QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department

Study plan No.	**2022/2021**		**University Specialization**		**Artificial Intelligence**
Course No.	**0142344**		**Course name**		**Neural Networks**
Credit Hours	**3**		**Prerequisite Co-requisite**		**Machine Learning**
Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	☐ FACULTY MANDATORY REQUIREMENT	☐ Support course family requirements	☐ Mandatory requirements / ☐ Elective requirements
Teaching style	☐ **Full online learning**		☐ **Blended learning**		☐ **Traditional learning**
Teaching model	☐ **2Synchronous: 1asynchronous**		☐ **2 face to face : 1synchronous**		☐ **3 Traditional**

Faculty member and study divisions information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Nagham Azmi al-madi	Associate Prof.	320	/	Nagham.a@zuj.edu.jo	
Division number	**Time**	**Place**	**Number of students**	**Teaching style**	**Approved model**

Brief description

This course is concerned with giving an introduction to deep learning neural networks. This course also focuses on theories and practical examples of deep learning algorithms and their applications, including intelligent neural networks (ANNs), deep learning building models, training and examination, in addition to their employment and applications.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	Machine Learning: The Ultimate Guide to Machine Learning, Neural Networks and Deep Learning for Beginners Who Want to Understand Applications, Artificial Intelligence, Data Mining, Big Data and More by Herbert Jones | Oct 5, 2018.
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1. Neural Networks and Deep Learning: A Textbook 1st ed. 2018 Edition by Charu C. Aggarwal • Publisher : Springer; 1st ed. 2018 edition (September 13, 2018). 2. Make Your Own Neural Network: An In-depth Visual Introduction For Beginners Paperback. By Tariq Rashid – October 4, 2017. 3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurélien Géron - Oct 15, 2019. 4. Learning Deep Learning: Theory and Practice of Neural Networks, Computer Vision, Natural

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	Language Processing, and Transformers Using TensorFlow, by Magnus Ekman | Aug 17, 2021.			
Supporting websites	1- https://www.youtube.com/playlist?list=PL63IRz2XF5WyBLsw6yJYWIiFJ1OmmRyK 2- https://cs230.stanford.edu/lecture/			
The physical environment for teaching	☐ Class room	☐ labs	☐ Virtual educational platform	☐ Others
Necessary equipment and software	**PYTHON, JAVA**			
Supporting people with special needs				
For technical support				

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

No.	Course learning outcomes	The associated program learning output code
	Knowledge	
K1	Neural Networks and Deep Learning	
K2	Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization	
K3	Structuring your Machine Learning Project	
K4	Convolutional Neural Networks	
	Skills	
S1	•Tensorflow •Artificial Neural Networks	
S2	•Convolutional Neural Networks •Recurrent Neural Networks •Transformers	
S3	•Python Programming •Deep Learning •Backpropagation	
S4	•Machine Learning •Transfer Learning •Multi-Task Learning	

S5	•Natural Language Processing	
	Competences	
C1	1. Be able to explain the major trends driving the rise of deep learning, and understand where and how it is applied today. 2. Build and train deep neural networks, implement vectorized neural networks, identify architecture parameters, and apply DL to your applications.	
C2	1. Learn to set up a machine learning problem with a neural network mindset. Learn to use vectorization to speed up your models. 2. Use best practices to train and develop test sets and analyze bias/variance for building DL applications, use standard NN techniques, apply optimization algorithms, and implement a neural network in TensorFlow.	
C3	1. Learn to build a neural network with one hidden layer, using forward propagation and backpropagation. 2. Use strategies for reducing errors in ML systems, understand complex ML settings, and apply end-to-end, transfer, and multi-task learning.	
C4	1. Build a Convolutional Neural Network, apply it to visual detection and recognition tasks, use neural style transfer to generate art, and apply these algorithms to image, video, and other 2D/3D data.	
C5	1. Build and train Recurrent Neural Networks and its variants (GRUs, LSTMs), apply RNNs to character-level language modeling, work with NLP and Word Embeddings, and use HuggingFace tokenizers and transformers to perform Named Entity Recognition and Question Answering.	
C6	1. Understand the key computations underlying deep learning, use them to build and train deep neural networks, and apply it to computer vision.	

