Learning, Sample Complexity, Noise and Model Complexity, Multiple Classes, Model Selection & Generalization.	2	8
3. **Bayesian Decision Theory :** Probabilistic reasoning, Classification and the MAP Hypothesis, Losses and risks, Discriminant functions ,Utility Theory.	1	4
4. **Parametric Methods :** Maximum Likelihood Estimation Bernoulli Density , Multinomial Density , Gaussian (Normal) Density ,Evaluating an Estimator: Bias and Variance , The Bayes' Estimator , Parametric Classification , Regression ,Tuning Model Complexity: Bias/Variance Dilemma , Model Selection Procedures .	2	8
5. **Multivariate Methods:** Parameter Estimation ,Estimation of Missing Values , Multivariate Normal Distribution ,Multivariate Classification , Tuning Complexity , Discrete Features , Multivariate Regression .	1	4
6. **Dimensionality Reduction :**Subset Selection , Principal Components Analysis , Factor Analysis , Multidimensional Scaling , Linear Discriminant Analysis .	2	8
7. **Clustering:** Mixture Densities , k-Means Clustering ,Expectation-Maximization Algorithm , Mixtures of Latent Variable Models , Supervised Learning after Clustering ,Hierarchical Clustering ,Choosing the Number of Clusters .	1	4
8. **Nonparametric Methods:** Nonparametric density estimation, Using nonparametric density estimation to do classification.	1	4
9. **Decision Trees:** Univariate decision trees, Building classification trees, Dealing with overfitting, Extracting rules from decision trees.	1	4
10. **Linear Discrimination:** The basic linear model, Geometry of linear discrimination, Two classes, Multiple classes, Logistic Discrimination, Generalizing the linear model with basis functions.	1	4

11. Pattern Classification, Face Recognition, and Data regression Applications	1	4

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	30	30	-	-	-	60
Credit	30	15	-	-	-	45

3. Additional private study/learning hours expected for students per week.

6 **Hours**

The total workload of the student in this course is then: 75 + 6 * 15 = 165 work hours.

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand the principles, advantages, limitations and possible applications of machine learning.	Lectures Lab demonstrations Case studies Individual presentations	Written Exam Homework assignments Lab assignments Class Activities Quizzes
1.2	Students will have an understanding of basic knowledge about the key algorithms and theory that form the foundation of machine learning and computational intelligence.		
1.3	introduce students to the basic concepts and techniques of Machine Learning.		
2.0	**Cognitive Skills**		
2.1	The ability to implement some basic machine learning algorithms.	Lectures. Lab	Written Exam Homework

		NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
2.2		Evaluate the strengths and limitations of learning procedures and select an appropriate learning algorithm for a given problem.	demonstrations. Case studies. Individual presentations. Brainstorming.	assignments Lab assignments Class Activities Quizzes
2.3		Be able to apply machine learning methods to particular target problems and evaluate and report the results appropriately.		
3.0	**Interpersonal Skills & Responsibility**			
3.1		Work in a group and learn time management.	Small group discussions. Whole group discussions. Brainstorming. Presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
3.2		Learn how to search for information through library and internet.		
3.3		Present a short report in a written form and orally using appropriate scientific language.		
4.0	**Communication, Information Technology, Numerical**			
4.1		Communicate with teacher, ask questions, solve problems, and use computers.	Small group discussions. Whole group discussions. Brainstorming. Presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
4.2		Use Information technology and computer skills to gather information about a selected topic.		
4.3		Operate questions during the lecture, work in groups, and communicate with each other and with me electronically, and periodically visit the sites I recommended.		
5.0	**Psychomotor**			
5.1	N/A		....	....

5. Schedule of Assessment Tasks for Students During the Semester:

	Assessment task	Week Due	Proportion of Total Assessment
1	First written mid-term exam	6	15%
2	Second written mid-term exam	12	15%
3	Presentation, class activities, and group discussion	Every week	10%

4	Homework assignments	After Every chapter	10%
5	Practical exam	15	10%
6	Final written exam	16	40%
7	Total		100%

D. Student Academic Counseling and Support

Office hours: Sun: 8-10, Mon. 8-10, Tus. 1-3.
Office call: Mon. 12-1 and Tus 12-1

Email: i.alsmadi@mu.edu.sa

E. Learning Resources

1. List Required Textbooks :
   EthemAlpaydin, Introduction to Machine Learning, ISBN-10: 026201243X | ISBN-13: 978-0262012430, MIT press, 2009.

2. **List Essential References Materials :**

   Christopher Bishop, Pattern Recognition and Machine Learning. Springer, 2006..

3. List Recommended Textbooks and Reference Material :
   N/A
4. **List Electronic Materials :**
   Determines as the course is going on.
5. Other learning material :
Videos and presentations are available with me

F. Facilities Required

1. Accommodation
Classrooms and Labs available at College of science in Zulfi.
2. Computing resources
Smart Board
3. Other resources
   N/A

G   Course Evaluation and Improvement Processes

1   Strategies for Obtaining Student Feedback on Effectiveness of Teaching:
- Analysis of students' results.
- Observation during work.
- Students' evaluations.
- Colleagues' evaluations.
- Evaluation questionnaire filled by the students.
- Interview a sample of students enrolled in the course to take their opinions.

2   Other Strategies for Evaluation of Teaching by the Program/Department Instructor :
- Self-assessment.
- External evaluation.
- Periodic review of course (the Commission of study plans).

3   Processes for Improvement of Teaching :
- Taking into account the recommendations yielded from the internal review of the course.
- Guidelines about course teaching provided by the by study plans commission.
- Department Guidelines about faculty member performance on the basis of direct observation.
- Training and development.
- Workshops to improve the educational process.

4. Processes for Verifying Standards of Student Achievement
- Reviewing the final exam questions and a sample of the answers of the students by others.
- Visiting the other institutions that introduce the same course one time per semester.
- Watching the videos of other courses by international institutions.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement :
- Comparison of the course to its counterparts offered in similar departments.
- Periodic revision of course description by faculty member.
- Periodic revision of course description by the study plans and schedules Commission.
- Update learning resources related to the course to ensure that the course is kept up with developments in the field.
- Make use of statistical results of course evaluation made by students to improve and develop the course.
- Giving the opportunity for students to express their opinions about what is taught and receive suggestions and study their effectiveness.

Course Specification Approved
Department Official Meeting No (6) Date … / …. / ….. *H*

Course's Coordinator	**Department Head**
Name : ISSA ALSMADI	*Name :* Dr Yossry Azzam
Signature :	*Signature :* ....
Date : 23./ 12 / 1435 *H*	*Date :* …./ … / …… *H*