Course Specifications

Course Title:	**Deep Learning**
Course Code:	**AI 417**
Program:	**Information and Computer Sciences**
Department:	**Computer Science and Information**
College:	**College of Science at AzZulfi**
Institution:	**Majmaah University**

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A. Course Identification

1. Credit hours: 2
2. Course type **a.** University ☐ College ☐ Department ☐ Others ☐ **b.** Required ☐ Elective ■
3. Level/year at which this course is offered:
4. Pre-requisites for this course (if any)**:** **Machine Learning – AI 411**
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**	✔	80 %
2	**Blended**	✔	5 %
3	**E-learning**	✔	5 %
4	**Correspondence**	✔	5 %
5	**Other**	✔	5 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	--
4	**Others** (specify)	--
	Total	60
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	10
3	**Library**	05
4	**Projects/Research Essays/Theses**	15
5	**Others** (specify)	--
	Total	(60+75 = 135)

* 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

This course is an elementary introduction to a machine learning technique called deep learning, as well as its applications to a variety of domains. Along the way, the course also provides an intuitive introduction to machine learning such as simple models, learning paradigms, optimization, overfitting, importance of data, training caveats, etc. The assignments explore key concepts and simple applications.

2. Course Main Objective

This course introduces students a complex view of object-oriented software development process, aiming in the ability to solve real problems in the given domain. The students will learn and apply a unified methodology to the analysis, design, implementation, testing and demonstration of a software system of a significant size and complexity.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Understand current of advanced AI technologies that enable machines to sense, comprehend, act and learn on their own.	K3-AI
2	**Skills :**	
2.1	Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	S1
2.2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	S3- AI
3	**Competence:**	
3.1	Empower scientific abilities to implement AI techniques with stakeholders to define their scopes, limitations, and social impacts.	C3-AI

C. Course Content

No	List of Topics	Contact Hours
1	**INTRODUCTION** Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.	12
2	**DEEP NETWORKS** History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	12
3	**DIMENTIONALITY REDUCTION** Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet -	12

	Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	
4	**OPTIMIZATION AND GENERALIZATION** Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	12
5	**CASE STUDY AND APPLICATIONS:** Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.	12
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Understand current of advanced AI technologies that enable machines to sense, comprehend, act and learn on their own.	Lectures Lab demonstrations Case studies Individual presentations	Written Exam Homework assignments Class & lab Activities Quizzes
2.0	**Skills**		
2.1	Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	Group discussions, Brainstorming Presentations	HomeWorks and assignments
2.2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning..		
3.0	**Competence**		
3.1	Empower scientific abilities to implement AI techniques with stakeholders to define their scopes, limitations, and social impacts.	Group discussions Case Studies Brainstorming Presentations	Lab Activities, Project report evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	First written mid-term exam	6	20%
2	Second written mid-term exam	12	20%
3	Class activities, group discussions, Seminars, Project Presentations.	Every week	10%
4	Homework + Assignments	After every chapter	10%
5	Final written 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 :
Office hours:
Email: @mu.edu.sa

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.** **ISBN: 9780262035613**
Essential References Materials	1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013. ISBN: 978-1-60198-815-7 2. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015. ISBN-13 : 978-0123954893 3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015
Electronic Materials	1.https://www.coursera.org/courses?query=deep%20learning 2.https://onlinecourses.nptel.ac.in/noc20_cs62/preview
Other Learning Materials	**Course material includes handouts, ppt, questionnaires as distributed among the students**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	1. Classrooms with required digital aids and to support traditional method of teaching using blackboard. 2. Classrooms with proper lighting and air conditioning system integrated with the sound System /audio system.

Item	Resources
	3. Classroom with smart board interface, display screen and a computer to aid the sessions
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart Board with supporting software / computers with updated versions of software as required to understand the subject concepts with quality headphones.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	NIL

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	Students Classroom Observation Committee Professional Development Unit External Reviewers – accreditation committee	Formal Classroom Observation - Direct Student Surveys - Indirect
Effectiveness of Assessment	Curriculum and Test Development Unit Curriculum Committee Assessment Committee External Reviewers	Faculty Feedback - indirect Student Feedback – indirect Course Reports
Extent of Achievement of Course Learning Outcomes	Quality Assurance Unit Curriculum and Test Development Unit	Course Reports Annual Program Review

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	