University: *Fayoum University*
Faculty: *Computers and Information*
Department: *Computer Science*

Course Specification

1- Basic Information		
Code: CSC 445	**Course Title:** Neural Networks	**Year/Level:** Fourth year – Second term
Programme: B.Sc degree in Computer Science	**Number of units:** **Lecture:** 4 hrs/ week **Tutorial:** 0 hrs/ week **Practical:** 2 hrs/ week	

2- Aims of Course:	The course introduces the theory and practice of neural computation. It offers the principles of neuro-computing with artificial neural networks widely used for addressing real-world problems such as classification, regression, pattern recognition, data mining, time-series prediction, etc... . Knowledge and tools for the specification, design, and practical implementation of ANNs are also provided.

3- Intended Learning Outcomes	
A- Knowledge and Understanding:	A1) Identify quality criteria that enable future development of computer-based systems A2) List the Fundamental topics in Computer Science related to software engineering principles, computer organization and architecture A3) Demonstrate the essential mathematics and physics relevant to computer science **Achieved through the following:** a1) A good understanding of artificial neural networks and its practical applications a2) An understanding of the basic fundamentals of the neural networks.
B- Intellectual Skills	B1) Analyze real problems, and appropriate problem solving methods that satisfy commercial or industrial constraints and analyze results B3) Generate a range of innovative design patterns and solutions to solve a computer science problem containing a range of commercial and industrial constraints B9) Compare between the classifications of (data, results, methods, techniques, algorithms... etc.). **Achieved through the following:** b1) How to think in simulating the human brain with an artificial neural network. b2) How to think building a supervised & unsupervised neural network
C- Professional and Practical Skills:	C1)Analyze and improve organizational processes from an ICT perspective C6) Employ the statistical, probabilistic and mathematical techniques in analyzing data and interpreting experimental results

	C7) Plan, schedule, control, and lead ICT projects C8) Deploy appropriate tools for the construction and documentation of computer-based systems that are used to solve practical problems C9) Deploy different modeling techniques to model and analyze real life computing problems **Achieved through the following:** c1) Build a simple neural network with Mat-Lab tool and try to perform simple training to his network with a small dataset. c2) Interact with the activation function the weight matrix for a given neural network.
D- General and transferable Skills	D2) use effective information-retrieval skills (including the use of browsers, search engines and catalogues) and general IT facilities D3) work as a member of a development team, recognizing the different roles within a team and different ways of organizing teams D6) Demonstrate skills in team work, team management, time management and organizational skills **Achieved through the following:** d1) The ability to use the neural networks in some applications like pattern recognitions and classification. d2) The ability to adapt the weight matrix of a given neural network during the training process in a small dataset.

4-Course Content:	1. Introduction and a historical review: Overview of neurocomputing, history of neurocomputing. 2. Neural network concepts: Basic definition, connections, processing elements. 3. Learning laws: Self-adaptation equations, coincidence learning, performance learning, competitive learning, filter learning, spatio-temporal learning. 4. Associative networks: Data transformation structures, Linear association network, learn matrix network, recurrent associative networks. 5. Mapping networks: Multilayer data transformation structures, the mapping implementation problem, Kolmogorovs theorem, the back-propagation neural network, self-organizing map, counter propagation network. 6. Spatiotemporal, stochastic, and hierarchical networks: Saptiotemporal pattern recognizer neural network, the Boltzman machine network, and the neurocognition network.

5- Teaching and Learning Methods:	1. Lectures 2. Computer-lab Sessions 3. Practical lab work 4. Class discussions 5. Independent Work

6- Teaching and Learning Methods for handicapped students :	-

7- Student Assessment	
A- Assessment Methods:	1. Assignments and Quizzes 2. Midterm written exam 3. Oral exam 4. Practical exam 5. Final written exam
B- Assessment schedule:	Midterm Examination: Week 7 Practical Examination: Week 13 Oral Examination: Week 14 Final Examination: Week 15
C- Weighting of assessments:	Assignments and Quizzes: 0% Mid-Term Examination: 10% Oral Examination: 10% Practical Examination: 15% Final-term Examination: 65%

8- Books and References	
A- Notes:	-
B- Essential Books (Text Books):	▪ Principe, Euliano, and Lefebvre, "Neural and Adaptive Systems: Fundamentals through Simulations", John Wiley and Sons. (2000)
▪ C- Recommended Books:	▪ Christopher M. Bishop, "Neural Networks for Pattern Recognition", Oxford University Press, USA. (2013)
D- Periodicals, Web sites, … etc	-

Course Professor: Dr.Masoud Ismail **Department Head: Dr. Amira Edress**

Course Content Intended Learning Outcomes Matrix

Course Title: Neural Networks
Course Code: CSC 445

Course Content	Week	Knowledge & Understanding		Intellectual Skills		Professional & Practical Skills		General & Transferable Skills	
		a1	a2	b1	b2	c1	c2	d1	d2
1. Introduction and a historical review: Overview of neurocomputing, history of neurocomputing.	1		x	x					
2. Neural network concepts: Basic definition, connections, processing elements.	2 - 3		x	x					x
3. Learning laws: Self-adaptation equations, coincidence learning, performance learning, competitive learning, filter learning, spatio-temporal learning.	4 - 5		x	x		x	x	x	x
4. Associative networks: Data transformation structures, Linear association network, learn matrix network, recurrent associative networks.	6	x		x	x	x		x	x
5. Mapping networks: Multilayer data transformation structures, the mapping implementation problem, Kolmogorovs theorem, the back-propagation neural network, self-organizing map, counter propagation network.	8 - 9	x		x	x	x		x	x
6. Spatiotemporal, stochastic, and hierarchical networks: Saptiotemporal pattern recognizer neural network, the Boltzman machine network, and the neurocognition network.		x		x	x	x		x	x

Course coordinator: Dr. Masoud Ismail Head of Department: Dr. Amira Edress