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
First exam				
Second / midterm exam		**%30**	%30	
Participation / practical applications		**0**		
Asynchronous interactive activities		**%20**	%20	
final exam		**%50**	%50	

Note: Asynchronous interactive activities are activities, tasks, projects, assignments, research, studies, projects, work within student groups ... etc, which the student carries out on his own, through the virtual platform without a direct encounter with the subject teacher.

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style*	Reference **
1	Introduction to Deep Learning	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	Neural Networks and Deep Learning
2	Neural Networks Basics	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	Neural Networks and Deep Learning
3	Neural Networks Basics	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	Neural Networks and Deep Learning
4	Shallow Neural Networks	• Classroom lectures, discussions, and review	https://www.youtube.com/playlist?list=PL6-3IRz2XF5WyBLsw6yJYWIiFJ1OmmRyK

		of theoretical concepts. Laboratory practical sessions. • slides	
5	Shallow Neural Networks	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://www.youtube.com/playlist?list=PL6-3IRz2XF5WyBLsw6yJYWIiFJ1OmmRyK
6	**Revision Midterm exam 30%**		
7	Deep Neural Networks	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/
8	Deep Neural Networks	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/
9	Neural Networks and Deep Learning	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/
10	Neural Networks and Deep Learning	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/
11	Improving Deep Neural Networks: Hyperparameter Tuning,	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	Neural Networks and Deep Learning

	Regularization and Optimization		
12	Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	Neural Networks and Deep Learning
13	Structuring Machine Learning Projects	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/
14	Structuring Machine Learning Projects	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • Slides •	https://cs230.stanford.edu/lecture/
15	Convolutional Neural Networks	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/ https://www.youtube.com/playlist?list=PL6-3IRz2XF5WyBLsw6yJYWIiFJ1OmmRyK
16	Natural Language Processing: Sequence Models	• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions. • slides	https://cs230.stanford.edu/lecture/ https://www.youtube.com/playlist?list=PL6-3IRz2XF5WyBLsw6yJYWIiFJ1OmmRyK
17	**Final Exam 50%**		

*** Learning styles: Lecture, flipped learning, learning through projects, learning through problem solving, participatory learning ... etc.**
**** Reference: Pages in a book, database, recorded lecture, content on the e-learning platform, video, website ... etc.**

Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

Week	Task / activity	Reference	Expected results
1	**Quizzes**	• Introduction to deep learning • Neural Networks Basics	
2	**Programming Assignments**	• Python Basics with Numpy (Optional) • Logistic Regression with a neural network mindset	
3	**Quizzes**	• Shallow Neural Networks • Key concepts on Deep Neural Networks	
4	**Programming Assignments**	• Planar data classification with a hidden layer • Building your Deep Neural Network: step by step • Deep Neural Network - Application	
5	**Quizzes**	• Practical aspects of deep learning • Optimization Algorithms	
6	**Programming Assignments**	• Initialization • Regularization • Gradient Checking • Optimization	
7	**Quizzes**	• Hyperparameter tuning, Batch Normalization, Programming Frameworks • Bird recognition in the city of Peacetopia (case study)	
8	**Programming Assignments**	•Tensorflow	

9	**Quizzes**	• The basics of ConvNets • Deep convolutional models	
10	**Programming Assignments**	• Convolutional Model: step by step • Convolutional Model: application • Keras Tutorial: This assignment is optional. • Residual Networks	
11	**Quizzes**	• Detection Algorithms • Special Applications: Face Recognition & Neural Style Tran	
12	**Programming Assignments**	• Car Detection with YOLO • Art Generation with Neural Style Transfer • Face Recognition	
13	**Quizzes**	• Recurrent Neural Networks	
14	**Programming Assignments**	• Building a Recurrent Neural Network - Step by Step • Dinosaur Land -- Character-level Language Modeling • Jazz improvisation with LSTM	
15	**Quizzes**	• Natural Language Processing and Word Embeddings • Sequence Models and Attention Mechanism	
16	**Programming Assignments**	• Operations on Word Vectors - Debiasing • Emojify! • Neural Machine	

		Translation with Attention • Trigger Word Detection	